cdpACCESS

ENERGY COMPLETE MONOGRAPH

CODE CHANGES AND PUBLIC COMMENTS TO THE 2022 IECC RESIDENTIAL, IRC CH. 11 AND ICCPC CH.15 PUBLIC COMMENT DRAFT #1

ICC
INTERNATIONAL CODE COUNCIL®

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INTRODUCTION

Following an extensive review and feedback process, on March 4, 2021 the Code Council Board (Board) released a new framework to address energy efficiency. This new framework includes a revised process for the development of the energy provisions with a new scope and intent and optional requirements aimed at achieving net zero energy buildings presently and by 2030. This framework includes using the Code Council's American National Standards Institute (ANSI) approved standards process to update the energy provisions contained in the IECC, Chapter 11 of the IRC and Chapter 15 of the International Code Council Performance Code (ICC PC). The results of this process will be the publication of the energy provisions in the 2024 IECC, IRC and ICC PC as part of the family of I-Codes in the fall of 2023.

The following has occurred since the March 4, 2021 release:

- June 22, 2021: Board appoints two new committees: Commercial Energy Code Consensus Committee and Residential Energy Code Consensus Committee following a Call for Committee members on March 19, 2021 and an application deadline of April 22, 2021.
- July 16, 2021: cdpACCESS opened for Public Input code change submissions, with a deadline of October 12, 2021.
- November 2021 to June 30, 2022 the IECC Residential Consensus Committee with recommendations from 6 Subcommittees took action on approximately 200 code change proposals.
- The Committee Action Report for the IECC Residential was released July 5, 2022 along with the initial ballot to the IECC-Residential committee. Ballot #1 was due on August 5, 2022. The report of Ballot #1 and the release of the Recirculation ballot #2 were issued on August 5, 2022. The Recirculation ballot #2 was collected on August 23, 2022. The report of Ballot #2 and the release of the Recirculation ballot #3 were issued on August 24, 2022. The Recirculation ballot #3 was collected on September 7, 2022. The results of Recirculation ballot #3 were posted on September 8, 2022. There were 16 proposals that received negative ballots from at least 1/3 of the committee. These items were placed on the agenda for a meeting of the IECC Residential Consensus Committee on September 26-27. The Consensus committee heard proposed modifications to resolve the negative ballots and voted on these proposals. An absentee ballot was distributed on September 28 and was collected on October 12, 2022. The results of the balloting were posted on October 17. Items that received a 2/3 affirmative vote as a result of the balloting process were included in the IECC-R Public Comment Draft #1.
- The IECC-R Public Comment Draft #1 was posted for comment in energy.cdpaccess on November 1, 2022. Public Comments were due on December 16, 2022.

As noted previously, the update process will follow the Code Council's standards development procedures entitled the "ICC Consensus Procedures" (ICC CP). The current version was approved by ANSI on August 2, 2021. Further to this process and in accordance with Section 3.1(c) of the ICC CP, the Board has adopted the "IECC Committee Procedures" for the development of the energy provisions of the 2024 editions and future editions. See document links on page iii.

In accordance with Section 8.2 of the ICC CP, the 2021 edition of the energy provisions (with the Board approved scope and intent) was used as the Initial Draft in order to solicit Public Input in the form of code change submittals. Following the deadline of October 12th, the proposed code change submittals were compiled, published and posted. The publication of these changes constitutes neither endorsement nor question of them but is in accordance with established procedures so that any interested individuals may make their views known to the relevant Subcommittee, Consensus Committee and others similarly interested. In furtherance of this purpose, the Subcommittees and Consensus Committees will hold open virtual meetings as noted below for the purpose of receiving comments and arguments for or against such proposed changes. Those who are interested in speaking on any of the published changes are expected to participate at these meetings.

This compilation of code change proposals is available in electronic form only.

SUBCOMMITTEES AND CONSENSUS COMMITTEES

Subcommittees

In accordance with Section 6 of the ICC Consensus Procedures, Subcommittees have been established and approved by the Consensus Committees following a public notice and application process. The objective of

Subcommittees is to provide for broad participation and develop consensus on an issue(s) and report the findings to the Consensus Committee for review and final determination. Voting members are comprised of both Consensus Committee members and interested parties.

Consensus Committees
The Board appointed Consensus Committees will determine the final code content of the energy provisions in accordance with the ICC Consensus Procedures.

All Subcommittee and Consensus Committee meetings are open meetings to all participants (voting and non-voting) with adequate public notice provided in accordance with the ICC Consensus Procedures.

ANTITRUST COMPLIANCE

ICC brings together numerous government officials and industry members to participate in the code and standard development process. ICC provides basic guidance on the antitrust laws that may be applicable to these and other activities sponsored by ICC ("ICC Activities"). Click here to view ICC's policy on Antitrust Compliance.

ANALYSIS STATEMENTS

Code changes may contain an "analysis" that appears after the proponent's reason. These comments do not advocate action by the Subcommittees or Consensus Committees for or against a proposal. The purpose of such comments is to identify pertinent information that is relevant to the consideration of the proposed change by the Subcommittees, Consensus Committees and interested parties. Staff analyses customarily identify such things as: conflicts and duplication within a proposed change and with other proposed changes and/or current code text; deficiencies in proposed text and/or substantiation; text problems such as wording defects and vagueness; background information on the development of current text; and staff's review of proposed new reference standards for compliance with procedures. Lack of an analysis indicates neither support for, nor opposition to a proposal.

NEW REFERENCE STANDARDS

Reference standards provide a very important role in ICC's Codes. As stipulated in Sections C108 and R108 of the IECC and Section R102.4 of the IRC, "….standards referenced in this code……shall be considered as part of the requirements of this code to the prescribed extent of each such reference…".

The I-Code process includes criteria for staff to evaluate the non-technical aspects of the standard, such as mandatory language and a consensus process for development. As an extension of the code, the code change submittal process for proposed new reference standards (a standard not currently referenced in one of the I-Codes) requires that the proponent identify the title and edition of the new standard as well as making the standard available for review. This is typically done in one of three ways:

1. The proponent secures a copy of the standard from the Standards Developing Organization (SDO) and sends it to staff for record retention. The proponent also requests that the SDO execute an ICC "Permission to Post Form", provided by the proponent, that allows ICC to post the standard on a password protected website for both staff and the Consensus Committees.
2. The proponent contacts the SDO and is informed that the standard is available on their website for free download. The download is typically specific only to the individual downloading the standard (in other words it cannot be sent electronically to another person). In addition, ICC administration will obtain a copy of the standard for internal purposes by accessing the SDO's website to download the standard.
3. The SDO tells the proponent the standard is available on their website for free access in a "read-only" format. The proponent provides ICC with the link to access the standard and ICC administration confirms that the standard is available in "read-only" format.

Where necessary, ICC will work with proponents and SDO's to help secure the standard in a reviewable format. It is still the responsibility of the proponent to contact the SDO to determine how the standard can be provided to support its potential inclusion in the code.

Proposed new reference standards must be completed and readily available in a timely fashion in order to facilitate the Consensus Committee approval process. New standards which are approved by the Consensus Committee will be listed in the "Referenced Standard" chapter of the applicable code(s).

REFERENCED STANDARDS UPDATES

Updates to currently referenced energy standards in the 2021 IECC, IRC and ICC PC will be considered by the Administrative Code Development Committee in the 2022 Group B Cycle of the ICC Code Development Process. Public Comment Draft #1 Proposals that reference updated standards that were not included in the 2022 Group B Cycle will be acted on by the Consensus Committee as new reference standards.

In accordance with I-Code procedures, an updated standard to the energy provisions of the IECC, IRC, and ICC PC must be finalized and published by December 1, 2023. If the standard update is not finalized and published by December 1, 2023, the affected energy provisions will be revised to reference the previously listed year edition of the standard and an errata issued.

PROPONENT CONTACT INFORMATION

In accordance with procedures, proponents are under no obligation to provide an email address for their posted proposal. For most of the code change proposals, an email address for the proponent has been provided. In an effort to continue to provide for proponent's privacy and at the same time allow an initial contact between an interested party and the proponent, we will be utilizing energy.cdpACCESS to allow an interested party to initiate contact with the proponent without identifying the proponent's email address. The process is follows:

- Interested party logs into energy.cdpACCESS and searches for the subject code change.
- Interested party locates the button "Contact the Proponent" to request that energy.cdpACCESS contact the proponent, providing the interested party's name and email address.
- Energy.cdpACCESS uses the proponent email address on file and sends a notification to the proponent indicating the name of the interested party and their email address and that the interested party would like to discuss the code change.
- The interested party receives an email noting that the energy.cdpACCESS system has sent the request to the proponent.
- It is up to the proponent to determine if they would like to respond and contact the interested party.
- <u>The proponent is under no obligation to respond to the energy.cdpACCESS request for contact or to contact the interested party. The proponent's contact information is not revealed to the interested party as part of this initial contact.</u>

CODE CHANGE SUBMITTALS WITH TABLES

Staff is aware that some of the code change proposals with tables may require additional formatting. In an effort to post these code changes as soon as practical in order to start the discussions at the Subcommittee level, the decision was made to post these proposals now and staff will continue to reformat the tables and re-post when reformatted. All interested parties who have signed up for the email distribution list for notifications (see below) will be notified when the code changes are re-posted.

ICC ENERGY WEBSITES/DOCUMENT POSTINGS

ICC websites are used extensively for access to documents which support the update of ICC's Codes. This current update of the energy provisions is no different. Postings include:

- This code change document
- Code change errata, if any, will be posted

- The "IECC Committee Procedures" previously mentioned will be posted
- Process information such as a flowchart of the key steps currently under development will be posted
- Additional documents/information to support the process will be posted

Links to websites:

- "Leading the Way to Energy Efficiency"
- Commercial: Commercial Energy Consensus Committee
- Residential: Residential Energy Consensus Committee

Users are encouraged to periodically review the websites.

ICC CONSENSUS PROCEDURES

Click here to download the current ICC Consensus Procedures

ICC ENERGY SECRETARIAT/EMAIL DISTRIBUTION LIST

The ICC Secretariat is Kristopher Stenger, AIA, CBO, LEED AP Director of Energy Programs at kstenger@iccsafe.org. Be sure to contact Kris in order to be placed on the email distribution list in order to receive timely meeting information, notices, etc.

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Note: RED1-130-22, RED1-149-22, RED1-323-22, and RED1-362-22 are reserved.

Errata items will be included in separate update to Public Comment Draft #1.

IRCED1-1-22

Proponents: Fredric Zwerg, representing Southwest Gas Corporation (fredric.zwerg@swgas.com)

2024 ENERGY Chapter11

Delete without substitution:

~~**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.~~

Reason: Delete this definition entirely. This definition is already provided in the IRC Definitions section. Redundant.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
No cost impact

Workgroup Recommendation

Proposal # 1153

IRCED1-2-22

Proponents: Shannon Corcoran, representing American Gas Association

2024 ENERGY Chapter11

Delete without substitution:

~~APPENDIX AY~~
~~ALL-ELECTIC RESIDENTIAL BUILDINGS~~

~~AY101~~
~~GENERAL~~

~~**AY101.1 Intent.** The intent of this Appendix 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.~~

~~**AY101.2 Scope.** This appendix applies to new residential buildings.~~

~~AY102~~
~~GENERAL DEFINITIONS~~

~~**AY102.1 . 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 and/or lighting that uses fuel gas or fuel oil.~~
~~**EQUIPMENT.** Piping, ducts, vents, control devices and other components of systems other than appliances 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.~~
~~**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).~~

~~AY103~~
~~ALL-ELECTRIC RESIDENTIAL BUILDINGS~~

~~**AY103.1 Application.** Residential buildings shall be *all-electric buildings* and comply with Section R401.2.5 and either Sections R401.2.1, R401.2.2, R401.2.3 or R401.2.4.~~

Reason: The International Energy Conservation Code should be fuel neutral and provide for energy savings regardless of the fuel source. The Code should not rely solely on one energy source and eliminate energy choice. It should continue to focus on cost-effective energy efficiency. This proposal does not guarantee any energy or carbon savings and could allow increased use of electric resistance space and water heating, thereby increasing both energy use and carbon emissions.
It is not true that, “combustion equipment in commercial and residential buildings accounted for 36% of the United States energy-related greenhouse gas emissions.” Although true that buildings account for 36% of emissions, only 11% results from “combustion equipment.” The rest comes from electricity use.

The statement that this proposal reduces the cost of construction is deceptive in that it is reduced ONLY when the cost of “natural gas infrastructure such as gas mains, services and meters” is included in the total cost of a mixed fuel home. There is typically NO cost to the home builder or owner for this infrastructure when gas appliances/equipment are installed.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
Removing the proposal from the draft code will not change the cost of construction

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Workgroup Recommendation

IRCED1-3-22

Proponents: Fredric Zwerg, representing Southwest Gas Corporation (fredric.zwerg@swgas.com)

2024 ENERGY Chapter11

Delete without substitution:

~~**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. Content~~

Reason: Delete this definition entirely. Since an automobile (car, truck van, golf cart, bus, motorcycle, etc.) is not defined, the definition is too vague and may not apply. What is a "private parking lot? for a home? This Chapter is on residential homes so why is "office" and "work areas" stated.

Cost Impact: The code change proposal will decrease the cost of construction.
The definition may actually increase the cost of construction for a home due to the issues above in my Reason section. Deleting this definition will reduce the cost of construction or have no cost impact.

Workgroup Recommendation

Proposal # 1152

IRCED1-4-22

Proponents: Tom Ortiz, representing National Propane Gas Association (tortiz@npga.org); Bruce Swiecicki, representing National Propane Gas Association (bswiecicki@npga.org)

2024 ENERGY Chapter11

Revise as follows:

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

Reason: There is no scientific or market-based rationale for preemptively excluding all renewable energy sources/carriers other than electricity from eligibility for a REC.We propose the following general principles as a pathway to achieving net zero carbon buildings:

1. It is highly doubtful that society, given the constraints of practicality and financial resources, would be able to fully upgrade the electric grid or provide enough on-site renewable energy to meet the demand that would be imposed with a “full-steam-ahead” electrification policy, which many are trying to achieve with the 2024 IECC.

2. The “real” issue we are addressing is not so much energy conservation, but carbon conservation in the form of limiting CO_2e emissions. No energy sources should be discounted if, on a source-basis, they can achieve a superior level of performance than other sources.

3. The code is revised and published every three years. A step-wise approach to be taken is the most prudent, as it allows the grid to be upgraded to handle the additional loads expected (much of it due to electrification of vehicles) and to allow implementation of two-way technology for returning electrons to the grid, which most locations to not currently permit.

It is very apparent that the huge ambitions held by some electrification advocates will outstrip the capacity of our infrastructure to deliver. The cost to build a “future-proof” grid will likely be somewhere between $1 trillion (Reuters[1]) and $7 trillion (Oilprice.com[2]). This is an expenditure on the order of what the US spent[3] on the wars in Iraq and Afghanistan between 2001 – 2021. The appetite for policymakers and ratepayers to absorb such costs is a question that is yet to be answered.

Meanwhile, the US EIA has documented that average electric transmission system outage times have roughly doubled between 2013 - 2021[4]. We therefore are facing the prospect of adding massive new load to a network that is already badly in need of maintenance, without knowing with any degree of certainty how much investment capital will be available to: a) enable safe and robust bi-directional power flow for distributed storage and generation; b) protect this new “smart” grid against cyberattack and other forms of sabotage; and c) procure enough domestic supplies of scarce critical minerals (e.g. lithium, cobalt, neodymium) to ensure a secure and affordable source for the—literally—billions of batteries that are intended to serve the electric vehicle, residential and commercial energy storage, utility-scale energy storage, and consumer electronics industries.

(And, not to be dismissed, when fusion energy becomes widespread, we will need yet more lithium from which to manufacture tritium—one necessary component of the most feasible fuel for any prospective fusion power plant.)

Therefore, we view inclusion of mandatory electrification in building codes as far more than an energy efficiency, or even a greenhouse gas, issue: it also has massive national security and health/safety implications that, in our opinions, are not being adequately analyzed. While building codes may not, per se, be tasked with solving all of those problems, they are nevertheless relied upon by decisionmakers as being rational, reliable, and conservative bases for managing the building stock of our nation’s homes and businesses. Based on the foregoing, there should be consideration for more agnostically defining what is meant by a sustainable (rather than, strictly speaking, renewable) resource in the hope that we can use every feasible tool imaginable to optimize our energy system with respect to its myriad technical and environmental constraints.

[1]

McLaughlin, T. (2022), “Creaky U.S. power grid threatens progress on renewables, EVs”, Reuters, https://www.reuters.com/investigates/special-report/usa-renewables-electric-grid/

[2] Hyman, L. and Tilles, W. (2021), “The $7 Trillion Cost Of Upgrading The U.S. Power Grid”, Oilprice.com, https://oilprice.com/Energy/Energy-General/The-7-Trillion-Cost-Of-Upgrading-The-US-Power-Grid.html .

[3] https://www.brown.edu/news/2021-09-01/costsofwar

[4] US Energy Information Administration (2022), “Table 11.2. Reliability metrics using IEEE of U.S. distribution system by state”, https://www.eia.gov/electricity/annual/ .

Cost Impact: The code change proposal will decrease the cost of construction.

More choices for energy means reduced cost of construction.

Bibliography: [1]   McLaughlin, T. (2022), “Creaky U.S. power grid threatens progress on renewables, EVs”, Reuters, https://www.reuters.com/investigates/special-report/usa-renewables-electric-grid/
[2] Hyman, L. and Tilles, W. (2021), “The $7 Trillion Cost Of Upgrading The U.S. Power Grid”, Oilprice.com, https://oilprice.com/Energy/Energy-General/The-7-Trillion-Cost-Of-Upgrading-The-US-Power-Grid.html .

[3] https://www.brown.edu/news/2021-09-01/costsofwar

[4] US Energy Information Administration (2022), “Table 11.2. Reliability metrics using IEEE of U.S. distribution system by state”, https://www.eia.gov/electricity/annual/ .

Workgroup Recommendation

Proposal # 1265

IRCED1-5-22

Proponents: Fredric Zwerg, representing Southwest Gas Corporation (fredric.zwerg@swgas.com)

2024 ENERGY Chapter11

Delete without substitution:

~~**N1104.2.2 Specific locations.** All permanently installed luminaires in garages, unfinished basements, laundry rooms, and utility rooms shall be controlled by an automatic shut-off 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.~~

Reason: Delete this section entirely. Garage door openers have an automatic light which turns on and the off after a short period of time. This garage door light is not manually controllable (occupant can turn off and on separately from opening/closing garage door). Technically, this requirement will disqualify all garage door openers and require manufacturers to make a major change in their wiring and controls.

Cost Impact: The code change proposal will decrease the cost of construction.
This proposal will prevent the need for manufactures to modify garage door opener operation and save construction costs.

Workgroup Recommendation

Proposal # 1163

IRCED1-6-22

Proponents: Rob Brooks, representing Self (rob@rtbrooks.com)

2024 ENERGY Chapter11

Revise as follows:

TABLE N1102.5.1.1 AIR BARRIER, AIR SEALING AND INSULATION INSTALLATION[a]

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
General requirements	A continuous air barrier shall be installed in the building envelope. Breaks or joints in the air barrier shall be sealed.	Air-permeable insulation shall not be used as a sealing material.
Ceiling/attic	A sealed air barrier shall be installed in any dropped ceiling or soffit to separate it from unconditioned space . Access openings, drop-down stairs or knee wall doors to unconditioned attic spaces shall be air 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. Access hatches and doors shall be installed and insulated in accordance with Section N1102.2.5 Eave Baffles shall be installed in accordance with Section N1102.2.4.
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 thermal envelope insulation for framed walls shall be installed in substantial contact and continuous alignment with the air barrier.
Windows, skylights and doors	The space between framing and skylights, and the jambs of windows and doors, shall be sealed.	Framing cavities around windows, skylights and doors shall be completely filled with insulation or insulated per window manufacturer's instructions.
Rim joists	Rim joists shall include an air barrier. 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.[b]
Floors, including cantilevered floors and floors above garages	The air barrier shall be installed at any exposed edge of insulation.	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.
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 N1102.2.11. 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.	Crawl space insulation, where provided instead of floor insulation, shall be installed in accordance with Section N1102.2.11. Conditioned basement foundation wall insulation shall be installed in accordance with Section N1102.2.9.1. Slab-on-grade floor insulation shall be installed in accordance with Section N1102.2.11.
Shafts, penetrations	Duct and flue shafts and other similar penetrations 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 N1101.10–N1101.12 and N1102.2.8.
Recessed lighting	Recessed light fixtures installed in the building thermal envelope shall be air sealed in accordance with Section N1102.5.5.	Recessed light fixtures installed in the building thermal envelope shall be airtight and IC rated, and shall be buried 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.
Showers, tubs, and	An air barrier shall separate insulation in the	

Showers, tubs, and fireplaces adjacent to the building thermal envelope	An air barrier shall separate insulation in the *building thermal envelope* from the shower, tub, and fireplace assemblies.	Exterior framed walls adjacent to showers, tubs and fireplaces shall be insulated.
Electrical,communication, and other equipment boxes, housings, and enclosures	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. The continuity of the air barrier shall be maintained around boxes, housings, and enclosures that penetrate the air barrier. Alternatively, air-sealed boxes shall be installed in accordance with N1102.5.6.	Boxes, housing, and enclosures shall be burried 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 in the building's thermal envelope shall be buried and 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	Walls shall be sealed using air sealing materials recognized in an approved design and in a listed fire-resistance rated common wall or double wall design and installed in accordance with the listing~~, or air sealing materials recognized in an approved design, shall be used~~. Common walls or double walls shall be considered an exterior wall for the purposes of air barrier and air sealing application of this Table.	Insulation materials recognized in the listed common wall or double-wall design and installed in accordance with the listing, or insulation materials recognized in the approved design, shall be used.

For SI: 1 inch = 25.4 mm.

a. Inspection of log walls shall be in accordance with the provisions of ICC 400.

b. Insulation full enclosure is not required in unconditioned/ventilated attic spaces and at rim joists.

Reason: The listings shown in the justification for this code change proposal allow for the use of air sealing materials around the perimeter of the wall assembly. The intent of the code change proposal is to seal the wall assembly using all available approved materials. The language has been revised to permit the use of both approved and listed materials, i.e. "and" instead of "or".
The original language was:

Air sealing materials recognized in a listed fire-resistance rated common wall or double wall design and installed in accordance with the listing, **or** air sealing materials recognized in an approved design, shall be used.

The revised language is:

Walls shall be sealed using air sealing materials recognized in an approved design **and** in a listed fire-resistance rated common wall or double wall design and installed in accordance with the listing~~, or air sealing materials recognized in an approved design, shall be used~~.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
Allowing the use of both an approved design and listed materials will not increase the cost of construction as it allows for the most cost effective solution.

Workgroup Recommendation

IRCED1-7-22

Proponents: Theresa Weston, representing ABAA (Air Barrier Association of America) (holtweston88@gmail.com)

2024 ENERGY Chapter11

Revise as follows:

N1102.5.1.2 Testing and maximum air leakage rate. The *building* or each *dwelling 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 4.0 air changes per hour or 0.22 cfm/ft^2 (1.1 L/s x m^2) of building or dwelling unit enclosure area. Testing shall be conducted in accordance with ANSI/RESNET/ICC 380, ASTM E779, ASTM E1827 or ASTM E3158 and reported at a pressure differential of 0.2 inch water gauge (50 Pa). 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.

Exceptions:

1. When testing individual dwelling units, an air leakage rate not exceeding 0.27 cubic feet per minute per square foot [1.35 L/s x m^2] 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 water gauge (50 Pa), shall be permitted in all climate zones for:

   1.1 Attached single and multiple family building dwelling units.

   1.2 Buildings or dwelling units that are 1,500 square feet (139.4 m^2) or smaller.

2. 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 N1102.5.1.1, 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 conditioned spaces in accordance with Sections N1102.2.13 and N1102.4.5, as applicable.
3. ~~Where tested in accordance with N1102.5.1.2, testing of each dwelling unit is not required.~~

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.

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

Reason: This proposal removes the 3rd exception which is confusing and has a circular logic. This exception is applies when following the the section to which it is an exception. It is removed to improve the clarity of the section.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This proposal removes confusing and circular language and will not effect the cost of construction.

Workgroup Recommendation

IRCED1-8-22

Proponents: Aaron Phillips, representing Asphalt Roofing Manufacturers Association (aphillips@asphaltroofing.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

ASTM

ASTM International
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken, PA 19428-2959

C1549-~~20~~16 (2022)	Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer
E903-20~~2012~~	Standard Test Method for Solar Absorptance, Reflectance, and Transmittance of Materials Using Integrating Spheres~~ (Withdrawn 2005)~~
E1918-21~~06(2016)~~	Standard Test Method for Measuring Solar Reflectance of Horizontal or Low-sloped Surfaces in the Field
E1980-11(2019)	Standard Practice for Calculating Solar Reflectance of Horizontal and Low-sloped Opaque Surfaces

2024 ENERGY Chapter11

Revise as follows:

TABLE N1108.2.1.3 MINIMUM ROOF REFLECTANCE[a]

ROOF SLOPE	THREE-YEAR AGED SOLAR REFLECTANCE INDEX[b]
Low-slope	75[b,c]
Steep-slope	16

a. The use of area-weighted averages to comply with these requirements shall be permitted. Materials lacking 3-year-aged tested values for solar reflectance shall be assigned a 3-year aged solar reflectance in accordance with Section N1108.2.1.3.1.

b. Aged solar reflectance tested in accordance with ASTM C1549, ASTM E903 or ASTM E1918 or CRRC-S100.

c. Solar reflectance index (SRI) shall be determined in accordance with ASTM E1980 using a convection coefficient of 2.1 Btu/h × ft^2 × °F (12 W/m^2 × K). Calculation of aged SRI shall be based on aged tested values of solar reflectance and thermal emittance. ~~Aged solar reflectance tested in accordance with ASTM C1549, ASTM E903 or ASTM E1918 or CRRC-S100.~~

Reason: This comment is primarily intended to update radiative property referenced standards C1549, E903, E1918, and E1980 to active editions and correct titles for the IECC residential provisions and the IRC. However, while preparing this comment, it became apparent that an error may have occurred while creating the 1st Public Comment Drafts for the IECC residential and IRC Chapter 11, because the third footnote of Table N1108.2.1.3 does not match Table R408.2.1.3. Therefore, the third footnote of Table N1108.2.1.3 is modified to match Table R408.2.1.3, which brings in ASTM E1980 as a required reference standard for the IRC.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
Update of referenced standards editions and correction of a discrepancy between the IECC and IRC Chapter 11 should have no impact on cost of construction.

Workgroup Recommendation

Proposal # 953

IRCED1-9-22

Proponents: Glen Clapper, representing National Roofing Contractors Association (gclapper@nrca.net)

2024 ENERGY Chapter11

Revise as follows:

N1111.1.1.6 Air barrier. Building thermal envelope assemblies altered in accordance with Section N1111.1.1 shall be provided with an air barrier in accordance with Section N1102.4. The air barrier shall not be required to be made continuous with unaltered portions of the building thermal envelope. Testing requirements of Section N1102.4.1.2 shall not be required.

> **Exception:** An air barrier shall not be required for a roof replacement where the alteration or renovation to the building does not include alterations, renovations or repairs to the remainder of the building thermal envelope.

Reason: This public comment code change proposal aligns the residential provisions of the IECC with the commercial provisions (exemption). There is no value to installing an air barrier in a roof assembly that is part of the building thermal envelope when alterations, renovations or repairs are not also being performed to the remainder of the building or building thermal envelope

Cost Impact: The code change proposal will decrease the cost of construction.
This code change proposal will decrease the cost of construction by not requiring an additional element or material in the alteration.

Workgroup Recommendation

Proposal # 1459

IRCED1-10-22

Proponents: Robert OBrien, representing NORA (robrien@noraweb.org)

2024 ENERGY Chapter11

Revise as follows:

N1103.2 Hot water boiler outdoor temperature reset. The manufacturer shall equip each gas, liquid fuel ~~oil~~, and electric boiler (other than a boiler equipped with a tankless domestic water heating coil) with automatic means of adjusting the water temperature supplied by the boiler to ensure 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.

Reason: This change more accurately reflects the liquid fuels in common use for heating and domestic hot water production. Most heating oil already contains 5% renewable liquid fuel (B5) and to comply with state mandates as well as industry goals, liquid fuel equipment manufacturers have rated their products for use with B20 (20% renewable) and are working rapidly to obtain listings for operation with B100. This will provide a pathway to rapid decarbonization
The Inflation Reduction Act of 2022 (IRA) provides a tax credit for Energy Star rated liquid fuel appliances that are rated for B20 in 2023-2026 transitioning to a minimum of 90% AFUE and B50 compatible in 2027-2032

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This change will have no impact on the cost of construction

Workgroup Recommendation

Proposal # 960

IRCED1-11-22

Proponents: Fredric Zwerg, representing Southwest Gas Corporation (fredric.zwerg@swgas.com)

2024 ENERGY Chapter11

Revise as follows:

N1104.1.5 <u>Fuel </u>Gas lighting <u> Equipment</u>. <u>Fuel </u>Gas-fired lighting appliances shall not <u>have</u> ~~be equipped with~~ continuously burning pilot lights <u>.</u> ~~ignition systems~~.

Reason: Delete the text as shown. The change is consistent with the proposed changes in the IECC addressing continuously burning pilot lights.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
No cost impact.

Workgroup Recommendation

Proposal # 1162

RED1-1-22

Proponents: Gayathri Vijayakumar, representing Steven Winter Associates, Inc. (gvijayakumar@swinter.com)

2024 International Energy Conservation Code [RE Project]

APPENDIX RC
ZERO NET ENERGY RESIDENTIAL BUILDING PROVISIONS

SECTION RC101
GENERAL

Revise as follows:

RC101.1 ~~General~~ Scope. This appendix applies to new ~~residential~~ *residential* *buildings*.

~~**RC101.2 Scope.** [no change, same as R406.1]~~

RC101.~~3~~ 2 Application. *Residential buildings* ~~Residential buildings~~ shall comply with Section R406.

Exception: Additions, *alterations* ~~alterations~~, repairs and changes of occupancy to existing buildings complying with Chapter 5.

RC101.~~4~~ 3 Certificate. [no change, same as R401.3]

RC102 GENERAL DEFINITIONS. COMMUNITY RENEWABLE ENERGY FACILITY (CREF). A facility that produces energy from ~~renewable energy resources~~ *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 agree~~-~~ment.~~”~~
PHYSICAL RENEWABLE ENERGY POWER PURCHASE AGREEMENT (PPPA). A contract for the purchase of re~~-~~newable electricity from a specific renewable electricity generator by a purchaser of renewable electricity.

RC103
ZERO NET ENERGY RESIDENTIAL BUILDINGS

Add new text as follows:

RC103.1
Scope. [no change, same as R406.1]

Revise as follows:

RC103.~~1~~ 2 ERI compliance (Replace R406.2). 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 90.2 Table 6-1 without the use of on-site power production (OPP),

   2.2 The requirements of Sections R402.4.1.1, R402.4.1.2, R406.3, R404.5 (Electric Readiness), R404.7 (Electric Vehicle Power Transfer Infrastructure), and

   2.3 The maximum ERI including adjusted OPP of Table RC103.~~3~~ 5 determined in accordance with RC103. 4~~3~~.

RC103.3~~2~~ Building thermal envelope. [no change, same as R406.3]

RC103.3 Energy Rating Index zero net energy score. The Energy Rating Index (ERI) not including renewable energy resources shall be determined in accordance with RESNET/ICC 301.The Energy Rating Index (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 RC406.4.1, on-site power production (OPP) shall be adjusted in accordance with Equation RC-1.

(Equation RC-1)

OPP_{kWh} = Annual electrical energy from on-site renewable energy, in units of kilowatt-hours (kWh).

$CREF_{kwh}$ = Annual electrical energy from a community renewable energy facility (CREF), in units of kilowatt-hours (kWh).
$PPPA_{kwh}$ = Where not included as OPP, the annual electrical energy contracted from a physical renewable energy power purchase agreement, in units of kilowatt-hours (kWh).
$FPPA_{kwh}$ = 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).

Revise as follows:

RC103.4~~3~~.1 Power purchase agreement contract. The renewable energy shall be delivered or credited to the building site under an energy contract with a duration of not less than 10 years. The contract shall be structured to survive a partial or full transfer of ownership of the building property.

RC103.5~~4~~ ERI-based compliance. Compliance based on an ERI analysis requires that the *rated proposed design* and confirmed built dwelling be shown to have an ERI less than or equal to both values indicated in Table RC103. 5~~3~~ when compared to the *ERI reference design*.

TABLE RC103.5~~3~~ MAXIMUM ENERGY RATING INDEX[a]

RC103.6~~5~~ Verification by approved agency. [no change, same as R406.6]

RC103.7~~6~~ Documentation. [no change, same as R406.7]

Reason: This Public Comment is intended as a clean-up (errata) to ensure Appendix RC is the same version as approved (RECPI-11).
RC101 was intended to only have 3 sections, with the same exact headings as R401 (Scope, Application, Certificate).

RC102 has some missing italicized words and some quotes and hyphens that need to be removed.

RC103 was intended to have the same 7 sub-sections as R406, so a Scope section is added as RC103.1 and other section numbers updated accordingly. Also "zero energy score" was intended to be struck from the Energy Rating Index sub-heading. Defined words were intended to be italicized, so those are corrected here.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
NA

Bibliography: None, however RECPI-11 from the CAR supports the changes in this PC.

Workgroup Recommendation

Proposal # 1380

RED1-2-22

Proponents: Fredric Zwerg, representing Southwest Gas Corporation (fredric.zwerg@swgas.com)

2024 International Energy Conservation Code [RE Project]

Delete without substitution:

~~**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, methods or system analyses.~~

Reason: Delete the proposed definition entirely. This definition is not necessary and is potentially restrictive to the code official. The code jurisdictions use third-party plan examiners and code enforcement officials that are under contract. Technically, once they are under contract, they are no longer legally independent. Some of these sources are not experienced in the application of engineering principles, but are experienced with the building codes and thier requirements. This proposal may limit the available resources and require the code officials to pay more for this.

Cost Impact: The code change proposal will decrease the cost of construction.
The wording may require jurisdictions to be limited to a more limited and specific third-party resource that is more costly. This may have a higher negative impact to small and/or remote jurisdictions.

Workgroup Recommendation

Proposal # 1106

RED1-3-22

Proponents: Greg Johnson, representing National Multifamily Housing Council (gjohnsonconsulting@gmail.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

GRADE PLANE. A reference plane representing the average of the finished ground level adjoining the building at all exterior walls. Where the finished ground level slopes away from the exterior wall, the reference plane ~~shall be~~ 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.

Reason: Requirements do not belong in definitions; definitions are intended to be explanatory.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
No effect on construction.

Workgroup Recommendation

Proposal # 1082

RED1-4-22 Part I

Proponents: Fredric Zwerg, representing Southwest Gas Corporation (fredric.zwerg@swgas.com)

2024 International Energy Conservation Code [RE Project]

Delete without substitution:

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

Reason: Delete this definition entirely. The IRC already defines a Living Space and it does not need to be added here. Redundancy.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
No cost impact.

Workgroup Recommendation

Proposal # 1110

RED1-4-22 Part II

Proponents: Fredric Zwerg, representing Southwest Gas Corporation (fredric.zwerg@swgas.com)

2024 ENERGY Chapter11

Delete without substitution:

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

Reason: Delete this definition entirely. This definition is already in the IRC and is redundant.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
No cost impact.

Workgroup Recommendation

Proposal # 1154

RED1-5-22

Proponents: Fredric Zwerg, representing Southwest Gas Corporation (fredric.zwerg@swgas.com)

2024 International Energy Conservation Code [RE Project]

Delete without substitution:

~~**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.~~

Reason: Delete this definition entirely. The defined work area for a residential building (new, addition or renovation) is defined by the project's scope of work and will vary from project to project. The jurisdiction will define the work and the systems that are to be included within the project scope of work once they review and examine the design drawings. This definition is not necessary and could cause potential legal issues and conflicts.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This change could reduce costs associated with any potential legal conflicts caused by the defined work area.

Workgroup Recommendation

Proposal # 1113

RED1-6-22

Proponents: Jonathan Humble, representing American Iron and Steel Institute (jhumble@steel.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

AISI

American Iron and Steel Institute
25 Massachusetts Avenue, NW, Suite 800
Washington, DC 20001

AISI S250-~~21~~ 22	North American Standard for Thermal Transmittance of Building Envelopes with Cold-Formed Steel Framing, with Supplement 1, dated 2022

Reason: Supplement #1 - 2022 modified Section B4.2 Standard Truss Framing equations by removing the parenthesis in the denominator, which was not intended to be included, in order to correctly illustrate the equation. No other modifications were made to Standard S250.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This modification to Standard S250 corrected an error tot he 2021 edition.

Bibliography: AISI S250-21w/S1-22 North American Standard for Thermal Transmittance of Building Envelopes with Cold-Formed Steel Framing, American Iron and Steel Institute, Washington, DC 2022.

Workgroup Recommendation

Proposal # 962

RED1-7-22

Proponents: Ryan Meres, representing RESNET (ryan.meres@gmail.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

RESNET

Residential Energy Services Network, Inc.
P.O. Box 4561
Oceanside, CA 92052-4561

ANSI/RESNET/ICC 301—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; Addendum B Approved October 12, 2022 and Addendum C

Reason: Since the publication of ANSI/RESNET/ICC 301-2022, RESNET's SDC 300 has approved new addenda.
Addendum A- provides language regarding the ownership of renewable energy certificates.

Addendum B- provides updated calculations for estimating carbon emissions of homes and creates a new CO2e index.

Addendum C- provides several improvements to the following: Ceiling Area, Interior Shade, Multi-systems, Onsite Battery. It also provides updates to incorporate the new federal equipment equipment testing/labeling requirements for SEER2/HSPF2.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
These new addenda to Standard 301 will not increase the cost of construction. Standard 301 is referenced in R406 which is an optional compliance pathway in the IECC.

Workgroup Recommendation

Proposal # 979

RED1-8-22

Proponents: Mike Nugent, representing BCAC (bcac@iccsafe.org)

2024 International Energy Conservation Code [RE Project]

SECTION R101
SCOPE AND GENERAL REQUIREMENTS

R101.1 Title. This code shall be known as the Energy Conservation Code of [NAME OF JURISDICTION] and shall be cited as such. It is referred to herein as “this code.”

R101.2 Scope (Not subject to public input). This code applies to 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.

Add new text as follows:

101.2.1 Appendices. Provisions in the appendices shall not apply unless specifically adopted.

Reason: Appendices are in all of the codes except for IZC. The intent is to put information about their adoption for inclusion in the same location in all of the codes immediately following the section on scope. This is already the case in the IBC, IFC, IMC, IPSDC and IWUIC. ADM7-22 has added this section to ICCPC, IGCC, IPMC, and ISPSC. This section was relocated in the IEBC, IFGC, IPC and IRC.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This is an editorial coordination item.

Workgroup Recommendation

Proposal # 1048

RED1-9-22

Proponents: Mike Nugent, representing BCAC (bcac@iccsafe.org)

2024 International Energy Conservation Code [RE Project]

SECTION R101
SCOPE AND GENERAL REQUIREMENTS

R101.1 Title. This code shall be known as the Energy Conservation Code of [NAME OF JURISDICTION] and shall be cited as such. It is referred to herein as "this code."

R101.2 Scope (Not subject to public input). This code applies to 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.

R101.3 Intent (Not subject to public input). The International Energy Conservation Code - 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 zeroenergy 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 non-mandatory appendices incorporating additional energy efficiency and greenhouse gas reduction resources developed by the 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 three-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.

Revise as follows:

~~**R101.5**~~ **<u>R101.4</u> Compliance.** *Residential buildings* shall meet the provisions of IECC—Residential Provisions. *Commercial buildings* shall meet the provisions of IECC—Commercial Provisions.

~~**R101.5.1**~~ **<u>R101.4.1</u> Compliance materials.** 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.

Add new text as follows:

<u>SECTION R102</u>
<u>APPLICABILITY</u>

Revise as follows:

~~**R101.4**~~ **<u>R102.1</u> 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**~~ **<u>R102.1.1</u> 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—Residential Provisions.

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

~~**R108.2**~~ **<u>R102.3</u> 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**~~ **<u>R102.4</u> 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 ~~R108.1.1~~ <u>R102.4.1</u> and ~~R108.1.2~~ <u>R102.4.1</u>.

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

~~**R108.1.2**~~ **<u>R102.4.2</u> 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.

Delete without substitution:

~~SECTION R107~~
~~VALIDITY~~

~~SECTION R108~~
~~REFERENCED STANDARDS~~

Reason: Right now many jurisdictions delete Chapter 1 of the codes and write their own unified Administrative provisions. Part of the reason for this is that it is not easy to see where the administrative provisions are similar or different. Chapter 1 of the I-codes should be different where applicable. However, if the administrative provisions are the same, it is important for the authority having jurisdiction to be able to identify that quickly. As we work on this throughout the codes, it is hoped that jurisdictions will use the Chapter 1's in the relative code.
The intent of this change is to have the provision in Section 101, Scope and General Requirements, and Section 102, Applicability, to contain the same basic points for all the codes. This will make compliance easier. For the IECC, this would involve some reorganization, including movement of the sections dealing with references standards (R108) and validity (R107). There are no changes to requirements. A similar proposal was submitted for IECC Commercial and was accepted.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This is a reorganization of administrative provisions with no change to technical requirements.

Workgroup Recommendation

Proposal # 1049

RED1-10-22

Proponents: Mike Nugent, representing BCAC (bcac@iccsafe.org)

2024 International Energy Conservation Code [RE Project]

Add new text as follows:

SECTION 103
CODE COMPLIANCE AGENCY

103.1 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.

103.2 Appointment. The authority having jurisdiction (AHJ) shall be appointed by the chief appointing authority of the jurisdiction.

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

Reason: This section include provisions for the creation of the code compliance agency. Similar language is in the IBC, IFC, IPC, IMC, IFGC, IEBC, IPMC, IPSDC, IWUIC, IRC and IGCC.
The department's responsibilities are more than just 'enforcement' of the code. The fill in the blank for the name allows for the agency to develop a name appropriate to their jurisdiction and responsibilities. This also allows for the code official to appoint staff where needed.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This is an editorial change with no change to construction requirements.

Workgroup Recommendation

Proposal # 1051

RED1-11-22

Proponents: Steven Rosenstock, representing Edison Electric Institute (srosenstock@eei.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R103.2.2 Solar-ready system. Where a solar-ready system is installed, the ~~The~~ construction documents shall provide details for dedicated roof area, structural design for roof dead and live load, and routing of conduit or pre-wiring from solar-ready zone to electrical service panel or plumbing from solar-ready zone to service water heating system.

Reason: New section 404.6 contains requirements for renewable energy infrastructure. However, it also contains 7 exceptions where new residential buildings will not have to install infrastructure:
"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 m2) of roof area oriented between 110 degrees and 270 degrees of true north.

3. A dwelling unit with less than 500 square feet (46m2) of roof area oriented between 110 degrees and 270 degrees of true north.

4. Dwelling units where 50 percent of the solar-ready area is shaded from direct-beam sunlight by natural objects or by structures that are not part of the building for more than 2500 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 whole-building electric use on an annual basis.

7. A dwelling unit less than or equal to 1,500 square feet (139 m2) of living space floor area located above grade plane."

Since there will be there are cases where a solar-ready system will not be installed, there needs to be language in R103.2.2 to account for the exceptions.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This proposal only deals with the content of construction documents.

Workgroup Recommendation

Proposal # 980

RED1-12-22

Proponents: Alex Smith, representing NAHB (asmith@nahb.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R105.2.2 Framing and air barrier rough-in inspection. Air barrier inspections at framing and rough-in shall be made before application of air permeable insulation and shall verify compliance of the air barrier details with the code ~~as to: fenestration properties such as *U*-factor and SHGC and proper installation; air leakage controls as required by the code; and~~ or *approved* plans and specifications. Exterior air barriers may be inspected after insulation is installed.

R105.2.3 Insulation and fenestration rough-in inspection. Inspections at insulation and fenestration 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 in-stallation; fenestration properties such as U-factor and SHGC and proper installation.

Reason: This proposed change removes duplicative requirements. The language in R105.2.2 to "fenestration properties such as U-factor and SHGC and proper installation" is very similar to the language in R105.2.3 that states "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." Duplicative requirements can lead to issues in the field with interpreting the intent of the code.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
The change is editorial and will not change the cost of construction.

Workgroup Recommendation

Proposal # 973

RED1-13-22

Proponents: Christopher McWhite, representing Region VI (cmcwhite@me.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

~~**R105.2.3**~~ **R105.2.6 Insulation and fenestration rough-in inspection.** Inspections at insulation and fenestration 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 in-stallation; fenestration properties such as U-factor and SHGC and proper installation.

~~**R105.2.4**~~ **R105.2.3 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 required, inspections shall verify pathways for routing of plumbing from solar-ready zone to service water heating system.

~~**R105.2.5**~~ **R105.2.4 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 C105.2.4.

~~**R105.2.6**~~ **R105.2.5 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 pre-wiring from solar-ready zone to electrical panel.

Reason: Renumbering the sections is not really a problem. Also, the Committee got it right by adding the electrical inspection language so the local inspector has guidance on what to inspect. The issue is that many inspectors view section 105 as the intended inspections order. By locating the insulation and fenestration ahead of the MEP rough inspections reverses the logical order and can have the unintended effect of obscuring in-wall systems with insulation. The intent of this change is to reorder the inspections so as to remain consistent with the logical order of inspections currently being done by inspectors.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This is a simple reordering of code sections and will not have an effect on the cost of construction.

Bibliography: I am a career, 22 year Building Code Official who has served communities in five states from the Midwest, to the South, and now in New England. Through The Rhode Island Building Code Standards Committee, I am accepted as a certified Building Official; *R.I.G.L. Ch. 23-27.3 §107.5*. Through The International Code Council, I am exam certified as a Certified Building Official, Housing Code Official, Combination Residential Building Inspector, and a Residential and Commercial Plans Examiner. Through the State of Massachusetts I am a certified/licensed Inspector of Buildings/Building Commissioner. Currently I am working as the Department Head Building and Zoning Official in the Town of Smithfield Rhode Island. Here we are committed to our communities' development through partnerships with local and statewide organizations, institutions, and people who are dedicated and/or focused on the process of maintaining existing buildings and constructing new edifices with the goal of making an ever safer built community. I am committed to pursuing improved life safety in residential and commercial structures and the judicious enforcement of current building code and its referenced standards through effective leadership both within the builders and design community and with the professional staff I have the honor to lead. My personal goal is the building of a team of amicable, fair, ethical, and consistently equitable Officials utilizing State and Local building regulations while also judiciously incorporating relevant 28 CFR, ADA requirements. My role is also to communicate these goals with political bodies, large stakeholder investors in high profile projects, local community projects, and simple renovations with homeowners, without parity. I am also a decades-long member of the International Code Council, the non-profit agency that develops and publishes the building Codes. I've twice served as a selected committee member for code development on the national level and I am currently serving as an elected, Governing Board Member with one ICC Membership Council while chairing a subcommittee in another.

Workgroup Recommendation

Proposal # 1208

RED1-14-22

Proponents: Alex Smith, representing NAHB (asmith@nahb.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R105.2.4 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 solar-ready zone is designated for a solar thermal system ~~required~~, inspections shall verify pathways for routing of plumbing from solar-ready zone to service water heating system.

Reason: This proposal adds clarity by coordinating requirements of the section with applicable definition. Solar-ready zone is defined as "A section or sections of the roof or building overhang designated and reserved for the future installation of solar photovoltaic or solar thermal system." Therefore, plumbing rough-in inspection applies only where the solar-ready zone is designated for a solar thermal system.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This proposal is only providing clarification and would not change the cost of construction.

Workgroup Recommendation

Proposal # 985

RED1-15-22

Proponents: Adam Berry, representing Colorado Energy Office (adam.berry@state.co.us)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R105.2.6 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 pre-wiring from solar-ready zone to electrical panel <u>and proper panel space and capacity necessary for future installation of a solar photovoltaic system</u>.

Reason: Inspections should ensure that the electrical panel has the proper capacity needed to support the future installation of a solar photovoltaic system. Failure to do so could lead to costly upgrades of electrical panels by homeowners when those upgrades could be avoided by installation of a panel with the proper capacity during new construction.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
Inspecting for panel capacity in addition to other infrastructure associated with solar readiness should not increase the cost of construction.

Workgroup Recommendation

Proposal # 1279

RED1-16-22

Proponents: Robert Schwarz, representing BUILDTank, Inc. (robby@btankinc.com)

2024 International Energy Conservation Code [RE Project]

SECTION R105
INSPECTIONS

Revise as follows:

R105.4 Approved <u>Third Party</u> 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 <u>or testing</u>, <u>and authorization is given prior to issuance of the building permit.</u>

Add new text as follows:

<u>**R105.4.1** **Authorization of approved third- party inspection agency.** . When authorized, and at the sole discretion of the authority having jurisdiction, the third-party inspection agencyshall represent the jurisdiction and have powers as delegated by of the authority having jurisdiction.</u>

<u>**R105.4.2** **Approved third-party inspections scope..** When authorized, and at the sole discretion of the authority having jurisdiction, the authority having jurisdiction shall determine and delegate compliance verification measures the third-party inspection agency can perform.</u>

<u>**R105.4.3 Approved third-party inspections reporting.** The approved agency shall submit inspection reports to the authority having jurisdiction and to the owner's representative in accordance with *International Residential Code* Section R104.4 before the Certificate of Occupancy can be issued.</u>

Reason: Reason Statements:
In relation to the International Energy Conservation Code, third-party inspection agencies and building officials currently have a variety of ideas regarding what should constitute the work of the agency. For the ERI path, for example, many Raters understand that they must develop an ERI score, but do not fully understand their relationship to inspection of other requirements in the IECC. Jurisdictions having authority, are often either abdicating inspections or believe that Rater's are looking at mandatory inspection items. In addition, the creation of a HERS Index score is different from the creation of an ERI score. A HERS Index score is an asset rating which allows for the derating of the R-value of poorly installed insulation in the energy model, as the objective is to benchmark the energy performance of the home on the HERS Index scale. An IECC ERI evaluation of the installation of Insulation does not allow for the deration of poorly installed insulation. If insulation is not installed in accordance with the manufactures instruction and the guidance given in Table R402.4.1.1, then the installation should fail inspection and be reinstalled until it meets the mandatory requirement of the code. This disconnect in understanding is the genesis of this code change proposal.

There are three aspects of the relationship that are specifically troublesome within the context of IECC enforcement and which this proposal addresses.

1. That the Approved third party works at the discretion of the Authority having jurisdiction. If the AHJ does not like the work that is being done the have the complete ability to refuse to accept compliance inspections and reports from a third Party. Clarifying this working relationship should also make it understood that regardless of who is paying the third party they are working at the pleasure of the AHJ and no one else. In addition, clarification of this relationship will enable better energy code enforcement and allow jurisdictions to meaningfully address the workforce shortage within their jurisdictions.

2. Assurance that a transfer of authority is established so that a third-party inspection agency is authorized to fail or pass the inspections they perform and that the party being inspected clearly understands that authority.

3. The code official must clearly establish what is needed from the third-party inspection agency.

4. Lastly, anything inspected by a third-party agency must be reported to the code official and the owner's representative

The clarity gained in the relationship between the authority having jurisdiction and the approved third-party inspection agency is crucial as we progress into more complicated and meaningful energy codes. Nationally, jurisdictions are losing experienced professionals to retirement. Consequently, more third-party inspection agencies are stepping in to fill the gap. These third-party inspection agencies tend to be solely focused on energy and are capable, and eager to work in the energy code compliance niche. They are filling a need for jurisdictions that are either under staffed or lack a desire to fully enforce the energy components of the code. This proposal clearly defines a path forward to meet the need by defining scope and responsibilities to better ensure compliance and thus achieve expected energy savings.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This proposal does not increase cost but better allocates dollars currently being spent to ensure that the job being undertaken by approved third party inspection agencies truly meets the needs of the authority having jurisdiction.

Workgroup Recommendation

Proposal # 1004

RED1-17-22

Proponents: Mike Nugent, representing BCAC (bcac@iccsafe.org)

2024 International Energy Conservation Code [RE Project]

SECTION R110
MEANS OF APPEALS

R110.1 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.

Revise as follows:

R110.2 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~~.

R110.3 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.

R110.4 Administration. The code official shall take ~~immediate~~ action without delay in accordance with the decision of the board.

Reason: The intent of this proposal is coordination for the means of appeals within the family of codes. Most of this was accomplished through ADM40-19 during the last cycle. Comments during the testimony, from the code development committees and subsequent discussions have suggested some improvements.

Limitation on authority. The deletion of ‘or interpret the administration of this code’ is proposed to be deleted so that the board could consider appeals on any part of the codes.

Qualifications: The phrase for experience and training is slightly different in each code. Adding this idea to all codes would provide consistency.

Administration: This modification is to revise Section R110.4 to so that the term 'immediate' is replaces with 'without delay' as a reasonable compromise for a building official to react promptly to a board of appeals decision, without having to respond immediately following the meeting.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
These are administration requirements, so there will be no change in construction requirements.

Workgroup Recommendation

Proposal # 1052

RED1-18-22

Proponents: Robert Schwarz, representing BUILDTank, Inc. (robby@btankinc.com)

2024 International Energy Conservation Code [RE Project]

CHAPTER 2 [RE]
DEFINITIONS

SECTION R202
GENERAL DEFINITIONS

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.

Add new definition as follows:

COMPLIANCE DOCUMENTS. Documents created to demonstrate compliance, that must be developed and reviewed prior to the issuance of a building permit or before certificate of occupancy is released. Compliance documents include but are not limited to Total UA Alternative, Simulated Performance, or Energy Rating Index compliance reports, insulation and other certificates, and performance testing reports.

Reason: Construction documents have become a defined term in the draft 2024 IECC so it makes sense that the other primary documents that are called out in the IEEC also be defined. Compliance documents are documents that do not have to be created by a design professional, so it is important to understand what they are and what they are used for.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This proposal will not increase the cost of construction

Workgroup Recommendation

Proposal # 1326

RED1-19-22

Proponents: Jay Crandell, representing Foam Sheathing Committee of the American Chemistry Council (jcrandell@aresconsulting.biz)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

CONSTRUCTION DOCUMENTS. Written, graphic and pictorial documents prepared or assembled for describing the design, location and physical characteristics of the elements of a project as necessary to ~~for~~ obtain~~ing~~ a building permit and to support construction and inspections.

Reason: This PC is submitted to coordinate with an identical proposal (CED1-7-22) submitted to the IECC commercial committee. It is considered a clarification of the definition by recognizing that construction documents (plans and specs) are not just for permitting purposes. They also support construction and inspection.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
The proposal clarifies a definition and will not change any requirements related to use of this definition in the code.

Workgroup Recommendation

Proposal # 1133

RED1-20-22 Part I

Proponents: Christopher McWhite, representing Region VI (cmcwhite@me.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

CONSTRUCTION DOCUMENTS. Written, electronic, 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.

Reason: The definition needs to include the use of digital representation of construction. I can see that the intent was to suggest that digital media is assumed in the word graphic, but graphic art or renderings need not necessarily be digital. Graphic designs are also hard copy and by omitting language in the definition could create a conflict with §R103.1, §R103.2.
It should also be noted that many jurisdictions delete chapter 1 and replace the chapter in its entirety. By omitting digital from the definition, the Code Official could be in a position to write Department policy that includes digital media submissions. This is especially important where a municipality has adopted electronic plan review.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
The addition of this text will not increase or decrease the cost of construction because plans are typically created electronically now. By explicitly defining Construction Docs as being electronic will clarify the acceptance of e-plans.

Bibliography: I am a career, 22 year Building Code Official who has served communities in five states from the Midwest, to the South, and now in New England. Through The Rhode Island Building Code Standards Committee, I am accepted as a certified Building Official; *R.I.G.L. Ch. 23-27.3 §107.5*. Through The International Code Council, I am exam certified as a Certified Building Official, Housing Code Official, Combination Residential Building Inspector, and a Residential and Commercial Plans Examiner. Through the State of Massachusetts I am a certified/licensed Inspector of Buildings/Building Commissioner. Currently I am working as the Department Head Building and Zoning Official in the Town of Smithfield Rhode Island. Here we are committed to our communities' development through partnerships with local and statewide organizations, institutions, and people who are dedicated and/or focused on the process of maintaining existing buildings and constructing new edifices with the goal of making an ever safer built community. I am committed to pursuing improved life safety in residential and commercial structures and the judicious enforcement of current building code and its referenced standards through effective leadership both within the builders and design community and with the professional staff I have the honor to lead. My personal goal is the building of a team of amicable, fair, ethical, and consistently equitable Officials utilizing State and Local building regulations while also judiciously incorporating relevant 28 CFR, ADA requirements. My role is also to communicate these goals with political bodies, large stakeholder investors in high profile projects, local community projects, and simple renovations with homeowners, without parity. I am also a decades-long member of the International Code Council, the non-profit agency that develops and publishes the building Codes. I've twice served as a selected committee member for code development on the national level and I am currently serving as an elected, Governing Board Member with one ICC Membership Council while chairing a subcommittee in another.

Workgroup Recommendation

Proposal # 1212

RED1-20-22 Part II

Proponents: Christopher McWhite, representing Region VI (cmcwhite@me.com)

2024 ENERGY Chapter11

Revise as follows:

CONSTRUCTION DOCUMENTS. Written, electronic, 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.

Reason: The definition needs to include the use of digital representation of construction. I can see that the intent was to suggest that digital media is assumed in the word graphic, but graphic art or renderings need not necessarily be digital. Graphic designs are also hard copy and by omitting language in the definition could create a conflict with §R103.1, §R103.2.
It should also be noted that many jurisdictions delete chapter 1 and replace the chapter in its entirety. By omitting digital from the definition, the Code Official could be in a position to write Department policy that includes digital media submissions. This is especially important where a municipality has adopted electronic plan review.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
There is no cost associated with this proposal.

Bibliography: I am a career, 22 year Building Code Official who has served communities in five states from the Midwest, to the South, and now in New England. Through The Rhode Island Building Code Standards Committee, I am accepted as a certified Building Official; *R.I.G.L. Ch. 23-27.3 §107.5*. Through The International Code Council, I am exam certified as a Certified Building Official, Housing Code Official, Combination Residential Building Inspector, and a Residential and Commercial Plans Examiner. Through the State of Massachusetts I am a certified/licensed Inspector of Buildings/Building Commissioner. Currently I am working as the Department Head Building and Zoning Official in the Town of Smithfield Rhode Island. Here we are committed to our communities' development through partnerships with local and statewide organizations, institutions, and people who are dedicated and/or focused on the process of maintaining existing buildings and constructing new edifices with the goal of making an ever safer built community. I am committed to pursuing improved life safety in residential and commercial structures and the judicious enforcement of current building code and its referenced standards through effective leadership both within the builders and design community and with the professional staff I have the honor to lead. My personal goal is the building of a team of amicable, fair, ethical, and consistently equitable Officials utilizing State and Local building regulations while also judiciously incorporating relevant 28 CFR, ADA requirements. My role is also to communicate these goals with political bodies, large stakeholder investors in high profile projects, local community projects, and simple renovations with homeowners, without parity. I am also a decades-long member of the International Code Council, the non-profit agency that develops and publishes the building Codes. I've twice served as a selected committee member for code development on the national level and I am currently serving as an elected, Governing Board Member with one ICC Membership Council while chairing a subcommittee in another.

Workgroup Recommendation

RED1-21-22 Part I

Proponents: Tom Ortiz, representing National Propane Gas Association (tortiz@npga.org); Bruce Swiecicki, representing National Propane Gas Association (bswiecicki@npga.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

RENEWABLE ENERGY RESOURCES. Energy derived from solar radiation, wind, waves, tides, landfill gas, biogas, renewable biomass, renewable hydrocarbon sources, or extracted from hot fluid or steam heated within the earth.

Add new definition as follows:

RENEWABLE BIOMASS. Each of the following (including any incidental, de minimis contaminants that are impractical to remove and are related to customary feedstock production and transport): (1) Planted crops and crop residue harvested from existing agricultural land cleared or cultivated prior to December 19, 2007 and that was nonforested and either actively managed or fallow on December 19, 2007. (2) Planted trees and tree residue from a tree plantation located on non-federal land (including land belonging to an Indian tribe or an Indian individual that is held in trust by the U.S. or subject to a restriction against alienation imposed by the U.S.) that was cleared at any time prior to December 19, 2007 and actively managed on December 19, 2007. (3) Animal waste material and animal byproducts. (4) Slash and pre-commercial thinnings from non-federal forestland (including forestland belonging to an Indian tribe or an Indian individual, that are held in trust by the United States or subject to a restriction against alienation imposed by the United States) that is not ecologically sensitive forestland. (5) Biomass (organic matter that is available on a renewable or recurring basis) obtained from within 200 feet of buildings and other areas regularly occupied by people, or of public infrastructure, in an area at risk of wildfire. (6) Algae. (7) Separated yard waste or food waste, including recycled cooking and trap grease.

RENEWABLE HYDROCARBON SOURCES. Hydrocarbon gases and liquids recovered from renewable biomass, or from reclamation of plastics (as polymer, monomer, or constituent chemical building blocks) in such a manner that they displace the primary or raw materials that are used as chemical building blocks in the production of plastics, or from synthesis of clean hydrogen and associated chemical feedstocks.

Reason: The definition of renewable energy resources excludes renewable hydrocarbons, which can be manufactured from clean hydrogen and captured carbon, recovered from recycled plastics, or derived from waste fats and oils. This proposal is based on extensive research that has been done and is ongoing, as well as the terminology currently found in the regulations promulgated by the U.S. Environmental Protection Agency[1]. Recent work regarding the recycling of plastics into useable forms of energy has demonstrated processes that can be used to help rid the world of an environmental scourge[2], or the use of clean hydrogen to convert captured carbon dioxide into propane and other hydrocarbons[3],[4].
All notions of renewability rely on circularity, the regeneration of raw materials from existing finished products in a way that allows for replenishment of those materials on the timescale of a human lifetime.

Naturally occurring hydrocarbons are generated chemically via the decomposition of organic material. Hydrocarbons can also be recovered from the chemical decomposition of polymers (plastics) and the synthesis of hydrogen and carbon dioxide. Renewable hydrocarbons result where the chemical processes which produce hydrocarbons consume preexisting feedstocks of any of the above types (organic, polymer, or hydrogen), of hydrocarbon, in one of three circular economic cycles.

Each circular, renewable hydrocarbon cycle can begin with an initial quantity of naturally (geologically) produced hydrocarbon feedstock. Imagine a gas well from which a quantity of propane can be isolated cryogenically in a processing plant. This propane can be burned as fuel, processed in a petrochemical plant into plastics, or used to produce organic materials[5]. From this point, three paths can be traversed.

In the first (“bottom-up inorganic recovery”) case, propane burned as fuel generates carbon dioxide as a byproduct. This carbon dioxide can be captured, either immediately at the point of combustion, or later via direct air capture of carbon dioxide. The captured carbon is then blended with clean (renewable) hydrogen in a synthesis reaction that results in new propane[6]. This propane can subsequently be burned, and its carbon dioxide byproduct recaptured, beginning the cycle again.

In the second (“top-down inorganic recovery”) case, propane is processed into plastics, the latter which eventually reach the end of their economically useful life. These plastics are decomposed in a catalytic reactor into new propane[7], which can either be burned or else reprocessed in petrochemical plants into fresh plastics, beginning the cycle again. It is immaterial whether the propane generated during each period are burned as fuel or processed into plastics; either product may be recovered and replenished.

The third (“organic recovery”) case involves industrial decomposition of renewable organic materials (e.g. wood, crops, fats, oils) into small chain hydrocarbons. Propane generated via industrial organic decomposition can likewise be burned or processed into plastics, and—as described above—regenerated into fresh propane using either the circular top-down or bottom-up inorganic processes.

Thus, we see that hydrocarbons may indeed be renewable and can be generated in a variety of equivalently circular processes. There is no distinction chemically, functionally, or from a carbon accounting perspective, among the renewable hydrocarbons generated via the available inorganic or organic recovery processes. Such hydrocarbons are therefore a legitimately renewable fuel source.

[1] 40 CFR Part 80 Subpart M: https://www.ecfr.gov/current/title-40/chapter-I/subchapter-C/part-80/subpart-M

[2] CSA Group: https://www.csagroup.org/article/research/defining-recycling-in-the-context-of-plastics/

[3]CSA Group: https://www.csagroup.org/article/research/defining-recycling-in-the-context-of-plastics/

[4] https://news.stanford.edu/2019/10/17/new-catalyst-helps-turn-carbon-dioxide-fuel/

[5] U.S. Patent 540563A (1995), "Process for the extraction of fats and oils", https://patents.google.com/patent/US5405633A/en

[6] Stanford News (2019), "Stanford researchers create new catalyst that can turn carbon dioxide into fuels", https://news.stanford.edu/2019/10/17/new-catalyst-helps-turn-carbon-dioxide-fuel/ .

[7] Guido Zichittella, Amani M. Ebrahim, Jie Zhu, Anna E. Brenner, Griffin Drake, Gregg T. Beckham, Simon R. Bare, Julie E. Rorrer, and Yuriy Román-Leshkov (2022), "Hydrogenolysis of Polyethylene and Polypropylene into Propane over Cobalt-Based Catalysts", *JACS Au Article ASAP*, DOI: 10.1021/jacsau.2c00402 .

Cost Impact: The code change proposal will decrease the cost of construction.
This proposal will broaden the choices for renewable energy so it will decrease the cost of construction.

Bibliography:
[1] 40 CFR Part 80 Subpart M: https://www.ecfr.gov/current/title-40/chapter-I/subchapter-C/part-80/subpart-M

[2] CSA Group: https://www.csagroup.org/article/research/defining-recycling-in-the-context-of-plastics/

[3]CSA Group: https://www.csagroup.org/article/research/defining-recycling-in-the-context-of-plastics/

[4] https://news.stanford.edu/2019/10/17/new-catalyst-helps-turn-carbon-dioxide-fuel/

[5] U.S. Patent 540563A (1995), "Process for the extraction of fats and oils", https://patents.google.com/patent/US5405633A/en

[6] Stanford News (2019), "Stanford researchers create new catalyst that can turn carbon dioxide into fuels", https://news.stanford.edu/2019/10/17/new-catalyst-helps-turn-carbon-dioxide-fuel/ .

[7] Guido Zichittella, Amani M. Ebrahim, Jie Zhu, Anna E. Brenner, Griffin Drake, Gregg T. Beckham, Simon R. Bare, Julie E. Rorrer, and Yuriy Román-Leshkov (2022), "Hydrogenolysis of Polyethylene and Polypropylene into Propane over Cobalt-Based Catalysts", *JACS Au Article ASAP*, DOI: 10.1021/jacsau.2c00402 .

Workgroup Recommendation

Proposal # 1247

RED1-21-22 Part II

Proponents: Tom Ortiz, representing National Propane Gas Association (tortiz@npga.org); Bruce Swiecicki, representing National Propane Gas Association (bswiecicki@npga.org)

2024 ENERGY Chapter11

Revise as follows:

RENEWABLE ENERGY RESOURCES. Energy derived from solar radiation, wind, waves, tides, landfill gas, biogas, renewable biomass, renewable hydrocarbon sources, or extracted from hot fluid or steam heated within the earth.

Add new definition as follows:

RENEWABLE BIOMASS. Each of the following (including any incidental, de minimis contaminants that are impractical to remove and are related to customary feedstock production and transport): (1) Planted crops and crop residue harvested from existing agricultural land cleared or cultivated prior to December 19, 2007 and that was nonforested and either actively managed or fallow on December 19, 2007. (2) Planted trees and tree residue from a tree plantation located on non-federal land (including land belonging to an Indian tribe or an Indian individual that is held in trust by the U.S. or subject to a restriction against alienation imposed by the U.S.) that was cleared at any time prior to December 19, 2007 and actively managed on December 19, 2007. (3) Animal waste material and animal byproducts. (4) Slash and pre-commercial thinnings from non-federal forestland (including forestland belonging to an Indian tribe or an Indian individual, that are held in trust by the United States or subject to a restriction against alienation imposed by the United States) that is not ecologically sensitive forestland. (5) Biomass (organic matter that is available on a renewable or recurring basis) obtained from within 200 feet of buildings and other areas regularly occupied by people, or of public infrastructure, in an area at risk of wildfire. (6) Algae. (7) Separated yard waste or food waste, including recycled cooking and trap grease.

RENEWABLE HYDROCARBON SOURCES. Hydrocarbon gases and liquids recovered from renewable biomass, or from reclamation of plastics (as polymer, monomer, or constituent chemical building blocks) in such a manner that they displace the primary or raw materials that are used as chemical building blocks in the production of plastics, or from synthesis of clean hydrogen and associated chemical feedstocks."

Reason: The definition of renewable energy resources excludes renewable hydrocarbons, which can be manufactured from clean hydrogen and captured carbon, recovered from recycled plastics, or derived from waste fats and oils.
This proposal is based on extensive research that has been done and is ongoing, as well as the terminology currently found in the regulations promulgated by the U.S. Environmental Protection Agency[1]. Recent work regarding the recycling of plastics into useable forms of energy has demonstrated processes that can be used to help rid the world of an environmental scourge[2], or the use of clean hydrogen to convert captured carbon dioxide into propane and other hydrocarbons[3],[4].

All notions of renewability rely on circularity, the regeneration of raw materials from existing finished products in a way that allows for replenishment of those materials on the timescale of a human lifetime.

Naturally occurring hydrocarbons are generated chemically via the decomposition of organic material. Hydrocarbons can also be recovered from the chemical decomposition of polymers (plastics) and the synthesis of hydrogen and carbon dioxide. Renewable hydrocarbons result where the chemical processes which produce hydrocarbons consume preexisting feedstocks of any of the above types (organic, polymer, or hydrogen), of hydrocarbon, in one of three circular economic cycles.

Each circular, renewable hydrocarbon cycle can begin with an initial quantity of naturally (geologically) produced hydrocarbon feedstock. Imagine a gas well from which a quantity of propane can be isolated cryogenically in a processing plant. This propane can be burned as fuel, processed in a petrochemical plant into plastics, or used to produce organic materials[5]. From this point, three paths can be traversed.

In the first ("bottom-up inorganic recovery") case, propane burned as fuel generates carbon dioxide as a byproduct. This carbon dioxide can be captured, either immediately at the point of combustion, or later via direct air capture of carbon dioxide. The captured carbon is then blended with clean (renewable) hydrogen in a synthesis reaction that results in new propane[6]. This propane can subsequently be burned, and its carbon dioxide byproduct recaptured, beginning the cycle again.

In the second ("top-down inorganic recovery") case, propane is processed into plastics, the latter which eventually reach the end of their economically useful life. These plastics are decomposed in a catalytic reactor into new propane[7], which can either be burned or else reprocessed in petrochemical plants into fresh plastics, beginning the cycle again. It is immaterial whether the propane generated during each period are burned as fuel or processed into plastics; either product may be recovered and replenished.

The third ("organic recovery") case involves industrial decomposition of renewable organic materials (e.g. wood, crops, fats, oils) into small chain hydrocarbons. Propane generated via industrial organic decomposition can likewise be burned or processed into plastics, and—as described above—regenerated into fresh propane using either the circular top-down or bottom-up inorganic processes.

Thus, we see that hydrocarbons may indeed be renewable and can be generated in a variety of equivalently circular processes. There is no distinction chemically, functionally, or from a carbon accounting perspective, among the renewable hydrocarbons generated via the available inorganic or organic recovery processes. Such hydrocarbons are therefore a legitimately renewable fuel source.

[1]

40 CFR Part 80 Subpart M: https://www.ecfr.gov/current/title-40/chapter-I/subchapter-C/part-80/subpart-M

[2] CSA Group: https://www.csagroup.org/article/research/defining-recycling-in-the-context-of-plastics/

[3]CSA Group: https://www.csagroup.org/article/research/defining-recycling-in-the-context-of-plastics/

[4] https://news.stanford.edu/2019/10/17/new-catalyst-helps-turn-carbon-dioxide-fuel/

[5] U.S. Patent 540563A (1995), “Process for the extraction of fats and oils”, https://patents.google.com/patent/US5405633A/en

[6] Stanford News (2019), “Stanford researchers create new catalyst that can turn carbon dioxide into fuels”, https://news.stanford.edu/2019/10/17/new-catalyst-helps-turn-carbon-dioxide-fuel/ .

[7] Guido Zichittella, Amani M. Ebrahim, Jie Zhu, Anna E. Brenner, Griffin Drake, Gregg T. Beckham, Simon R. Bare, Julie E. Rorrer, and Yuriy Román-Leshkov (2022), “Hydrogenolysis of Polyethylene and Polypropylene into Propane over Cobalt-Based Catalysts”, *JACS Au Article ASAP*, DOI: 10.1021/jacsau.2c00402 .

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This code change will allow more options for energy and will potentially decrease the cost of construction.

Bibliography: [1] 40 CFR Part 80 Subpart M: https://www.ecfr.gov/current/title-40/chapter-I/subchapter-C/part-80/subpart-M
[2] CSA Group: https://www.csagroup.org/article/research/defining-recycling-in-the-context-of-plastics/

[3]CSA Group: https://www.csagroup.org/article/research/defining-recycling-in-the-context-of-plastics/

[4] https://news.stanford.edu/2019/10/17/new-catalyst-helps-turn-carbon-dioxide-fuel/

[5] U.S. Patent 540563A (1995), “Process for the extraction of fats and oils”, https://patents.google.com/patent/US5405633A/en

[6] Stanford News (2019), “Stanford researchers create new catalyst that can turn carbon dioxide into fuels”, https://news.stanford.edu/2019/10/17/new-catalyst-helps-turn-carbon-dioxide-fuel/ .

[7] Guido Zichittella, Amani M. Ebrahim, Jie Zhu, Anna E. Brenner, Griffin Drake, Gregg T. Beckham, Simon R. Bare, Julie E. Rorrer, and Yuriy Román-Leshkov (2022), “Hydrogenolysis of Polyethylene and Polypropylene into Propane over Cobalt-Based Catalysts”, *JACS Au Article ASAP*, DOI: 10.1021/jacsau.2c00402 .

Workgroup Recommendation

Proposal # 1278

RED1-22-22

Proponents: Diana Burk, representing New Buildings Institute (diana@newbuildings.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

RENEWABLE ENERGY RESOURCES. Energy derived from solar radiation, wind, waves, tides, ~~landfill gas, biogas, biomass~~ *renewable fuels* or extracted from hot fluid or steam heated within the earth.

Add new definition as follows:

RENEWABLE FUEL. Fuels that achieve a 70% greenhouse gas emission reduction from a comparable fossil fuel calculated in accordance with California Air Resources Board's Low Carbon Fuel Standard or Annex V or Annex VI of the European Union Renewable Energy Directive 2018/2001.

Add new standard(s) as follows:

CARB California Air Resources Board. Low Carbon Fuel Standard: CA- GREET 3.0 model

EU European Parliament. Annex V and VI of the European Union Renewable Energy Directive 2018/2001 (RED II)

Reason: NBI submitted proposal CEPI-12 Part II to revise the definition of renewable energy resource by removing the word "biomass" from the definition and substituting it with "biomass waste" to more accurately address the types of biomass that are likely to reduce and not increase pollutants and greenhouse gas emissions. Several conversations with industry stakeholders during the debate of this proposed amendment raised valid concerns with this approach namely, the revised definition approved in the draft 2024 IECC may be both difficult to enforce and could eliminate certain fuels that reduce greenhouse gas emissions not sourced from biomass waste products.

The ICC should instead model the definition of a renewable fuel on existing policies used to reduce greenhouse gas emissions from fuels. This new proposed definition is based on current policies for transportation fuels in California, Washington and Oregon, Green-e's renewable fuel standard, and requirements for renewable fuels in Europe. Like the Green-e certified renewable fuel standard, the proposed definition relies on a method for calculating the greenhouse gas emission reduction from a renewable fuel product using California Air Resource Board's Low Carbon Fuel Standard. [1], [2] A similar calculation developed by the European Union for their Renewable Energy Directive II is also provided as an optional method for calculating emissions. Both methods include both direct greenhouse gas emission from the production and consumption of the fuel and indirect greenhouse gas emissions from land use changes. [3]

The required greenhouse gas emission reduction target of 70% when compared to fossil fuels is equivalent to the requirements for renewable building fuels in Europe as of 2021. Europe will increase the required percentage to 80% by 2026. [3] NBI believes the IECC should eventually follow Europe's lead and reduce the greenhouse gas emission requirement for renewable fuels as the US transitions to a more renewable grid.
This revised renewable fuel definition proposed is easier to enforce, technology neutral, and will ensure the renewable energy requirement proposed for inclusion in the 2024 IECC will prevent increased localized criteria air pollution while still reducing carbon emissions from the building. A similar amendment has been proposed for inclusion in the commercial energy code so that the definition for renewable energy resources can be consistent between both versions of the code.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This code change proposal will not affect the cost of construction.

Bibliography: [1] California Air Resources Board. (2022, July 7). LCFS Pathway Certified Carbon Intensities. Retrieved from https://ww2.arb.ca.gov/resources/documents/lcfs-pathway-certified-carbon-intensities.
[2] Center for Resource Solutions. (2021, September 16). Green-e. Retrieved from Green-e Renewable Fuels Standard, Version 1.0: https://www.green-e.org/docs/rf/Green-e%20Renewable%20Fuels%20Standard.pdf
[3] European Commission. (2022, July 7). Renewable Energy – Recast to 2030 (RED II). Retrieved from EU Science Hub: https://joint-research-centre.ec.europa.eu/welcome-jec-website/reference-regulatory-framework/renewable-energy-recast-2030-red-ii_en

Attached Files

- **Annex V and VI of the European Union Renewable Energy Directive 2018 2001 (RED II).pdf**
  https://energy.cdpaccess.com/proposal/1070/2535/files/download/452/

Workgroup Recommendation

RED1-23-22

Proponents: Diana Burk, representing New Buildings Institute (diana@newbuildings.org)

2024 International Energy Conservation Code [RE Project]

Add new definition as follows:

BIOMASS WASTE. Organic non-fossil material of biological origin that is a byproduct or a discarded product. Biomass waste includes municipal solid waste from biogenic sources, landfill gas, sludge waste, agricultural crop byproducts, straw, and other biomass solids, liquids, and biogases; but excludes wood and wood-derived fuels (including black liquor), biofuel, feedstock, biodiesel, and fuel ethanol.

Revise as follows:

RENEWABLE ENERGY RESOURCES. Energy derived from solar radiation, wind, waves, tides, ~~landfill gas, biogas,~~ *biomass* *waste* or extracted from hot fluid or steam heated within the earth.

Reason: There is currently no definition for biomass in the residential IECC even though biomass was recently listed as a potential renewable energy resource. Because there are many flavors of biomass, it is important for the IECC to clarify which forms of biomass energy count towards reducing a residential buildings' ERI score. The revision limits the biomass sources that count as renewable energy resources to those that are specified as waste products and ensures that virgin material of unknown origin does not count as a steady source of renewable energy. Without an available standard to cite in the IECC for sustainable biomass, it is critical to ensure that biomass used in compliance with the IECC is derived from waste products or byproducts. The definition of *biomass waste* is taken from the glossary of the Energy Information Administration. A similar amendment has been approved by the commercial IECC and is included in the draft code.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This code change will not affect the cost of construction.

Workgroup Recommendation

Proposal # 1071

RED1-24-22 Part I

Proponents: Christopher McWhite, representing Region VI (cmcwhite@me.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

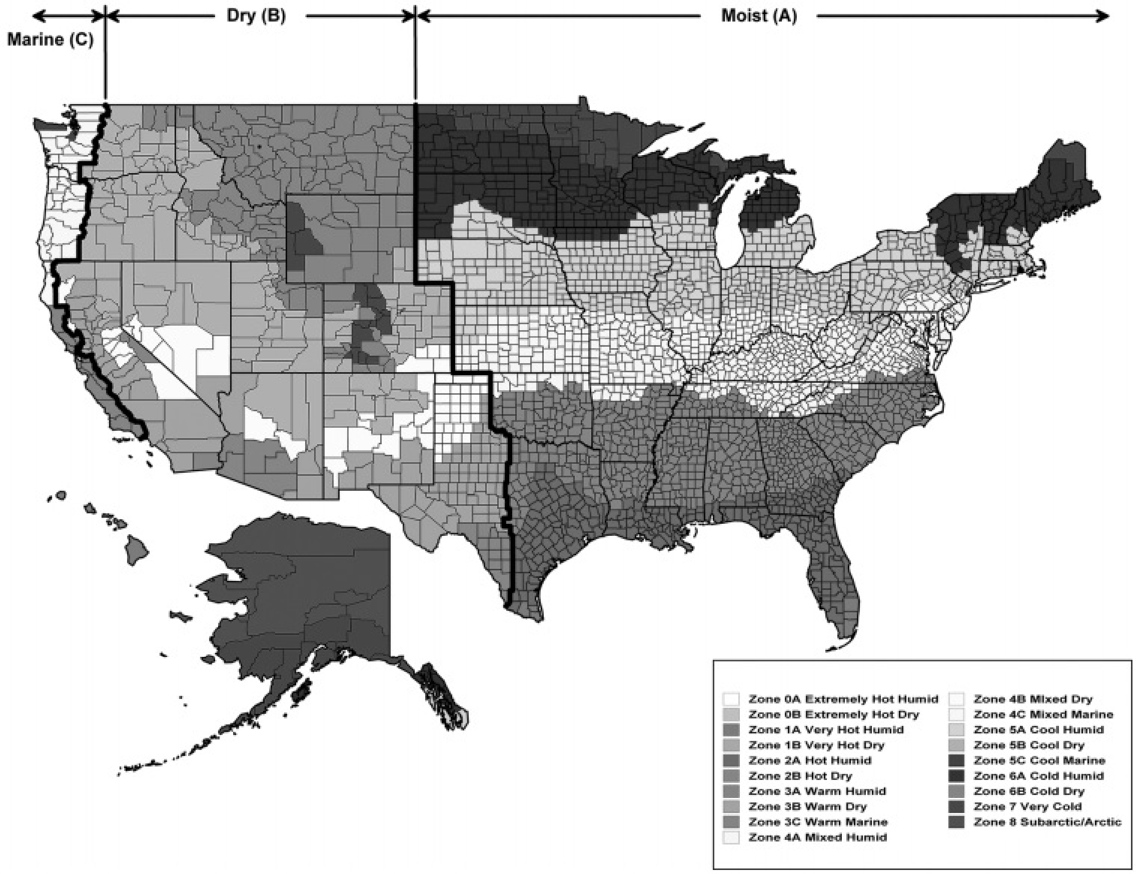

FIGURE R301.1 CLIMATE ZONES

Reason: The figure is inconsistent with the legend. The graphic representation of the eastern portions of The United States shows Moist (A) but the legend uses the language Humid.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This change will not increase or decrease the cost of construction.

Bibliography: I am a career, 22 year Building Code Official who has served communities in five states from the Midwest, to the South, and now in New England. Through The Rhode Island Building Code Standards Committee, I am accepted as a certified Building Official; *R.I.G.L. Ch. 23-27.3 §107.5*. Through The International Code Council, I am exam certified as a Certified Building Official, Housing Code Official, Combination Residential Building Inspector, and a Residential and Commercial Plans Examiner. Through the State of Massachusetts I am a certified/licensed Inspector of Buildings/Building Commissioner. Currently I am working as the Department Head Building and Zoning Official in the Town of Smithfield Rhode Island. Here we are committed to our communities' development through partnerships with local and statewide organizations, institutions, and people who are dedicated and/or focused on the process of maintaining existing buildings and constructing new edifices with the goal of making an ever safer built community. I am committed to pursuing improved life safety in residential and commercial structures and the judicious enforcement of current building code and its referenced standards through effective leadership both within the builders and design community and with the professional staff I have the honor to lead. My personal goal is the building of a team of amicable, fair, ethical, and consistently equitable Officials utilizing State and Local building regulations while also judiciously incorporating relevant 28 CFR, ADA requirements. My role is also to communicate these goals with political bodies, large stakeholder investors in high profile projects, local community projects, and simple renovations with homeowners, without parity. I am also a decades-long member of the International Code Council, the non-profit agency that develops and publishes the building Codes. I've twice served as a selected committee member for code development on the national level and I am currently serving as an elected, Governing Board Member with one ICC Membership Council while chairing a subcommittee in another.

Workgroup Recommendation

Proposal # 1217

RED1-24-22 Part II

Proponents: Christopher McWhite, representing Region VI (cmcwhite@me.com)

2024 ENERGY Chapter11

FIGURE N1101.7 CLIMATE ZONES

Reason: The figure is inconsistent. The graphic representation of the eastern portions of The United States shows Moist (A) but the legend uses the language Humid. The language should be consistently Humid.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This change will not increase or decrease the cost of construction.

Bibliography: I am a career, 22 year Building Code Official who has served communities in five states from the Midwest, to the South, and now in New England. Through The Rhode Island Building Code Standards Committee, I am accepted as a certified Building Official; *R.I.G.L. Ch. 23-27.3 §107.5*. Through The International Code Council, I am exam certified as a Certified Building Official, Housing Code Official, Combination Residential Building Inspector, and a Residential and Commercial Plans Examiner. Through the State of Massachusetts I am a certified/licensed Inspector of Buildings/Building Commissioner. Currently I am working as the Department Head Building and Zoning Official in the Town of Smithfield Rhode Island. Here we are committed to our communities' development through partnerships with local and statewide organizations, institutions, and people who are dedicated and/or focused on the process of maintaining existing buildings and constructing new edifices with the goal of making an ever safer built community. I am committed to pursuing improved life safety in residential and commercial structures and the judicious enforcement of current building code and its referenced standards through effective leadership both within the builders and design community and with the professional staff I have the honor to lead. My personal goal is the building of a team of amicable, fair, ethical, and consistently equitable Officials utilizing State and Local building regulations while also judiciously incorporating relevant 28 CFR, ADA requirements. My role is also to communicate these goals with political bodies, large stakeholder investors in high profile projects, local community projects, and simple renovations with homeowners, without parity. I am also a decades-long member of the International Code Council, the non-profit agency that develops and publishes the building Codes. I've twice served as a selected committee member for code development on the national level and I am currently serving as an elected, Governing Board Member with one ICC Membership Council while chairing a subcommittee in another.

Workgroup Recommendation

Proposal # 1226

RED1-25-22

Proponents: Michele DeFrance, representing City of Portland Maine (mdefrance@portlandmaine.gov)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

C401.2.1 . Commercial buildings shall comply with one of the following:

1. Prescriptive Compliance. The Prescriptive Compliance option requires compliance with Sections C402 through C406, and Section C408. Dwelling units and sleeping units in Group R-2 buildings shall be deemed to be in compliance with this chapter, provided that they comply with Section R406.
2. Simulated Building Performance. The Simulated Building Performance option requires compliance with Section C407.

Exception: Additions, alterations, repairs and changes of occupancy to existing buildings complying with Chapter 5.

Reason: The current language requires the Prescriptive Compliance Option to comply with Sections R401-R404 and R401-R408. This is not the intention. A comma is required to provide the correct compliance range. It should read: "The Prescriptive Compliance Option requires compliance with Sections R401 through R404, and R408."

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This is a grammatical change only and doesn't change the intent of the code.

Workgroup Recommendation

Proposal # 1022

RED1-26-22

Proponents: Aaron Phillips, representing Asphalt Roofing Manufacturers Association (aphillips@asphaltroofing.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R408.1 Scope. This section establishes additional efficiency credits to achieve additional energy efficiency~~ in accordance with Section R401.2.5~~.

R408.2 Additional energy efficiency credit requirements . Where required, two~~Two~~ of the additional measures shall be selected from Table R408.2 that meet or exceed a total of ten credits. Five additional credits shall be selected for dwelling units with greater than 5,000 square feet (465 m^2) of living space floor area located above grade plane. Each measure selected shall meet the relevant subsections of Section R408 and receive credit as specified in Table R408.2 for the specific Climate Zone. Interpolation of credits between measures shall not be permitted.

2024 ENERGY Chapter11

Revise as follows:

N1108.1 Scope. This section establishes additional efficiency credits to achieve additional energy efficiency~~ in accordance with Section N1101.13.5~~.

N1108.2 Additional energy efficiency credit requirements. Where required, two~~Two~~ of the additional efficiency measures shall be selected from Table N1108.2 that meet or exceed a total of ten credits. Five additional credits shall be selected for dwelling units with greater than 5,000 square feet (465 m^2) of living space floor area located above grade plane. Each measure selected shall meet the relevant subsections of Section N1108 and receive credit as specified in Table N1108.2 for the specific Climate Zone. Interpolation of credits between measures shall not be permitted.

Reason: Sections R401.2.5 and N1101.13.5 are not present in the residential 1st Public Comment Draft, so this comment removes references to those sections. The provisions of Section R408 are not always applicable, but are triggered by other sections of the IECC. Therefore, the comment adds the phrase, "Where required," to the beginning of Sections R408.2 and N1108.2 to clarify that the additional energy efficiency credit requirements are not applicable in all cases.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This comment makes an editorial correction and adds a clarifying phrase without making technical changes. Therefore, no impact is expected to cost of construction.

Workgroup Recommendation

Proposal # 967

RED1-27-22

Proponents: Gayathri Vijayakumar, representing Steven Winter Associates, Inc. (gvijayakumar@swinter.com); Mark Lyles, representing California IOUs (markl@newbuildings.org)

2024 International Energy Conservation Code [RE Project]

Add new text as follows:

APPENDIX RG
2024 IECC Stretch Code

RG101
COMPLIANCE

RG405.2 Simulated Performance compliance. Compliance based on total building performance requires that a *proposed design* meets all of the following:

1. The requirements of the sections indicated within Table R405.2.
2. The proposed total *building thermal envelope* TC, which is the sum of the U-factor times assembly area and F-factor times perimeter, 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 1.10 in Climate Zones 3 through 8 in accordance with Equation 4-2. The area-weighted maximum fenestration SHGC permitted in Climate Zones 0 through 3 shall be 0.30.

   For Climate Zones 0-2: $TC_{\text{Proposed design}} \leq 1.08 \times TC_{\text{Prescriptive reference design}}$ **(Equation 4-2)**

   For Climate Zones 3-8: $TC_{\text{Proposed design}} \leq 1.10 \times TC_{\text{Prescriptive reference design}}$

3. For buildings without a fuel burning appliance for space heating or water heating, the annual energy cost of the *proposed design* that is less than or equal to 75 percent of the annual energy cost of the *standard reference design*. For buildings with a fuel burning appliance for space heating or water heating, the annual energy cost of the *proposed design* that is less than or equal to 70 percent of the annual energy cost of the *standard reference design*. For dwelling units with greater than 5,000 square feet (465 m^2) of living space floor area located above grade plane, the annual energy cost of the *proposed design* shall be reduced by an additional 5 percent of annual energy cost of the *standard reference design*. Energy prices shall be taken from a source *approved* by the *code official*, such as the Department of Energy, 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 multipliers for all energy sources shall be obtained from ASHRAE Standard 105 (Tables K2, K4, or K8) or from another data source *approved* by the *code official*.
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 for an all-electric building with on-site renewable energy installed.

RG406.5 ERI-based compliance. Compliance based on an ERI analysis requires that the *rated proposed design* and confirmed built dwelling be shown to have an ERI less than or equal to the appropriate value indicated in Table R406.5 when 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.

Exception: Where the ERI analysis excludes OPP, the maximum ENERGY RATING INDEX NOT INCLUDING OPP shall be permitted.

R406.5 MAXIMUM ENERGY RATING INDEX

CLIMATE ZONE	ENERGY RATING INDEX NOT INCLUDING OPP	ENERGY RATING INDEX WITH OPP
0-1	45	30
2	45	30
3	45	30
4	45	30
5	45	30
6	45	30
7	45	30
8	45	30

RG408.2 Additional energy efficiency credit requirements. No less than two measures shall be selected from Table R408.2 that meet or exceed a total of twenty credits. Five additional credits shall be selected for dwelling units with greater than 5,000 square feet (465 m^2) of living space floor area located above grade plane. Each measure selected shall meet the relevant subsections of Section R408 and receive credit as specified in Table R408.2 for the specific Climate Zone. For *dwelling units* in Group R-2 buildings, where applicable, the requirements shall be met in each dwelling unit in order to receive credit. Interpolation of credits between measures shall not be permitted.

Reason: This glide path appendix is being offered as a simple option for jurisdictions to adopt to exceed the energy performance 2024 IECC on their "glide path" to net zero energy. To attain that additional performance, this Appendix has three sections that would replace the corresponding sections in the main body of the code: one section from each Compliance option (Prescriptive, Simulated Performance, and ERI).
Where changes are made throughout the public comment period to these three copied sections, those changes would be intended to be updated here as well.

Cost Impact: The code change proposal will increase the cost of construction.
For jurisdictions that adopt this code, local building construction costs at the time of adoption should be considered to determine cost-effectiveness.

Bibliography: None

Workgroup Recommendation

Proposal # 1119

RED1-28-22

Proponents: Gayathri Vijayakumar, representing Steven Winter Associates, Inc. (gvijayakumar@swinter.com)

2024 International Energy Conservation Code [RE Project]

Add new text as follows:

APPENDIX RH
Operational Carbon Rating and Energy Reporting

RH101
GENERAL DEFINITIONS

Add new definition as follows:

CO2e INDEX. A numerical integer value, calculated in accordance with ANSI / RESNET / ICC 301 that represents the relative Carbon Dioxide equivalence (CO_2e) emissions of a *rated design* as compared with the CO_2e emissions of the CO_2e reference design and where an Index value of 100 represents the CO_2e performance of the CO_2e reference design and an Index value of 0 (zero) represents a home that emits zero net CO_2e annually.

Add new text as follows:

RH102
COMPLIANCE

RH401.2 Application. Residential buildings shall comply with Section R406.

Exception: Additions, alterations, repairs and changes of occupancy to existing buildings complying with Chapter 5.

RH401.3 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 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 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 and CO_2e 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.

RH406.2 ERI and CO2e Index compliance. Compliance based on the ERI and *CO_2e Index* requires that the *rated design* and confirmed built dwelling meet all of the following:

1. The requirements of the sections indicated within Table R406.2.
2. Maximum ERI values indicated in Table R406.5.
3. Maximum *CO_2e Index* of 55, not including OPP, determined in accordance with ANSI/RESNET/ICC 301.

RH406.7.2.2 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 and CO_2e 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 reference design and the constructed *dwelling unit*.
6. A final confirmed certificate indicating that the constructed building has been verified to comply with Sections R406.2 and R406.4. 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 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 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.

Reason: As stated in the Executive Summary of the "Path Forward on Energy and Sustainability to Confront a Changing Climate," reduction of greenhouse gas emissions is part of our mission on this Committee. This proposal is a step toward that goal, by reporting an index, similar to ERI, that helps a builder/homeowner understand the performance of their home with respect to GHG. The calculation of this CO2e index has no added cost and requires no additional effort by the builder or rater. The same software that calculates an ERI in 2024 IECC R406 path will be done so in accordance with ANSI 301-2022. That Standard requires software to list this CO2e Index on labels & certificates. It will be published in time for reference within the 2024 IECC to include an update to GHG emission factors (Addendum B).
This proposal also provides an achievable but maximum CO2e Index and adds the reporting of energy use such that GHG emissions could be calculated separately, if other metrics are being used by the jurisdiction to document GHG performance.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
The code change proposal will neither increase nor decrease the cost of construction since the reporting of this value is already part of compliance with the referenced Standard.

Bibliography: None

Workgroup Recommendation

Proposal # 1170

RED1-29-22

Proponents: Fredric Zwerg, representing Southwest Gas Corporation (fredric.zwerg@swgas.com)

2024 International Energy Conservation Code [RE Project]

Delete without substitution:

~~**ENERGY RATING INDEX (ERI).** A numerical integer value that represents the relative energy performance of a Rated Home 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 home with zero net energy performance.~~

Reason: Delete this definition entirely. The ERI is already defined by RESNET/ICC 301 and is not needed. Adding it here could cause potential conflicts with the definitions in two non-related documents.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
No cost impact.

Workgroup Recommendation

Proposal # 1109

RED1-30-22

Proponents: Amy Boyce, representing Energy Efficient Codes Coalition (EECC) (amy.boyce@imt.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R102.1.1 Above code programs. The *code official* or other authority having jurisdiction 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* UA, which is the 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 1.0 ~~1.08~~ in Climate Zones 0, 1, 2, and by 1.1 ~~1.15~~ in Climate Zones 3 through 8, in accordance with Equation 4-1. The area-weighted maximum fenestration SHGC permitted in Climate Zones 0 through 3 shall be 0.30.

$$\text{For Climate Zones 0-2: } UA_{\text{Proposed design}} \le \underline{1.0}\ \cancel{1.08} \times UA_{\text{Prescriptive reference design}}$$
$$\text{For Climate Zones 3-8: } UA_{\text{Proposed design}} \le \underline{1.1}\ \cancel{1.15} \times UA_{\text{Prescriptive reference design}}$$

R405.2 Simulated performance compliance. Compliance based on total building performance requires that a *proposed design* meets all of the following:

1. The requirements of the sections indicated within Table R405.2.
2. The proposed total building thermal envelope UA, which is the sum of the 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 1.0 ~~1.08~~ in Climate Zones 0, 1, and 2, and 1.1 ~~1.15~~ in Climate Zones 3 through 8 in accordance with Equation 4-2. The area-weighted maximum fenestration SHGC permitted in Climate Zones 0 through 3 shall be 0.30.

$$\text{For Climate Zones 0-2: } UA_{\text{Proposed design}} \le \underline{1.0}\ \cancel{1.08} \times UA_{\text{Prescriptive reference design}}$$
$$\text{For Climate Zones 3-8: } UA_{\text{Proposed design}} \le \underline{1.1}\ \cancel{1.15} \times UA_{\text{Prescriptive reference design}}$$

(Equation 4-2)

3. For buildings without a fuel burning appliance for space heating or water heating, the annual energy cost of the proposed design that is less than or equal to 85 percent of the annual energy cost of the *standard reference design*. For buildings with a fuel burning appliance for space heating or water heating, the annual energy cost of the proposed design that is less than or equal to 80 percent of the annual energy cost of the standard reference design. For dwelling units with greater than 5,000 square feet (465 m^2) of living space floor area located above grade plane, the annual energy cost of the proposed design shall be reduced by an additional 5 percent of annual energy cost of the standard reference design. Energy prices shall be taken from a source *approved* by the *code official*, such as the Department of Energy, 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 multipliers for all energy sources shall be obtained from ASHRAE Standard 105 (Tables K2, K4, or K8) or from another data source approved by the *code official*.
   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 for an all-electric building with on-site renewable energy installed.

R406.3 Building thermal envelope. 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 1.0 ~~1.08~~ in Climate Zones 0, 1, and 2, and by 1.1 ~~1.15~~ in Climates Zones 3 through 8, in accordance with Equation 4-3. The area-weighted maximum fenestration SHGC permitted in Climate Zones 0 through 3 shall be 0.30.

$$\text{For Climate Zones 0-2: } UA_{\text{Proposed design}} \le \underline{1.0}\ \cancel{1.08} \times UA_{\text{Prescriptive reference design}}$$
$$\text{For Climate Zones 3-8: } UA_{\text{Proposed design}} \le \underline{1.1}\ \cancel{1.15} \times UA_{\text{Prescriptive reference design}}$$

(Equation 4-3)

Reason: This public comment would help reduce the likelihood of a significant rollback in efficiency in the 2024 IECC by setting a thermal envelope backstop more appropriate to the broader scope of efficiency trade-offs proposed for the 2024 IECC. As a result of REPI-122, the draft 2024 IECC

allows efficiency trade-offs for heating, cooling, and water heating efficiency, and awards credit for ducts located inside conditioned space. These are all credits that are not allowed under the 2021 IECC, and that were not considered in the proposal to set the thermal envelope backstop at 1.15xUA. During the balloting process, several Residential Consensus Committee members expressed support for tightening the thermal envelope backstop along the lines of this proposal. Although we believe REPI-122 should be reversed, if the Committee decides to allow such broad performance path trade-offs, we believe a more stringent envelope backstop is necessary in order to reduce the likelihood that a building constructed to the 2024 IECC could be weaker than one built to the 2021 IECC. We could also support a single Total UA backstop for all climate zones at 1.08 x UA, which is already specified in the draft 2024 IECC for climate zones 0-2.
This comment also adjusts the envelope backstops for above-code programs and the Energy Rating Index compliance path. The draft 2024 IECC incorporates several weakening amendments to the ERI (as compared to the 2021 IECC), such as the elimination of the enhanced envelope backstop for projects with on-site power production, the elimination of the cap on trade-offs for on-site power production, and weaker ERI target scores overall. While this comment would still not prevent reduced efficiency under the ERI, it would at least reduce the risk of long-term efficiency losses due to weaker building envelope efficiency.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This proposal will neither increase nor decrease the cost of construction. Because it adjusts an envelope backstop, and does not alter the requirements of the performance or ERI compliance options, the proposal would not directly impact costs or cost-effectiveness.

Workgroup Recommendation

Proposal # 1347

RED1-31-22

Proponents: Alex Smith, representing NAHB (asmith@nahb.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

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 ~~against a baseline~~ to determine code compliance.

Reason: This proposal clarifies the definition. The *standard refence design* is the baseline.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This is a clarification of intent.

Workgroup Recommendation

Proposal # 1017

RED1-32-22

Proponents: Robert Schwarz, representing BUILDTank, Inc. (robby@btankinc.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

Table R402.4.1.1
AIR BARRIER, AIR SEALING AND INSULATION INSTALLATION a.

COMPONENT	AIR BARRIER <u>AND AIR SEALING</u> CRITERIA	INSULATION INSTALLATION CRITERIA
HVAC Register boots	HVAC supply and return register boots ~~that penetrate the *building thermal envelope*~~ shall be sealed to the subfloor, wall covering, or ceiling penetrated by the boot.	<u>HVAC supply and return register boots located in the *building's thermal envelope* shall be buried in or surrounded by insulation.</u> ~~Insulation shall be fitted tightly aroundHVAC supply and return register boots located in the *buildings thermal envelope to maintain its required assembly R-value per section R401.2*~~

Reason: This proposal was approved as modified by the committee. However, only the approved changes to the Insulation installation criteria were listed in the released draft of the IECC for public comment. There were also approved changes to the Air Barrier side of the table that were not reflected in the released draft of the IECC for public comment. This Public ensures that there is a record of everything that was approved by the committee as an errata to the released draft of the IECC for public comment.
In addition the Public comment addes “and air Sealing” to the table header so it now would read, “Air Barrier And Air Sealing Criteria” to better reflect the purpose of the table.

The proposal as originally written and approved requires that all supply and return registers be sealed to the surface they are penetrating. The origin of this air sealing requirement comes from ENERGY STAR, who has demonstrated that energy loss is associated with duct boot installation in three ways: 1) if the boot directly penetrates the thermal envelope, such as a duct boot coming from a ventilated attic into the house; 2) when air that should be delivered to the conditioned space is redirected into building cavities when it hits the register cover; 3) when Venturi pressure, sometimes called the Coanda effect, is created and pulls air into the building cavity as it is being delivered into the room. See Bibliography for more)

Read more here, **https://www.achrnews.com/articles/128615-why-dirt-streaking-occurs-around-vents**

By not being able to deliver the HVAC designed volume of air to the rooms of the house, the occupant is often left with no other choice than to raise the thermostat set point temperature in the winter and to lower it in the summer. This causes energy inefficiencies while not correcting their comfort issue. In addition, building cavities are often connected to unconditioned space which increases duct leakage to the outside, as well as other inefficiencies. Therefore, I believe that it is an important energy and building durability issue. This needs to be addressed at this time because many builders and contractors have experience implementing this in part, if not in whole, and this proposal finished what the code has been intending when it barrowed this requirement from the Energy Star program.

There have not been insulation requirements associated with duct boots in the past which continues to make this a significant code change proposal. Ensuring that our building cavities are insulated properly is imperative when duct boots are placed in them, and this proposal directly addresses that issue at the termination of the duct boot and the substrate it passes through.

Lastly, this proposal aligns with ENERGY STAR requirements that are the basis of the creation of this table that has been adopted by the IECC.

6. Duct Quality Installation: See Bibliography from more information

6.4.1 In addition, all duct boots sealed to the finished surface, Rater-verified at final. 39

Cost Statement:

§ As the committee noted this proposal changes the scope of the requirement and therefore should slightly increase the cost of execution. However, the proposed in reality offers better clarity and expansion of existing requirements.

Cost Impact: The code change proposal will increase the cost of construction.
The proposed language may possibly increase the cost of construction a small amount due to the application of additional caulk but the benefits to the energy performance of the system far out way the small incremental cost. For Energy Star builders there would be no increase in cost.

Bibliography: Read more here, **https://www.achrnews.com/articles/128615-why-dirt-streaking-occurs-around-vents**

Workgroup Recommendation

Proposal # 1012

RED1-33-22

Proponents: Steven Rosenstock, representing Edison Electric Institute (srosenstock@eei.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R405.1 Scope. This section establishes criteria for compliance using simulated building performance analysis. Such analysis shall include heating, cooling, mechanical ventilation and service water-heating energy only. 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 *standard reference design* or the *proposed design.*

TABLE R405.2 REQUIREMENTS FOR SIMULATED BUILDING PERFORMANCE

SECTION[a]	TITLE
General	
R401.2.5	Additional energy efficiency
R401.3	Certificate
Building Thermal Envelope	
R402.1.1	Vapor retarder
R402.2.3	Attic knee or pony wall
R402.2.4	Eave baffle
R402.2.5.1	Access hatches and doors
R402.2.9	Basement walls
R402.2.9.1	Basement wall insulation installation
R402.2.10.1	Slab-on-grade floor insulation installation
R402.2.11.1	Crawl space wall insulation installations
R402.5.1.1	Installation
R402.5.1.2	Testing
R402.5.2	Fireplaces
R402.5.3	Fenestration air leakage
R402.5.4	Room containing fuel burning applicances
R402.5.5	Recessed lighting
R402.5.6	Air-sealed electrical and communication outlet boxes
R402.6	Maximum fenestration *U*-factor and SHGC
Mechanical	
R403.1	Controls
R403.2	Hot water boiler temperature reset
R403.3	Duct systems
R403.4	Mechanical system piping insulation
R403.5 except Section R403.5.2 (staff note: this needs to be fixed with hot water pipe insulation)	Service hot water system
R403.5.2	Hot water pipe insulation
R403.6	Mechanical ventilation
R403.7, except Section R403.7.1	Equipment sizing and efficiency rating
R403.8	Systems serving multiple dwelling units
R403.9	Snow melt and ice system controls
R403.11	Energy consumption of pools and spas
R403.12	Portable spas
R403.13	Residential pools and permanent residential spas
Electrical Power and Lighting Systems	
R404.1	Lighting equipment
R404.2	Interior lighting controls
R404.5	Electric readiness
R404.6	Renewable energy infrastructure
~~R404.7~~	~~Electric Vehicle power transfer infrastructure~~

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

Reason: This proposed change will make Section 405 consistent with the code language shown in Section R406.4 for the Energy Rating Index and

in Section C407.1 (simulated building performance).
While the energy for the vehicle may be transferred through the building's electrical service, the energy transferred to vehicles that operate off-site is not being consumed for building energy services. In other words, the energy going through a building's electric (or gas) meter should not be considered as part of the building energy baseline reference design or proposed design.

This will also help to avoid complications where EV charging on the building site is provided by a third party and receiving electric service from separate electric distribution equipment that is not serving the building.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This change only affects the building simulation program for the performance path and has no cost impact.

Workgroup Recommendation

Proposal # 1064

RED1-34-22

Proponents: Gayathri Vijayakumar, representing Steven Winter Associates, Inc. (gvijayakumar@swinter.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R405.1 Scope. This section establishes criteria for compliance using simulated building performance analysis. Such analysis shall include heating, cooling, mechanical ventilation and service water-heating energy only. Such analysis shall be limited to all-electric dwelling units.

R405.2 Simulated performance compliance. Compliance based on total building performance requires that a *proposed design* meets all of the following:

1. The requirements of the sections indicated within Table R405.2.
2. The proposed total building thermal envelope UA, which is the sum of the 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 1.08 in Climate Zones 0, 1, and 2, and 1.15 in Climate Zones 3 through 8 in accordance with Equation 4-2. The area-weighted maximum fenestration SHGC permitted in Climate Zones 0 through 3 shall be 0.30.

(Equation 4-2)

$$\text{For Climate Zones 0-2: } UA_{\text{Proposed design}} \leq 1.08 \times UA_{\text{Prescriptive reference design}}$$
$$\text{For Climate Zones 3-8: } UA_{\text{Proposed design}} \leq 1.15 \times UA_{\text{Prescriptive reference design}}$$

3. ~~For buildings without a fuel burning appliance for space heating or water heating, the~~ For each *dwelling unit*, the annual energy use ~~cost~~ of the *proposed design* that is less than or equal to 85 percent of the annual energy use ~~cost~~ of the *standard reference design,* based on site energy expressed in Btu or Btu per square foot of *conditioned floor area*.

   . ~~For buildings with a fuel burning appliance for space heating or water heating, the annual energy cost of the proposed design that is less than or equal to 80 percent of the annual energy cost of the standard reference design.~~ For dwelling units with greater than 5,000 square feet (465 m^2) of living space floor area located above grade plane, the annual energy use ~~cost~~ of the *proposed design* shall be reduced by an additional 5 percent of annual energy use ~~cost~~ of the *standard reference design*. ~~Energy prices shall be taken from a source *approved* by the *code official*, such as the Department of Energy, 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.~~

   Exception~~s~~:

   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 multipliers for all energy sources shall be obtained from ASHRAE Standard 105 (Tables K2, K4, or K8) or from another data source approved by the *code official*.~~
   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 for an all-electric building with on-site renewable energy installed.~~

Reason: In the recirculation ballots from the Summer of 2022, the two comments below were made by multiple voting members regarding RECPI-8, which proposed to include a CO2e Index in the main body of the code. That proposal ultimately was not approved and has since been re-proposed as an Appendix.
However, the comments below indicate an issue with R405 that needs to be similarly resolved. This PC seeks to provide that resolution.

1. "The CO2e Index addresses emissions from electricity generation by utilities – this is outside of the scope of the IECC."

Because many voting members do not want emissions from utilities to be part of the main body of the code, the Exception that would allow source-energy savings to be used instead of energy costs has been removed. Like the CO2e Index, this exception could be proposed as an Appendix.

2. "Two identically-designed buildings located near each other but serviced by two different utilities can have large differences in the CO2e Index that cannot be addressed through building design or operation."

Because many voting members feel that two identical buildings served by different utilities should not have differences in performance that cannot be addressed through building design or operation, the charging language has been changed to require site energy savings rather than energy costs, since pricing does vary by utility. The 2nd exception is therefore removed and the scope updated accordingly.

If voting members would like to see source energy savings and energy cost savings retained in R405 in the main body of the code, they may want to reconsider allowing the CO2e Index in the main body as well.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
.

Bibliography: IECC Residential Recirculation Ballots 1 and 2 on RECPI-8

Workgroup Recommendation

Proposal # 1401

RED1-35-22

Proponents: Greg Johnson, representing National Multifamily Housing Council (gjohnsonconsulting@gmail.com)

2024 International Energy Conservation Code [RE Project]

R405.1 Scope. This section establishes criteria for compliance using simulated building performance analysis. Such analysis shall include heating, cooling, mechanical ventilation and service water-heating energy only.

Revise as follows:

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

1. The requirements of the sections indicated within Table R405.2.
2. The proposed total building thermal envelope UA, which is the sum of the 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 1.08 in Climate Zones 0, 1, and 2, and 1.15 in Climate Zones 3 through 8 in accordance with Equation 4-2. The area-weighted maximum fenestration SHGC permitted in Climate Zones 0 through 3 shall be 0.30.

(Equation 4-2)

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

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

3. For buildings without a fuel burning appliance for space heating or water heating, the annual energy cost of the proposed design that is less than or equal to 85 percent of the annual energy cost of the *standard reference design*. For buildings with a fuel burning appliance for space heating or water heating, the annual energy cost of the proposed design that is less than or equal to 80 percent of the annual energy cost of the standard reference design. For dwelling units with greater than 5,000 square feet (465 m^2) of living space floor area located above grade plane, the annual energy cost of the proposed design shall be reduced by an additional 5 percent of annual energy cost of the standard reference design. Energy prices shall be taken from ~~a~~ an *approved* source ~~*approved* by the *code official*~~, such as the Department of Energy, 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 multipliers for all energy sources shall be obtained from ASHRAE Standard 105 (Tables K2, K4, or K8) or from another data source approved by the *code official*.
   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 for an all-electric building with on-site renewable energy installed.

TABLE R405.2 REQUIREMENTS FOR SIMULATED BUILDING PERFORMANCE

Portions of table not shown remain unchanged.

SECTION[a]	TITLE
R404.6 except R404.6.2	Renewable energy infrastructure

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

R405.3.2.1 Compliance report for permit application. A compliance report submitted 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 the software used to produce the results for the reference design and/or the rated home.
5. A certificate indicating that the proposed design complies with Section R405.3. 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 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 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.

R405.3.2.2 Compliance report for certificate of occupancy. A compliance report submitted for obtaining the certificate of occupancy shall include the following:

1. Building street address, or other building site identification.
2. Declaration of the 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.
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.
6. A final confirmed certificate indicating compliance based on inspection, and a statement indicating that the 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, including component-level insulation *R*-values or *U*-factors; results from any required duct system and building envelope air leakage testing; and the type and rated efficiencies of the heating, cooling, mechanical ventilation and service water-heating equipment installed.
7. ~~When on-site renewable energy systems have been installed, the certificate shall report the type and production size of the installed system.~~

Reason: R404.6.2 is an inappropriate reference; it violates intent of the IECC-R as specified in Section 105 by mandating compliance with voluntary adoption appendix of the IECC- commercial code. This is inconsistent with commitments made by the ICC to industry and does not accommodate locations where the IECC-C is not adopted.
It is a sloppy code structure with no regard for the people who use the code for design, building, or regulation. We need to do better work.

R401.3(5) already requires detailed information about onsite solar energy systems; redundant documentation is not needed.

Cost Impact: The code change proposal will decrease the cost of construction.
Some redundant documentation is eliminated which should save some $.

Workgroup Recommendation

Proposal # 1391

RED1-36-22

Proponents: Kevin Rose, representing Northwest Energy Efficiency Alliance (NEEA) (krose@neea.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R405.2 Simulated performance compliance. Compliance based on total building performance requires that a *proposed design* meets all of the following:

1. The requirements of the sections indicated within Table R405.2.
2. The proposed total building thermal envelope UA, which is the sum of the 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 1.08 in Climate Zones 0, 1, and 2, and 1.15 in Climate Zones 3 through 8 in accordance with Equation 4-2. The area-weighted maximum fenestration SHGC permitted in Climate Zones 0 through 3 shall be 0.30.

(Equation 4-2)

$$\text{For Climate Zones 0-2: } UA_{\text{Proposed design}} \leq 1.08 \text{ x } UA_{\text{Prescriptive reference design}}$$

$$\text{For Climate Zones 3-8: } UA_{\text{Proposed design}} \leq 1.15\text{x } UA_{\text{Prescriptive reference design}}$$

3. For buildings without a fuel burning appliance for space heating or water heating, the annual energy cost of the proposed design that is less than or equal to 85 percent of the annual energy cost of the *standard reference design*. For buildings with a fuel burning appliance for space heating or water heating, the annual energy cost of the proposed design that is less than or equal to 80 percent of the annual energy cost of the standard reference design. For dwelling units with greater than 5,000 square feet (465 m^2)~~ of living space floor area located above grade plane~~, the annual energy cost of the proposed design shall be reduced by an additional 5 percent of annual energy cost of the standard reference design. Energy prices shall be taken from a source *approved* by the *code official*, such as the Department of Energy, 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 multipliers for all energy sources shall be obtained from ASHRAE Standard 105 (Tables K2, K4, or K8) or from another data source approved by the *code official*.
   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 for an all-electric building with on-site renewable energy installed.

R408.2 Additional energy efficiency credit requirements . Two of the additional measures shall be selected from Table R408.2 that meet or exceed a total of ten credits. Five additional credits shall be selected for dwelling units with greater than 5,000 square feet (465 m^2)~~ of living space floor area located above grade plane~~. Each measure selected shall meet the relevant subsections of Section R408 and receive credit as specified in Table R408.2 for the specific Climate Zone. Interpolation of credits between measures shall not be permitted.

Reason: This proposal seeks to restore the version of this proposal that was approved prior to compromises made in finalizing the 2024 IECC-R first public comment draft.

The new requirement for large homes to achieve additional efficiency stems from proposal REPI-20-21. After some modifications (notably to remove this requirement for homes using the ERI compliance path), REPI-20 was approved (AM) by strong margins in both the subcommittee (17-2) and main committee (28-10). However, as part of the compromises made in finalizing the 2024 IECC-R first public comment draft, the threshold for this requirement was reduced from 'greater than 5,000 square feet of *conditioned floor area*' to 'greater than 5,000 square feet of living space floor area located above grade plane'.

The current text limits this new requirement to an extremely small portion of the market. Per 2021 data from the Census Bureau's Survey of Construction (SOC), and as reported by NAHB in its "Eye on Housing" publication, only about 2.9% of new homes are 5,000 sf or larger. Restricting the scope to only homes with greater than 5,000 sf of living space above grade, as in the current 2024 IECC-R draft, would limit the applicability of this requirement to only the very top end of the market. The technical backup provided with REPI-20, as well as the previous subcommittee and committee actions, support the original scope of greater than 5,000 of conditioned floor area. It is unclear what criteria were used to justify the inflation of this threshold to require all this floor area to be above grade.

Furthermore, "living space floor area" is not a defined term, and different interpretations of what constitutes living space could lead to confusion and inconsistent enforcement.

Finally, opponents to REPI-20 previously noted that this requirement could keep large families from being able to afford these homes. However, new construction homes of the sizes impacted by this proposal are typically luxury models, and it seems unlikely that price-sensitive consumers constitute the true market for these homes.

Cost Impact: The code change proposal will increase the cost of construction.
This proposal would only increase costs for a small portion of the high end of the construction market: new homes with 5,000 square feet of floor area but not 5,000 square feet of living space floor area above grade.

Bibliography: REPI-20-21: energy.cdpaccess.com/live/proposal/438/html/

NAHB Eye on Housing: eyeonhousing.org/2022/09/percent-share-of-5000-square-foot-homes-rises-in-2021/

Workgroup Recommendation

Proposal # 1306

RED1-37-22

Proponents: Eric Tate, representing Atmos Energy (eric.tate@atmosenergy.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R405.2 Simulated performance compliance. Compliance based on total building performance requires that a *proposed design* meets all of the following:

1. The requirements of the sections indicated within Table R405.2.
2. The proposed total building thermal envelope UA, which is the sum of the 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 1.08 in Climate Zones 0, 1, and 2, and 1.15 in Climate Zones 3 through 8 in accordance with Equation 4-2. The area-weighted maximum fenestration SHGC permitted in Climate Zones 0 through 3 shall be 0.30.

(Equation 4-2)

$$\text{For Climate Zones 0-2: } UA_{\text{Proposed design}} \leq 1.08 \times UA_{\text{Prescriptive reference design}}$$
$$\text{For Climate Zones 3-8: } UA_{\text{Proposed design}} \leq 1.15 \times UA_{\text{Prescriptive reference design}}$$

3. For buildings without a fuel burning appliance for space heating or water heating, Tthe annual energy cost of the proposed design that is less than or equal to ~~85~~ 80 percent of the annual energy cost of the *standard reference design*. ~~For buildings with a fuel burning appliance for space heating or water heating, the annual energy cost of the proposed design that is less than or equal to 80 percent of the annual energy cost of the standard reference design.~~ For dwelling units with greater than 5,000 square feet (465 m^2) of living space floor area located above grade plane, the annual energy cost of the proposed design shall be reduced by an additional 5 percent of annual energy cost of the standard reference design. Energy prices shall be taken from a source *approved* by the *code official*, such as the Department of Energy, 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 multipliers for all energy sources shall be obtained from ASHRAE Standard 105 (Tables K2, K4, or K8) or from another data source approved by the *code official*.
   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 for an all-electric building with on-site renewable energy installed.

Reason: The proposed language discriminates against installation of natural gas burning space heating and water heating by providing a larger increment of energy cost reduction than for electric space heating and water heating. Since natural gas is already a lower operating cost energy source, this additional stringency in annual operating cost for the standard reference design provides an additional burden for compliance of natural gas-served standard reference designs. No energy savings or emissions benefits are claimed or can be justified by the proposal since the bias toward a standard reference design in favor of electric space heating and water heating is likely to increase energy consumption over the full fuel cycle and increase operating cost from an energy choice in favor of electricity. Based upon most U. S. electricity grid primary energy sources, decision making created by the bias in favor of electric space heating and water heating is likely to increase carbon emissions.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
The proposed change will not affect cost of construction.

Workgroup Recommendation

RED1-38-22

Proponents: Eric Tate, representing Atmos Energy (eric.tate@atmosenergy.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R405.2 Simulated performance compliance. Compliance based on total building performance requires that a *proposed design* meets all of the following:

1. The requirements of the sections indicated within Table R405.2.
2. The proposed total building thermal envelope UA, which is the sum of the 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 1.08 in Climate Zones 0, 1, and 2, and 1.15 in Climate Zones 3 through 8 in accordance with Equation 4-2. The area-weighted maximum fenestration SHGC permitted in Climate Zones 0 through 3 shall be 0.30.

(Equation 4-2)

$$\text{For Climate Zones 0-2: UA}_{\text{Proposed design}} \leq 1.08 \text{ x UA}_{\text{Prescriptive reference design}}$$

$$\text{For Climate Zones 3-8: UA}_{\text{Proposed design}} \leq 1.15\text{x UA}_{\text{Prescriptive reference design}}$$

3. For buildings without a fuel burning appliance for space heating or water heating, the annual energy cost of the proposed design that is less than or equal to 85 percent of the annual energy cost of the *standard reference design*. For buildings with a fuel burning appliance for space heating or water heating, the annual energy cost of the proposed design that is less than or equal to 80 percent of the annual energy cost of the standard reference design. For dwelling units with greater than 5,000 square feet (465 m^2) of living space floor area located above grade plane, the annual energy cost of the proposed design shall be reduced by an additional 5 percent of annual energy cost of the standard reference design. Energy prices shall be taken from a source *approved* by the *code official*, such as the Department of Energy, 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 multipliers for all energy sources shall be obtained from ASHRAE Standard 105 (~~Tables K2, K4, or K8)~~ or from another data source approved by the *code official*.
   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 for an all-electric building with on-site renewable energy installed.

Reason: While the replacement of the outdated source energy multiplier for grid electricity with reference to multipliers from ASHRAE Standard 105 is an improvement for more granular source energy considerations, the specification of ASHRAE Standard 105 Tables K2, K4, and K8 is unjustified and removes from consideration other multipliers covered by the Standard (e.g., Table K6). All source energy coverage by ASHRAE Standard 105 is equally informative, useful, and benefiting by the ASHRAE Consensus Standards Process. As a result, a simple reference to ASHRAE Standard 105 is appropriate and retains code official flexibility to specify appropriate multipliers, both within the ASHRAE Standard 105 tables and from other sources.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
The deletion of specific ASHRAE Standard 105 table references will not affect cost of construction.

Workgroup Recommendation

Proposal # 1457

RED1-39-22

Proponents: Steven Rosenstock, representing Edison Electric Institute (srosenstock@eei.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R405.2 Simulated performance compliance. Compliance based on total building performance requires that a *proposed design* meets all of the following:

1. The requirements of the sections indicated within Table R405.2.
2. The proposed total building thermal envelope UA, which is the sum of the 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 1.08 in Climate Zones 0, 1, and 2, and 1.15 in Climate Zones 3 through 8 in accordance with Equation 4-2. The area-weighted maximum fenestration SHGC permitted in Climate Zones 0 through 3 shall be 0.30.

(Equation 4-2)

$$\text{For Climate Zones 0-2: } UA_{\text{Proposed design}} \leq 1.08 \text{ x } UA_{\text{Prescriptive reference design}}$$
$$\text{For Climate Zones 3-8: } UA_{\text{Proposed design}} \leq 1.15\text{x } UA_{\text{Prescriptive reference design}}$$

3. For buildings without a fuel burning appliance for space heating or water heating, the annual energy cost of the proposed design that is less than or equal to 85 percent of the annual energy cost of the *standard reference design*. For buildings with a fuel burning appliance for space heating or water heating, the annual energy cost of the proposed design that is less than or equal to 80 percent of the annual energy cost of the standard reference design. For dwelling units with greater than 5,000 square feet (465 m^2) of living space floor area located above grade plane, the annual energy cost of the proposed design shall be reduced by an additional 5 percent of annual energy cost of the standard reference design. Energy prices shall be taken from a source *approved* by the *code official*, such as the Department of Energy, 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 multipliers for all energy sources shall be obtained from ASHRAE Standard 105 (Tables K2, K4, or K8) or from another data source approved by the *code official*.
   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 for an all-electric building with on-site renewable energy installed.
   3. 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 for an all-electric building using 100% renewable energy.

Reason: There is still a need for an exception for those buildings that are using 100% renewable energy. This change will be in addition to the exception finalized by the committee during the previous deliberations, and will account for buildings that are using on-site renewable energy, off-site renewable energy, or a combination of both to meet their energy supply requirements.
When a building is using 100% renewable energy, the source multiplier has the same value for the standard reference design and the proposed design. Under the "captured energy" approach, the source multiplier for renewable electricity is 1.0. If the standard reference design uses 100 kWh, that is equal to 341,200 site Btu's and 341,200 "source" Btu's. If the proposed design uses 70 kWh, that is equal to 238,840 site Btu's and 238,840 "source" Btu's. There is no difference in the results.

Even if another value, such as 1.05 were used, the difference / percentage reduction would still be the same (30%), as the ratio would be (70 * 1.05) / (100 * 1.05) = 70/100.

Under the "infinite energy" approach, the source multiplier for renewable electricity is 0.0. In this scenario, by using the "source" value, the standard reference design uses 0.0 "source" Btu's and the proposed design uses 0.0 "source" Btu's. For this situation, it is analytically necessary to use site energy as the basis of comparison.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This proposed change only adds an exception for the building performance analysis and has no impact on construction costs.

Bibliography: ASHRAE Standard 105-2021, *Standard Methods for Determining, Expressing, and Comparing Building Energy Performance and Greenhouse Gas Emissions*, Appendix J and Appendix K, 2021, Atlanta, GA

Workgroup Recommendation

Proposal # 1065

RED1-40-22

Proponents: Amy Boyce, representing Energy Efficient Codes Coalition (EECC) (amy.boyce@imt.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R405.2 Simulated performance compliance. Compliance based on total building performance requires that a *proposed design* meets all of the following:

1. The requirements of the sections indicated within Table R405.2.
2. The proposed total building thermal envelope UA, which is the sum of the 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 1.08 in Climate Zones 0, 1, and 2, and 1.15 in Climate Zones 3 through 8 in accordance with Equation 4-2. The area-weighted maximum fenestration SHGC permitted in Climate Zones 0 through 3 shall be 0.30.

(Equation 4-2)

$$\text{For Climate Zones 0-2: } UA_{\text{Proposed design}} \leq 1.08 \times UA_{\text{Prescriptive reference design}}$$
$$\text{For Climate Zones 3-8: } UA_{\text{Proposed design}} \leq 1.15 \times UA_{\text{Prescriptive reference design}}$$

3. For buildings without a fuel burning appliance for space heating or water heating, the annual energy cost of the proposed design that is less than or equal to 85 percent of the annual energy cost of the *standard reference design*. For buildings with a fuel burning appliance for space heating or water heating, the annual energy cost of the proposed design that is less than or equal to 80 percent of the annual energy cost of the standard reference design. For dwelling units with greater than 4,000 ~~5,000~~ square feet (465 m^2) of living space floor area located above grade plane, the annual energy cost of the proposed design shall be reduced by an additional 10 ~~5~~ percent of annual energy cost of the standard reference design. Energy prices shall be taken from a source *approved* by the *code official*, such as the Department of Energy, 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 multipliers for all energy sources shall be obtained from ASHRAE Standard 105 (Tables K2, K4, or K8) or from another data source approved by the *code official*.
   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 for an all-electric building with on-site renewable energy installed.

Reason: This proposal improves the draft 2024 IECC by requiring larger buildings to achieve greater energy efficiency. The current draft 2024 IECC requires buildings over 5,000 square feet of living space floor area to demonstrate 5% lower annual energy costs than a similarly built smaller home under the performance path. This adjustment is far too narrow and it does not require enough of an efficiency improvement. According to the U.S. Census, 5,000 square feet is roughly twice as large as the average home built in 2021. Requiring only a 5% improvement in efficiency for essentially twice the home size is inadequate. And according to the Census Bureau, less than 3% of new homes in 2021 were larger than 5,000 square feet. This proposal would expand the requirement to cover homes over 4,000 square feet—roughly 9% of new single-family homes—and it would require an additional 10% reduction in energy cost as compared to the standard reference design. Although we believe even more efficiency measures are justified for large homes, we urge the Residential Consensus Committee to adopt the improvements above as a first step.

Cost Impact: The code change proposal will increase the cost of construction.
This proposal will increase the cost of construction. Although this proposal will still only apply to roughly 9% of new single-family homes, it will require an additional 5% reduction in energy cost as compared to the performance path standard reference design. This is likely to increase costs, but the amount of the cost increase and the cost-effectiveness will vary based on choices made by the design professional or builder.

Workgroup Recommendation

RED1-41-22

Proponents: Ben Rabe, representing California IOUs (ben@newbuildings.org); Mark Lyles, representing California IOUs (markl@newbuildings.org); Emma Gonzalez-Laders, representing DOS/DBSC (emma.gonzalez-laders@dos.ny.gov); Jennifer Amann, representing ACEEE (jamann@aceee.org); Hendrik Shank, representing New York State, Department of State (hendrikus.shank@dos.ny.gov)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R405.2 Simulated performance compliance. Compliance based on total building performance requires that a *proposed design* meets all of the following:

1. The requirements of the sections indicated within Table R405.2.
2. The proposed total building thermal envelope UA, which is the sum of the 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 1.08 in Climate Zones 0, 1, and 2, and ~~1.15~~ 1.10 in Climate Zones 3 through 8 in accordance with Equation 4-2. The area-weighted maximum fenestration SHGC permitted in Climate Zones 0 through 3 shall be 0.30.

(Equation 4-2)

For Climate Zones 0-2: $UA_{\text{Proposed design}}$ £ 1.08 x $UA_{\text{Prescriptive reference design}}$

For Climate Zones 3-8: $UA_{\text{Proposed design}}$ £ ~~1.15~~ 1.10 x $UA_{\text{Prescriptive reference design}}$

3. For buildings without a fuel burning appliance for space heating or water heating, the annual energy cost of the proposed design that is less than or equal to 85 percent of the annual energy cost of the *standard reference design*. For buildings with a fuel burning appliance for space heating or water heating, the annual energy cost of the proposed design that is less than or equal to 80 percent of the annual energy cost of the standard reference design. For dwelling units with greater than 5,000 square feet (465 m^2) of living space floor area located above grade plane, the annual energy cost of the proposed design shall be reduced by an additional 5 percent of annual energy cost of the standard reference design. Energy prices shall be taken from a source *approved* by the *code official*, such as the Department of Energy, 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 multipliers for all energy sources shall be obtained from ASHRAE Standard 105 (Tables K2, K4, or K8) or from another data source approved by the *code official*.
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 for an all-electric building with on-site renewable energy installed.

Reason: California's Statewide Utility Codes and Standards Team submitted a detailed analysis in support of the recommended multiplier for total building thermal envelope UA in the IECC Residential Consensus Committee Results of Ballot #2 (attached below). The analysis investigated whether the proposed 1.15 multiplier is an appropriate target for all climate zones using 2015 IECC prescriptive envelope requirements as a benchmark for minimum allowed envelope performance. The analysis indicated that a multiplier of 1.10 be used for the total building thermal envelope UA in Climate Zones 3-8. To avoid using a multiplier that might represent a net decrease in energy efficiency in 2024 IECC R405.2, we recommend that once all other envelope measures have been finalized that additional analysis is undertaken by PNNL to choose a multiplier that at a minimum maintains a level of envelope performance in 2024 IECC equivalent to the 2015 IECC prescriptive envelope. Until that analysis is completed, we suggest updating the multiplier from 1.15 to 1.10. See analysis attached to public comment.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
These is no cost impact here as buildings be up to 10% less efficient than the preceptive envelope requirements.

Attached Files

- **ANALYSIS OF IECC TOTAL BUILDING THERMAL ENVELOPE UA.pdf**
  https://energy.cdpaccess.com/proposal/1087/2653/files/download/457/

Workgroup Recommendation

Proposal # 1087

RED1-42-22

Proponents: Amy Boyce, representing Energy Efficient Codes Coalition (EECC) (amy.boyce@imt.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R405.2 Simulated performance compliance. Compliance based on total building performance requires that a *proposed design* meets all of the following:

1. The requirements of the sections indicated within Table R405.2.
2. The proposed total building thermal envelope UA, which is the sum of the 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 1.08 in Climate Zones 0, 1, and 2, and 1.15 in Climate Zones 3 through 8 in accordance with Equation 4-2. The area-weighted maximum fenestration SHGC permitted in Climate Zones 0 through 3 shall be 0.30.

(Equation 4-2)

$$\text{For Climate Zones 0-2: } UA_{\text{Proposed design}} \leq 1.08 \times UA_{\text{Prescriptive reference design}}$$
$$\text{For Climate Zones 3-8: } UA_{\text{Proposed design}} \leq 1.15x\ UA_{\text{Prescriptive reference design}}$$

3. For buildings without a fuel burning appliance for space heating or water heating, the annual energy cost of the proposed design that is less than or equal to 80 ~~85~~ percent of the annual energy cost of the *standard reference design*. For buildings with a fuel burning appliance for space heating or water heating, the annual energy cost of the proposed design that is less than or equal to 75 ~~80~~ percent of the annual energy cost of the standard reference design. For dwelling units with greater than 5,000 square feet (465 m^2) of living space floor area located above grade plane, the annual energy cost of the proposed design shall be reduced by an additional 5 percent of annual energy cost of the standard reference design. Energy prices shall be taken from a source *approved* by the *code official*, such as the Department of Energy, 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 multipliers for all energy sources shall be obtained from ASHRAE Standard 105 (Tables K2, K4, or K8) or from another data source approved by the *code official*.
   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 for an all-electric building with on-site renewable energy installed.

Reason: This proposal will help prevent a reduction in efficiency in the 2024 IECC by applying a more conservative multiplier to projects complying via the performance path. The 2021 IECC requires that homes constructed to the performance path demonstrate an annual energy cost no higher than 95% of the standard reference design energy cost. Proposal REPI-122, as modified, altered this multiplier to 80% for homes with fossil fuel-fired heating or water heating, or 85% for homes with electric heating and water heating (a net of 10 or 15%). However, REPI-122 also significantly reduced the efficiency of the performance path by incorporating trade-offs for heating, cooling, and water heating equipment efficiencies higher than federal minimum efficiencies. Because of the wide use of higher-efficiency equipment, this change is likely to lead to an abundance of trade-off credit that is not currently permitted in the 2021 IECC. In addition, proposal REPI-122 awards credit for duct systems located inside conditioned space—another credit not allowed under the 2021 IECC. Taken together, these four potential credits could be used to trade away the efficiency of envelope components and other measures, and the 2024 IECC performance path is likely to be weaker than the same path in the 2021 IECC. The 80% and 85% multipliers are simply not stringent enough to counteract such large potential efficiency losses—let alone improve the code by any amount.
The proponent did not provide any analysis to support the 80% or 85% multipliers in section R405.2, and we believe these adjustments are inadequate to make up for such a big efficiency rollback. Although these multipliers will require a code user to improve the standard reference design by 10 or 15%, the amount of trade-off credit available from heating, cooling, water heating, and duct location is several times that much. Using the section R408 points table approved by the Residential Consensus Committee as a proxy (i.e. each point represents 1% efficiency), here are the potential credits available for the equipment and duct trade-offs:

Range of Potential Credits Under R408 For Comparison to R405 Performance Path Trade-Offs

	CZ 0&1	CZ 2	CZ 3	CZ 4	CZ 4C	CZ 5	CZ 6	CZ 7	CZ 8
Heating Equipment Efficiency	0-8	2-7	3-6	5-6	5-6	5-8	4-8	4-8	3-10
Cooling Equipment Efficiency	0-8	2-7	4-6	3-6	3-6	2-8	1-7	1-6	1-5
Water Heating Equipment Efficiency	4-12	5-12	5-11	3-8	3-8	2-6	2-5	3-5	1-4
Duct Location Credit	4	6	8	12	12	15	17	19	20
Max Potential Credits	**32**	**32**	**31**	**32**	**32**	**37**	**37**	**38**	**39**

Given the maximum potential credits available, it is clear that the 10 or 15% adjustment to the performance path multiplier will not be enough to prevent a huge efficiency rollback in R405. Code users who specify one or more pieces of efficient equipment in the performance path will likely be able to use excess “credit” for efficient equipment to reduce the overall efficiency of the building to a level that would have failed the 2021 IECC. (There may be additional credits available -- It is important to keep in mind that additional trade-off credit may be available for even higher efficiency equipment that is not specified in the R408 table.)

If the equipment trade-offs are included in the final 2024 IECC, we recommend modifying the performance path multipliers to 75/80% or 70/75% (a net of 15-25% as compared to the 2021 IECC) to reduce the likelihood that homes built to the 2024 IECC will be less efficient than homes built to the 2021 IECC, or at least taking a closer look at the magnitude of potential efficiency losses in order to set the performance path multipliers at levels that will keep the IECC moving toward improved efficiency.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This proposal will neither increase nor decrease construction costs. Because the scope of the performance path was so significantly changed by REPI-122, it would be very difficult to compare the 2021 IECC to the 2024 IECC in terms of costs or cost-effectiveness. In any case, the burden of demonstrating cost-effectiveness falls on the proponent of a code change, and the proponent of REPI-122 did not provide any analysis to support the percentage multipliers proposed for the performance path.

Workgroup Recommendation

Proposal # 1346

RED1-43-22

Proponents: Alisa McMahon, representing self (mcmahon.gbac@cox.net)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R405.2 Simulated performance compliance. Compliance based on total building performance requires that a *proposed design* meets all of the following:

1. The requirements of the sections indicated within Table R405.2.
2. The proposed total building thermal envelope UA, which is the sum of the 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 1.08 in Climate Zones 0, 1, and 2, and 1.15 in Climate Zones 3 through 8 in accordance with Equation 4-2. The area-weighted maximum fenestration SHGC permitted in Climate Zones 0 through 3 shall be 0.30.

(Equation 4-2)

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

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

3. For buildings without a fuel burning appliance for either space heating or water heating, the annual energy cost of the proposed design ~~that is~~ shall be less than or equal to 85 percent of the annual energy cost of the *standard reference design*. For buildings with a fuel burning appliance for space heating or water heating, the annual energy cost of the proposed design ~~that is~~ shall be less than or equal to 80 percent of the annual energy cost of the standard reference design. For dwelling units with greater than 5,000 square feet (465 m^2) of living space floor area located above grade plane, the annual energy cost of the proposed design shall be reduced by an additional 5 percent of annual energy cost of the standard reference design. Energy prices shall be taken from a source *approved* by the *code official*, such as the Department of Energy, 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 multipliers for all energy sources shall be obtained from ASHRAE Standard 105 (Tables K2, K4, or K8) or from another data source approved by the *code official*.
   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 for an all-electric building with on-site renewable energy installed.

Reason: The PCD #1 language creates a nonsensical situation where if one appliance is fuel burning and one is not, both sentences and both conditions apply: 85% and 80%. For the provision to make sense, the first sentence must make clear that no fuel burning appliances are present.

It doesn't work to say: "the annual energy cost that is . . ." The first two sentences have been changed to match the structure of the third sentence: "the annual energy cost shall be . . ."

There may be another proposal that addresses "buildings" versus "dwelling units" in this section.

Alternative Options (first two sentences only):

3. For buildings without a fuel burning appliance for space heating and without a fuel burning appliance for water heating, the annual energy cost of the proposed design shall be less than or equal to 85 percent of the annual energy cost of the *standard reference design*. For buildings with a fuel burning appliance for space heating or water heating, the annual energy cost of the proposed design shall be less than or equal to 80 percent of the

annual energy cost of the standard reference design.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
Editorial change.

Workgroup Recommendation

Proposal # 1342

RED1-44-22

Proponents: Gary Heikkinen, representing American Gas Association (gary.heikkinen@nwnatural.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R405.2 Simulated performance compliance. Compliance based on total building performance requires that a *proposed design* meets all of the following:

1. The requirements of the sections indicated within Table R405.2.
2. The proposed total building thermal envelope UA, which is the sum of the 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 1.08 in Climate Zones 0, 1, and 2, and 1.15 in Climate Zones 3 through 8 in accordance with Equation 4-2. The area-weighted maximum fenestration SHGC permitted in Climate Zones 0 through 3 shall be 0.30.

(Equation 4-2)

$$\text{For Climate Zones 0-2: } UA_{\text{Proposed design}} \leq 1.08 \text{ x } UA_{\text{Prescriptive reference design}}$$
$$\text{For Climate Zones 3-8: } UA_{\text{Proposed design}} \leq 1.15\text{x } UA_{\text{Prescriptive reference design}}$$

3. For buildings without a fuel burning appliance for space heating or water heating, the annual energy cost of the proposed design that is less than or equal to 85 percent of the annual energy cost of the *standard reference design*. For buildings with a fuel burning appliance for space heating or water heating, the annual energy cost of the proposed design that is less than or equal to 80 percent of the annual energy cost of the standard reference design. For dwelling units with greater than 5,000 square feet (465 m^2) of living space floor area located above grade plane, the annual energy cost of the proposed design shall be reduced by an additional 5 percent of annual energy cost of the standard reference design. Energy prices shall be taken from a source *approved* by the *code official*, such as the Department of Energy, 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 multipliers for all energy sources shall be obtained from ASHRAE Standard 105 (Tables K2, K4, K6, or K8) or from another data source approved by the *code official*.
   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 for an all-electric building with on-site renewable energy installed.

Reason: ASHRAE Std 105-2021 has a total of 4 tables in Informative Appendix K with source energy factors (K2, K4, K6 and K8). The original proposal failed to include Table K6. This proposed change corrects that.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This proposal is merely a correction and will not affect cost of construction.

Workgroup Recommendation

Proposal # 1111

RED1-45-22

Proponents: Gary Heikkinen, representing American Gas Association (gary.heikkinen@nwnatural.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R405.2 Simulated performance compliance. Compliance based on total building performance requires that a *proposed design* meets all of the following:

1. The requirements of the sections indicated within Table R405.2.
2. The proposed total building thermal envelope UA, which is the sum of the 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 1.08 in Climate Zones 0, 1, and 2, and 1.15 in Climate Zones 3 through 8 in accordance with Equation 4-2. The area-weighted maximum fenestration SHGC permitted in Climate Zones 0 through 3 shall be 0.30.

(Equation 4-2)

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

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

3. For all buildings ~~without a fuel burning appliance for space heating or water heating~~, the annual energy cost of the proposed design that is less than or equal to ~~85~~ 80 percent of the annual energy cost of the *standard reference design*. ~~For buildings with a fuel burning appliance for space heating or water heating, the annual energy cost of the proposed design that is less than or equal to 80 percent of the annual energy cost of the standard reference design.~~ For dwelling units with greater than 5,000 square feet (465 m^2) of living space floor area located above grade plane, the annual energy cost of the proposed design shall be reduced by an additional 5 percent of annual energy cost of the standard reference design. Energy prices shall be taken from a source *approved* by the *code official*, such as the Department of Energy, 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 multipliers for all energy sources shall be obtained from ASHRAE Standard 105 (Tables K2, K4, or K8) or from another data source approved by the *code official*.
   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 for an all-electric building with on-site renewable energy installed.

Reason: The distinction between buildings with or without fuel burning appliances was not in the original proposal and was added during negotiations on the omnibus proposal as a concession and had no sound logic other than the fact that natural gas is less expensive on a btu basis than electricity. This proposed change will require that all buildings, regardless of equipment type, will be required to show that the proposed design is less than or equal to the better performance standard of 80% of the annual energy cost of the standard design.

Cost Impact: The code change proposal will increase the cost of construction.
Meeting the better standard of 80% may result in slight increases in construction costs when compared to the 85% requirement.

Workgroup Recommendation

Proposal # 1105

RED1-46-22

Proponents: Amy Boyce, representing Energy Efficient Codes Coalition (EECC) (amy.boyce@imt.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R405.2 Simulated performance compliance. Compliance based on total building performance requires that a *proposed design* meets all of the following:

1. The requirements of the sections indicated within Table R405.2.
2. The proposed total building thermal envelope UA, which is the sum of the 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 1.08 in Climate Zones 0, 1, and 2, and 1.15 in Climate Zones 3 through 8 in accordance with Equation 4-2. The area-weighted maximum fenestration SHGC permitted in Climate Zones 0 through 3 shall be 0.30.

(Equation 4-2)

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

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

3. ~~For buildings without a fuel burning appliance for space heating or water heating, the~~ The annual energy cost of the proposed design ~~that is~~ shall be less than or equal to 90 ~~85~~ percent of the annual energy cost of the *standard reference design*. ~~For buildings with a fuel burning appliance for space heating or water heating, the annual energy cost of the proposed design that is less than or equal to 80 percent of the annual energy cost of the standard reference design.~~ For dwelling units with greater than 5,000 square feet (465 m^2) of living space floor area located above grade plane, the annual energy cost of the proposed design shall be reduced by an additional 5 percent of annual energy cost of the standard reference design. Energy prices shall be taken from a source *approved* by the *code official*, such as the Department of Energy, 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 multipliers for all energy sources shall be obtained from ASHRAE Standard 105 (Tables K2, K4, or K8) or from another data source approved by the *code official*.
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 for an all-electric building with on-site renewable energy installed.

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 Table R402.1.2.	As proposed
	Solar absorptance = 0.75.	As proposed
	Emittance = 0.90.	As proposed
Basement and crawl space walls	Type: same as proposed.	As proposed
	Gross area: same as proposed.	As proposed
	U-factor: as specified in Table R402.1.2, with the insulation layer on the interior side of the walls.	As proposed
Above-grade floors	Type: wood frame.	As proposed
	Gross area: same as proposed.	As proposed
	U-factor: as specified in Table R402.1.2.	As proposed
Ceilings	Type: wood frame.	As proposed
	Gross area: same as proposed.	As proposed
	U-factor: as specified in Table R402.1.2.	As proposed
Roofs	Type: composition shingle on wood sheathing.	As proposed
	Gross area: same as proposed.	As proposed
	Solar absorptance = 0.75.	As proposed
	Emittance = 0.90.	As proposed
Attics	Type: vented with an aperture of 1 ft^2 per 300 ft^2 of ceiling area.	As proposed
Foundations	Type: same as proposed.	As proposed
	Foundation wall area above and below grade and soil characteristics: same as proposed.	As proposed
Opaque doors	Area: 40 ft^2.	As proposed
	Orientation: North.	As proposed
	U-factor: same as fenestration as specified in Table R402.1.2.	As proposed
Vertical fenestration other than opaque doors	Total area[h] = (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 Table R402.1.2.	As proposed
	SHGC: as specified in Table R402.1.2 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 × SHGC for the standard reference design).	Interior shade fraction: 0.92 – (0.21 × SHGC as proposed)
	External shading: none	As proposed
Skylights	None	As proposed
Thermally isolated sunrooms	None	As proposed
	The air leakage rate at a pressure of 0.2 inch w.g. (50 Pa) shall be Climate Zones 0 through 2: 5.0 air changes per hour. Climate Zones 3 , 4, and 5: 3.0 air changes per hour. Climate Zones 6 through 8: 2.5 air changes per hour.	The measured air exchange rate.[a]
	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 B x M where:	

Air exchange rate	where: B = 0.01 × CFA + 7.5 × (Nbr + 1), cfm. M = 1.0 where the measured air exchange rate is > = 3.0 air changes per hour at 50 Pascals, and otherwise, M = minimum (1.7, Q/B) Q = the proposed mechanical ventilation rate, cfm. CFA = conditioned floor area, ft2. Nbr = number of bedrooms. 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 Section R403.6.1. Heat recovery or energy recovery shall not be modeled for mechanical ventilation where not required by Section R403.6.1.	The mechanical ventilation rate[b], Q, shall be in addition to the air leakage rate and shall be as proposed.
Mechanical ventilation	Where mechanical ventilation is not specified in the proposed design: None Where mechanical ventilation is specified in the proposed design, the annual vent fan energy use, in units of kWh/yr, shall equal (8.76 × B × M)/ef where: B and M are determined in accordance with the Air Exchange Rate row of this table. e_f = the minimum fan efficacy, as specified in Table 403.6.2, corresponding to the system type at a flow rate of B × M. *CFA* = conditioned floor area, ft^2. N_{br} = number of bedrooms.	As proposed
Internal gains	IGain, in units of Btu/day per dwelling unit, shall equal 17,900 + 23.8 ×*CFA* + 4,104 × N_{br} where: *CFA* = conditioned floor area, ft^2. N_{br} = number of bedrooms.	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[c] but not integral to the building 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 Table R402.1.3, 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[d, e, j, k]	For other than electric heating without a heat pump: as proposed. 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 Section R403.7.	As proposed
	~~Fuel Type/Capacity: Same as proposed design~~	~~As proposed~~
	~~Product class: Same as proposed design~~	~~As proposed~~
	~~Efficiencies:~~	~~As proposed~~
	~~Heat pump: Complying with 10 CFR §430.32~~	~~As proposed~~
	~~Non-electric furnaces: Complying with 10 CFR §430.32~~	~~As proposed~~
	~~Non-electric boilers: Complying with 10 CFR §430.32~~	~~As proposed~~
Cooling systems[d, f, k]	As proposed. Capacity: sized in accordance with Section R403.7.	As proposed
	~~Fuel Type: Electric~~ ~~Capacity: Same as proposed design~~	~~As proposed~~
	~~Efficiencies: Complying with 10 CFR §430.32~~	~~As proposed~~
		As proposed Use, in units of gal/day = 25.5 + (8.5 × N_{br}) × (1 – *HWDS*) where:

<table>
<tr>
<td rowspan="7">Service water heating[d, g, k]</td>
<td>As proposed.
Use, in units of gal/day = 25.5 + (8.5 × N_{br})
where: N_{br} = number of bedrooms.</td>
<td>where:
N_{br} = number of bedrooms.
HWDS = factor for the compactness of the hot water distribution system.
<table>
<tr><th colspan="2">Compactness ratio[i] factor</th><th>HWDS</th></tr>
<tr><td>1 story</td><td>2 or more stories</td><td></td></tr>
<tr><td>> 60%</td><td>> 30%</td><td>0</td></tr>
<tr><td>> 30% to ≤ 60%</td><td>> 15% to ≤ 30%</td><td>0.05</td></tr>
<tr><td>> 15% to ≤ 30%</td><td>> 7.5% to ≤ 15%</td><td>0.10</td></tr>
<tr><td>< 15%</td><td>< 7.5%</td><td>0.15</td></tr>
</table></td>
</tr>
<tr><td>~~Fuel Type: Same as proposed design~~</td><td>~~As proposed~~</td></tr>
<tr><td>~~Rated Storage Volume: Same as proposed design~~</td><td>~~As proposed~~</td></tr>
<tr><td>~~Draw Pattern: Same as proposed design~~</td><td>~~As proposed~~</td></tr>
<tr><td>~~Efficiencies: Uniform Energy Factor complying with 10 CFR §430.32~~</td><td>~~As proposed~~</td></tr>
<tr><td>~~Tank Temperature: 120° F (48.9° C)~~</td><td>~~Same as standard reference design~~</td></tr>
<tr><td></td><td></td></tr>
<tr>
<td rowspan="4">Thermal distribution systems</td>
<td>Duct location: <u>same as proposed design</u>
<table>
<tr><td>~~Foundation Type~~</td><td>~~Slab on grade~~</td><td>~~Unconditioned crawl space~~</td><td>~~Basement or conditioned crawl space~~</td></tr>
<tr><td>~~Duct location (supply and return)~~</td><td>~~One-story building: 100% in unconditioned attic~~

~~All other: 75% in unconditioned attic and 25% inside conditioned space~~</td><td>~~One-story building: 100% in unconditioned crawlspace~~

~~All other: 75% in unconditioned crawlspace and 25% inside conditioned space~~</td><td>~~50% inside conditioned space~~

~~50% unconditioned attic~~</td></tr>
</table></td>
<td>Duct location: as proposed.</td>
</tr>
<tr><td>Duct insulation: in accordance with Section R403.3.1.</td><td>Duct insulation: as proposed.</td></tr>
<tr><td>Duct system leakage to outside:
For duct systems serving > 1,000ft2 of conditioned floor area, the duct leakage to outside rate shall be 4 cfm (113.3 L/min) per 100 ft2 (9.29 m2) of conditioned floor area.
For duct systems serving ≤ 1,000ft2 of conditioned floor area, the duct leakage to outside rate shall be 40 cfm (1132.7 L/min).</td>
<td>Duct System Leakage to Outside: The measure total duct system leakage rate shall be entered into the software as the duct system leakage to outside rate.
Exceptions:
<table>
<tr><td>1.</td><td>When duct system leakage to outside is tested in accordance ANSI/ RESNET/ICC 380 or ASTM E1554, the measured value shall be permitted to be entered.</td></tr>
<tr><td>2.</td><td>When total duct system leakage is measured without the air handler installed, the simulation value shall be 4 cfm (113.3 L/min) per 100 ft^2 (9.29 m^2) of conditioned floor area.</td></tr>
</table></td></tr>
<tr><td>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.</td><td>For hydronic systems and ductless systems, DSE shall be as specified in Table R405.4.2(2).</td></tr>
<tr><td>Thermostat</td><td>Type: Manual, cooling temperature setpoint = 75°F;
Heating temperature setpoint = 72°F.</td><td>Same as standard reference design.</td></tr>
<tr><td>Dehumidistat</td><td>Where a mechanical ventilation system with latent heat recovery is not specified in the proposed design: None. Where the proposed design utilizes a mechanical ventilation system with latent heat recovery:
Dehumidistat type: manual, setpoint = 60% relative humidity.
Dehumidifier: whole-dwelling with integrated energy factor = 1.77 liters/kWh.</td><td>Same as standard reference design.</td></tr>
</table>

For SI: 1 square foot = 0.93 m^2, 1 British thermal unit = 1055 J, 1 pound per square foot = 4.88 kg/m^2, 1 gallon (US) = 3.785 L, °C = (°F-32)/1.8, 1 degree = 0.79 rad.

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.

g. For a proposed design the following assumptions shall be made for both the proposed design and standard reference design.

   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 §130.32

h. For residences with conditioned basements, R-2 and R-4 residences, and for townhouse units, 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.

i. 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 Table R405.4.2(1), the standard reference design shall be the same as proposed design.

Reason: This proposal will help maintain the efficiency of the 2021 IECC by eliminating performance path trade-offs for heating, cooling, and water heating equipment, and for duct location that were added through the Residential Committee's adoption of proposal REPI-122. The proposal also adjusts the performance path multiplier to 90%, capturing the intended 5% overall improvement applied to Section R408. If the equipment trade-offs and duct location credits are removed from the performance path, there is no need to adjust the standard reference design multiplier any lower than 90%.
Adding equipment trade-offs to the performance path in the 2024 IECC would be a significant efficiency rollback and a departure from precedent set by ICC Governmental Members for several code cycles. Since the 2009 IECC, trade-offs between equipment efficiency and envelope components have not been allowed in the performance path, and ICC Governmental Member Voting Representatives have rejected such proposals over 5 code update cycles; in the 2021 IECC cycle, over 90% of a record number of voting representatives voted to reject similar trade-offs. Nearly every state that has adopted the 2009 IECC or newer edition has adopted the code without these trade-offs, and the reintroduction of a potentially large loophole would be a significant setback for building efficiency. Trade-off credit for duct location is also not allowed in the 2021 IECC, and we believe that awarding credits for duct location—given that a significant percentage of homes already locate ducts inside conditioned space—could introduce even more free-ridership credit that could equal or surpass the equipment trade-offs in terms of efficiency losses.

The efficiency benefits of equipment should not be traded one-for-one against a building's thermal envelope. Equipment will be replaced multiple times over the building's lifetime (likely with more efficient equipment each time), whereas the envelope is unlikely to ever be upgraded. And because of federal preemption, the assumed efficiency in the standard reference design is based on outdated federal minimum efficiencies that lag well behind the efficiencies of commonly installed equipment. Recent DOE Residential Field Study data indicates that builders are already regularly incorporating improved efficiency in heating, cooling, and water heating equipment across the country. Setting the performance path standard reference design at federal minimum efficiencies for this equipment would treat these installations as improvements and award new trade-off credit not currently included in the IECC. The net effect of introducing these trade-offs will be a reduction in overall efficiency of the home, since these credits will likely be used to reduce the efficiency of other components within the building.

The draft 2024 IECC would also award credit based on the percentage of ducts located inside conditioned space. This rollback was not originally part of REPI-122, and was added very late in the process with no additional support or analysis from the proponent. Creating this new trade-off credit, based on standard reference design assumptions for duct location that lack any analysis, will lead to more free-ridership credit that can be used to further reduce envelope efficiency. While the code should encourage builders and design professionals to locate ducts inside conditioned space, we are concerned that treating duct location as a credit in the 2024 IECC simply awards free credit without actually shifting current building practices.

The performance path multipliers and the UA-based thermal envelope backstop do not make up for the significant efficiency losses that will result from these trade-offs. The proponent did not provide any analysis to support the 80% or 85% multipliers in section R405.2, and we believe these adjustments are inadequate to make up for such a big efficiency rollback. Although these multipliers will require a code user to improve the standard reference design by 10 or 15%, the amount of trade-off credit available from heating, cooling, water heating, and duct location is several times that much. Using the section R408 points table approved by the Residential Consensus Committee as a proxy (i.e. each point represents 1% efficiency), here are the potential credits available for equipment efficiency above federal minimums and duct locations other than the assumed baseline:

Range of Potential Credits Under R408 For Comparison to R405 Performance Path Trade-Offs

	CZ 0&1	CZ 2	CZ 3	CZ 4	CZ 4C	CZ 5	CZ 6	CZ 7	CZ 8
Heating Equipment Efficiency	0-8	2-7	3-6	5-6	5-6	5-8	4-8	4-8	3-10
Cooling Equipment Efficiency	0-8	2-7	4-6	3-6	3-6	2-8	1-7	1-6	1-5
Water Heating Equipment Efficiency	4-12	5-12	5-11	3-8	3-8	2-6	2-5	3-5	1-4
Duct Location Credit	4	6	8	12	12	15	17	19	20
Max Potential Credits	**32**	**32**	**31**	**32**	**32**	**37**	**37**	**38**	**39**

Given the maximum potential credits available, it is clear that the 10 or 15% adjustment to the performance path multiplier will not be enough to prevent a huge efficiency rollback in R405. Code users who specify one or more pieces of efficient equipment in the performance path will likely be able to use excess “credit” for efficient equipment to reduce the overall efficiency of the building to a level that would have failed the 2021 IECC. (There may be additional rollbacks not accounted for here -- It is important to keep in mind that additional trade-off credit may be available for even higher efficiency equipment that is not specified in the R408 table.) We also note that the revised Total UA-based thermal envelope backstop was designed based on the stronger prescriptive envelope requirements of the 2021 IECC and without any consideration of equipment or duct location trade-offs. Even if equipment trade-offs were appropriate, the envelope backstop would need to be updated to further limit envelope trade-offs to avoid a large number of homes being built with inadequate thermal envelopes. REPI-122 is the single biggest efficiency reduction adopted into the 2024 IECC draft, and we urge the Committee to reverse its effects.

Please see attached "Support Letter - EECC Comments" for a list of government representatives and organizations supporting this proposal.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
It will restore a significant piece of the 2021 IECC performance path and help reduce the likelihood that the 2024 IECC is less efficient than the 2021 edition of the code.

Attached Files

- **Support Letter - EECC Comments.pdf**
  https://energy.cdpaccess.com/proposal/1272/2662/files/download/478/

Workgroup Recommendation

Proposal # 1272

RED1-47-22 Part I

Proponents: Fredric Zwerg, representing Southwest Gas Corporation (fredric.zwerg@swgas.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R405.2 Simulated performance compliance. Compliance based on total building performance requires that a *proposed design* meets all of the following:

1. The requirements of the sections indicated within Table R405.2.
2. The proposed total building thermal envelope UA, which is the sum of the 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 1.08 in Climate Zones 0, 1, and 2, and 1.15 in Climate Zones 3 through 8 in accordance with Equation 4-2. The area-weighted maximum fenestration SHGC permitted in Climate Zones 0 through 3 shall be 0.30.

(Equation 4-2)

$$\text{For Climate Zones 0-2: } UA_{\text{Proposed design}} \leq 1.08 \text{ x } UA_{\text{Prescriptive reference design}}$$
$$\text{For Climate Zones 3-8: } UA_{\text{Proposed design}} \leq 1.15\text{x } UA_{\text{Prescriptive reference design}}$$

3. ~~For buildings without a fuel burning appliance for space heating or water heating, the~~ An annual energy cost ~~of the proposed design~~ that is less than or equal to ~~85 percent of~~ the annual energy cost of the *standard reference design*. ~~For buildings with a fuel burning appliance for space heating or water heating, the annual energy cost of the proposed design that is less than or equal to 80 percent of the annual energy cost of the standard reference design. For dwelling units with greater than 5,000 square feet (465 m²) of living space floor area located above grade plane, the annual energy cost of the proposed design shall be reduced by an additional 5 percent of annual energy cost of the standard reference design. Energy prices shall be taken from a source *approved* by the *code official*, such as the Department of Energy, 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.~~ Energy prices shall be taken from a source approved by the code official, such as the Department of Energy, Energy Information Administrations' State Energy Data System Prices and Expenditures reports. Code officials shall be permitted to require time-of-use pricing in energy cost calculations. 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~~s~~ for ~~all energy sources shall be obtained from ASHRAE Standard 105 (Tables K2, K4, or K8) or from another data source approved by the *code official*.~~ electricity shall be 3.16. The source energy multiplier for fuels other than electricity shall be 1.1.
   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 for an all-electric building with on-site renewable energy installed.~~

Reason: Delete the proposed changes to Section R405.2, Item 3 and keep the original text. The proposed changes are electrification based and promote the electrification of the homes space heating and water heating systems which will increase the construction cost of the home and at the expense of the home owner. This text change will remove the penalization of one fuel over another without justifiable energy savings.
Delete the proposed changes to Section R405.2 Item 3, Exception 1 entirely and keep the original text. The proposed text selectively picks the electrification tables in ASHRAE Standard 105. The original text accounts for the energy source efficiencies (generation, transportation and distribution) and should continue to be used.

Delete Section R405.2 Item 3, Exception 2 entirely. On-site energy is not the same as source energy and is biased toward electrical energy usage. It does not account for the energy losses and efficiencies of electrical power generation. This is an electrification issue and ignores the energy losses. An energy code needs to account for all of this.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
No cost impact.

Workgroup Recommendation

RED1-47-22 Part II

Proponents: Fredric Zwerg, representing Southwest Gas Corporation (fredric.zwerg@swgas.com)

2024 ENERGY Chapter11

Revise as follows:

N1105.2 Simulated performance based compliance. Compliance based on simulated building performance requires that a *proposed design* meets all of the following:

1. The requirements of the sections indicated within Table N1105.2.
2. The proposed total building thermal envelope UA, which is the sum of the U-factor times assembly area, shall be less than or equal to the building thermal envelope UA using the prescriptive U-factors from Table N1102.1.2 multiplied by 1.08 in Climate Zones 0, 1 and 2, and 1.15 in Climates Zones 3 through 8, in accordance with Equation 11-6. The area-weighted maximum fenestration SHGC permitted in Climate Zones 0 through 3 shall be 0.30.

(Equation 11-6)

$$\text{For Climate Zones 0-2: } UA_{\text{Proposed design}} \leq 1.08 \text{ x } UA_{\text{Prescriptive reference design}}$$
$$\text{For Climate Zones 3-8: } UA_{\text{Proposed design}} \leq 1.15\text{x } UA_{\text{Prescriptive reference design}}$$

3. ~~For buildings without a fuel burning appliance for space heating or water heating, the~~ An annual energy cost ~~of the proposed design~~ that is less than or equal to ~~85 percent of~~ the annual energy cost of the *standard reference design*. For buildings with a fuel burning appliance for space heating or water heating, the annual energy cost of the proposed design that is less than or equal to 80 percent of the annual energy cost of the standard reference design. F~~or dwelling units with greater than 5,000 square feet (465 m²) of living space floor area located above grade plane, the annual energy cost of the proposed design shall be reduced by an additional 5 percent of annual energy cost of the standard reference design.~~

   Energy prices shall be taken from a source *approved* by the *code official*, such as the Department of Energy, 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. ~~The source energy multipliers for all energy sources shall be obtained from ASHRAE Standard 105 (Tables K2, K4, or K8) or from another data source approved by the code official.~~
   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 for an all-electric building with on-site renewable energy installed.~~

Reason: Delete the proposed changes to Section R1105.2, Item 3. The proposed changes are electrification based and promote the electrification of the homes space heating and water hoeing systems which wil increase the construction cost of the home and at the expense of the homeowner. The text change will remove the penalization of one fuel over another without justifiable energy savings. Delete the proposed changes to Section R1105.2 Exception 1 and delete Exception 2 entirely. The proposed text selectively picks the eletrcfication tables in ASHRAE Standard 105. The original text accounts for the energy source efficiencies (generation, transportation and distribution) and should continue to be used.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
No cost impact.

Workgroup Recommendation

Proposal # 1174

RED1-48-22

Proponents: Kevin Duell, representing NW Natural

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R405.2 Simulated performance compliance. Compliance based on total building performance requires that a *proposed design* meets all of the following:

1. The requirements of the sections indicated within Table R405.2.
2. The proposed total building thermal envelope UA, which is the sum of the 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 1.08 in Climate Zones 0, 1, and 2, and 1.15 in Climate Zones 3 through 8 in accordance with Equation 4-2. The area-weighted maximum fenestration SHGC permitted in Climate Zones 0 through 3 shall be 0.30.

(Equation 4-2)

$$\text{For Climate Zones 0-2: } UA_{\text{Proposed design}} \leq 1.08 \times UA_{\text{Prescriptive reference design}}$$
$$\text{For Climate Zones 3-8: } UA_{\text{Proposed design}} \leq 1.15 \times UA_{\text{Prescriptive reference design}}$$

3. ~~For buildings without a fuel burning appliance for space heating or water heating, the~~ The annual energy cost of the proposed design that is less than or equal to 85 percent of the annual energy cost of the *standard reference design*. ~~For buildings with a fuel burning appliance for space heating or water heating, the annual energy cost of the proposed design that is less than or equal to 80 percent of the annual energy cost of the standard reference design.~~ For dwelling units with greater than 5,000 square feet (465 m^2) of living space floor area located above grade plane, the annual energy cost of the proposed design shall be reduced by an additional 5 percent of annual energy cost of the standard reference design. Energy prices shall be taken from a source *approved* by the *code official*, such as the Department of Energy, 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 multipliers for all energy sources shall be obtained from ASHRAE Standard 105 (Tables K2 - for all sources except electricity - and K6~~, K4,~~ or K8) or from another data source approved by the *code official*.
   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 for an all-electric building with on-site renewable energy installed.

Reason: For Part 3: Each building should be evaluated on its energy performance independent of the fuel source if the intent is to regulate energy efficiency. If the intent is to account for emissions - which the original proposal hints at - then that should be explicit, not approximated by percentage points across all building stock. Furthermore, emissions calculations must be based on source emissions, not just site, to account for *total* effects on the atmosphere and to account for regional differences in emissions from electrical generation (per ASHRAE 105-2021).
For Exception 1: Referencing Table K6 is vital because avoided energy is the correct metric for comparing energy performance: per ASHRAE 105-2021 "Average primary energy and greenhouse gas emissions calculations may be useful for inventory purposes, but they may provide misleading information when deciding what energy efficiency or conservation measures to include in new building designs or to implement in retrofit programs." Avoided energy more accurately reflects the impact of a building on the energy grid, rather than having its impact diluted within average energy calculations.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
Since this proposal evaluates energy performance, any number of measures may be taken that may or may not affect cost.

Bibliography: ANSI / ASHRAE Standard 105-2021 - "Standard Methods of Determining, Expressing, and Comparing Building Energy Performance and Greenhouse Gas Emissions"

Workgroup Recommendation

Proposal # 1382

RED1-49-22 Part I

Proponents: Tom Ortiz, representing National Propane Gas Association (tortiz@npga.org); Bruce Swiecicki, representing National Propane Gas Association (bswiecicki@npga.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R405.2 Simulated performance compliance. Compliance based on total building performance requires that a *proposed design* meets all of the following:

1. The requirements of the sections indicated within Table R405.2.
2. The proposed total building thermal envelope UA, which is the sum of the 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 1.08 in Climate Zones 0, 1, and 2, and 1.15 in Climate Zones 3 through 8 in accordance with Equation 4-2. The area-weighted maximum fenestration SHGC permitted in Climate Zones 0 through 3 shall be 0.30.

(Equation 4-2)

$$\text{For Climate Zones 0-2: } UA_{\text{Proposed design}} \leq 1.08 \text{ x } UA_{\text{Prescriptive reference design}}$$
$$\text{For Climate Zones 3-8: } UA_{\text{Proposed design}} \leq 1.15 \text{x } UA_{\text{Prescriptive reference design}}$$

3. ~~For buildings without a fuel burning appliance for space heating or water (Equation 4-2) heating, the An annual energy cost of the proposed design that is less than or equal to 85 percent of the annual energy cost of the standard reference design. For buildings with a fuel burning appliance for space heating or water heating, the annual energy cost of the proposed design that is less than or equal to 80 percent of the annual energy cost of the standard reference design.~~ For dwelling units with greater than 5,000 square feet (465 m2) of living space floor area located above grade plane, the annual energy cost of the proposed design shall be reduced by an additional 5 percent of annual energy cost of the standard reference design. Energy prices shall be taken from a source approved by the code official, such as the Department of Energy, 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 multipliers for~~ electricity shall be 3.16. The source energy multiplier for fuels other than electricity shall be 1.1.~~all energy sources shall be obtained from ASHRAE Standard 105 (Tables K2, K4, or K8) or from another data source approved by the code official.
   2. The energy use based on source~~site~~ energy expressed in Btu or Btu per square foot of conditioned floor area shall be ~~permitted to be~~ substituted for the energy cost for an all-electric building with on-site renewable energy installed.

Reason: This section penalizes fuel burning systems in terms of required energy performance. There is no scientific basis for making this distinction. First, electric systems incur substantial energy losses during transmission which are not applicable to point-of-use fuel burning systems. Second, fuel gas or fuel oil may be completely renewable, thereby generating as few or even fewer carbon emissions than electricity which may be generated from coal or natural gas. A consequence of the first point is that source—not site—energy use should be the basis for comparison among energy delivery systems.We propose the following general principles as a pathway to achieving net zero carbon buildings:
1. It is highly doubtful that society, given the constraints of practicality and financial resources, would be able to fully upgrade the electric grid or provide enough on-site renewable energy to meet the demand that would be imposed with a "full-steam-ahead" electrification policy, which many are trying to achieve with the 2024 IECC.

2. The "real" issue we are addressing is not so much energy conservation, but carbon conservation in the form of limiting CO_2e emissions. No energy sources should be discounted if, on a source-basis, they can achieve a superior level of performance than other sources.

3. The code is revised and published every three years. A step-wise approach to be taken is the most prudent, as it allows the grid to be upgraded to handle the additional loads expected (much of it due to electrification of vehicles) and to allow implementation of two-way technology for returning electrons to the grid, which most locations to not currently permit.

It is very apparent that the huge ambitions held by some electrification advocates will outstrip the capacity of our infrastructure to deliver. The cost to build a "future-proof" grid will likely be somewhere between $1 trillion (Reuters[1]) and $7 trillion (Oilprice.com[2]). This is an expenditure on the order of what the US spent[3] on the wars in Iraq and Afghanistan between 2001 – 2021. The appetite for policymakers and ratepayers to absorb such costs is a question that is yet to be answered.

Meanwhile, the US EIA has documented that average electric transmission system outage times have roughly doubled between 2013 - 2021[4]. We therefore are facing the prospect of adding massive new load to a network that is already badly in need of maintenance, without knowing with any degree of certainty how much investment capital will be available to: a) enable safe and robust bi-directional power flow for distributed storage and generation; b) protect this new “smart” grid against cyberattack and other forms of sabotage; and c) procure enough domestic supplies of scarce critical minerals (e.g. lithium, cobalt, neodymium) to ensure a secure and affordable source for the—literally—billions of batteries that are intended to serve the electric vehicle, residential and commercial energy storage, utility-scale energy storage, and consumer electronics industries.

(And, not to be dismissed, when fusion energy becomes widespread, we will need yet more lithium from which to manufacture tritium—one necessary component of the most feasible fuel for any prospective fusion power plant.)

Therefore, we view inclusion of mandatory electrification in building codes as far more than an energy efficiency, or even a greenhouse gas, issue: it also has massive national security and health/safety implications that, in our opinions, are not being adequately analyzed. While building codes may not, per se, be tasked with solving all of those problems, they are nevertheless relied upon by decisionmakers as being rational, reliable, and conservative bases for managing the building stock of our nation’s homes and businesses. Based on the foregoing, there should be consideration for more agnostically defining what is meant by a sustainable (rather than, strictly speaking, renewable) resource in the hope that we can use every feasible tool imaginable to optimize our energy system with respect to its myriad technical and environmental constraints.

[1]

McLaughlin, T. (2022), “Creaky U.S. power grid threatens progress on renewables, EVs”, Reuters, https://www.reuters.com/investigates/special-report/usa-renewables-electric-grid/

[2] Hyman, L. and Tilles, W. (2021), “The $7 Trillion Cost Of Upgrading The U.S. Power Grid”, Oilprice.com, https://oilprice.com/Energy/Energy-General/The-7-Trillion-Cost-Of-Upgrading-The-US-Power-Grid.html .

[3] https://www.brown.edu/news/2021-09-01/costsofwar

[4] US Energy Information Administration (2022), “Table 11.2. Reliability metrics using IEEE of U.S. distribution system by state”, https://www.eia.gov/electricity/annual/ .

Cost Impact: The code change proposal will decrease the cost of construction.
This change will allow "fair" consideration of fuel gases without penalization and thereby decrease the cost of construction.

Bibliography:
[1] McLaughlin, T. (2022), “Creaky U.S. power grid threatens progress on renewables, EVs”, Reuters, https://www.reuters.com/investigates/special-report/usa-renewables-electric-grid/

[2] Hyman, L. and Tilles, W. (2021), “The $7 Trillion Cost Of Upgrading The U.S. Power Grid”, Oilprice.com, https://oilprice.com/Energy/Energy-General/The-7-Trillion-Cost-Of-Upgrading-The-US-Power-Grid.html .

[3] https://www.brown.edu/news/2021-09-01/costsofwar

[4] US Energy Information Administration (2022), “Table 11.2. Reliability metrics using IEEE of U.S. distribution system by state”, https://www.eia.gov/electricity/annual/ .

Workgroup Recommendation

Proposal # 1254

RED1-49-22 Part II

Proponents: Tom Ortiz, representing National Propane Gas Association (tortiz@npga.org); Bruce Swiecicki, representing National Propane Gas Association (bswiecicki@npga.org)

2024 ENERGY Chapter11

Revise as follows:

N1105.2 Simulated performance based compliance. Compliance based on simulated building performance requires that a *proposed design* meets all of the following:

1. The requirements of the sections indicated within Table N1105.2.
2. The proposed total building thermal envelope UA, which is the sum of the U-factor times assembly area, shall be less than or equal to the building thermal envelope UA using the prescriptive U-factors from Table N1102.1.2 multiplied by 1.08 in Climate Zones 0, 1 and 2, and 1.15 in Climates Zones 3 through 8, in accordance with Equation 11-6. The area-weighted maximum fenestration SHGC permitted in Climate Zones 0 through 3 shall be 0.30.

(Equation 11-6)

$$\text{For Climate Zones 0-2: UA}_{\text{Proposed design}} \leq 1.08 \text{ x UA}_{\text{Prescriptive reference design}}$$
$$\text{For Climate Zones 3-8: UA}_{\text{Proposed design}} \leq 1.15\text{x UA}_{\text{Prescriptive reference design}}$$

3. ~~For buildings without a fuel burning appliance for space heating or water (Equation 11-6) heating, the An annual energy cost of the proposed design that is less than or equal to 85 percent of the annual energy cost of the standard reference design. For buildings with a fuel burning appliance for space heating or water heating, the annual energy cost of the proposed design that is less than or equal to 80 percent of the annual energy cost of the standard reference design.~~ For dwelling units with greater than 5,000 square feet (465 m2) of living space floor area located above grade plane, the annual energy cost of the proposed design shall be reduced by an additional 5 percent of annual energy cost of the standard reference design.

   Energy prices shall be taken from a source *approved*by the *code official*, such as the Department of Energy, 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. The source energy multiplier for fuels other than electricity shall be 1.1.~~ multipliers for all energy sources shall be obtained from ASHRAE Standard 105 (Tables K2, K4, or K8) or from another data source approved by the code official.
   2. The energy use based on <u>source</u>~~site~~ energy expressed in Btu or Btu per square foot of conditioned floor area shall be ~~permitted to be~~ substituted for the energy cost for an all-electric building with on-site renewable energy installed.

Reason: This section penalizes fuel burning systems in terms of required energy performance. There is no scientific basis for making this distinction. First, electric systems incur substantial energy losses during transmission which are not applicable to point-of-use fuel burning systems. Second, fuel gas or fuel oil may be completely renewable, thereby generating as few or even fewer carbon emissions than electricity which may be generated from coal or natural gas. A consequence of the first point is that source—not site—energy use should be the basis for comparison among energy delivery systems.We propose the following general principles as a pathway to achieving net zero carbon buildings:

1. It is highly doubtful that society, given the constraints of practicality and financial resources, would be able to fully upgrade the electric grid or provide enough on-site renewable energy to meet the demand that would be imposed with a "full-steam-ahead" electrification policy, which many are trying to achieve with the 2024 IECC.

2. The "real" issue we are addressing is not so much energy conservation, but carbon conservation in the form of limiting CO_2e emissions. No energy sources should be discounted if, on a source-basis, they can achieve a superior level of performance than other sources.

3. The code is revised and published every three years. A step-wise approach to be taken is the most prudent, as it allows the grid to be upgraded to handle the additional loads expected (much of it due to electrification of vehicles) and to allow implementation of two-way technology for returning electrons to the grid, which most locations to not currently permit.

It is very apparent that the huge ambitions held by some electrification advocates will outstrip the capacity of our infrastructure to deliver. The cost to build a "future-proof" grid will likely be somewhere between $1 trillion (Reuters[1]) and $7 trillion (Oilprice.com[2]). This is an expenditure on the order of what the US spent[3] on the wars in Iraq and Afghanistan between 2001 – 2021. The appetite for policymakers and ratepayers to absorb such costs is a question that is yet to be answered.

Meanwhile, the US EIA has documented that average electric transmission system outage times have roughly doubled between 2013 - 2021[4]. We therefore are facing the prospect of adding massive new load to a network that is already badly in need of maintenance, without knowing with any degree of certainty how much investment capital will be available to: a) enable safe and robust bi-directional power flow for distributed storage and generation; b) protect this new "smart" grid against cyberattack and other forms of sabotage; and c) procure enough domestic supplies of scarce critical minerals (e.g. lithium, cobalt, neodymium) to ensure a secure and affordable source for the—literally—billions of batteries that are intended to serve the electric vehicle, residential and commercial energy storage, utility-scale energy storage, and consumer electronics industries.

(And, not to be dismissed, when fusion energy becomes widespread, we will need yet more lithium from which to manufacture tritium—one necessary component of the most feasible fuel for any prospective fusion power plant.)

Therefore, we view inclusion of mandatory electrification in building codes as far more than an energy efficiency, or even a greenhouse gas, issue: it also has massive national security and health/safety implications that, in our opinions, are not being adequately analyzed. While building codes may not, per se, be tasked with solving all of those problems, they are nevertheless relied upon by decisionmakers as being rational, reliable, and conservative bases for managing the building stock of our nation's homes and businesses. Based on the foregoing, there should be consideration for more agnostically defining what is meant by a sustainable (rather than, strictly speaking, renewable) resource in the hope that we can use every feasible tool imaginable to optimize our energy system with respect to its myriad technical and environmental constraints.

[1]

McLaughlin, T. (2022), "Creaky U.S. power grid threatens progress on renewables, EVs", Reuters, https://www.reuters.com/investigates/special-report/usa-renewables-electric-grid/

[2] Hyman, L. and Tilles, W. (2021), "The $7 Trillion Cost Of Upgrading The U.S. Power Grid", Oilprice.com, https://oilprice.com/Energy/Energy-General/The-7-Trillion-Cost-Of-Upgrading-The-US-Power-Grid.html .

[3] https://www.brown.edu/news/2021-09-01/costsofwar

[4] US Energy Information Administration (2022), "Table 11.2. Reliability metrics using IEEE of U.S. distribution system by state", https://www.eia.gov/electricity/annual/ .

Cost Impact: The code change proposal will decrease the cost of construction.
Fuel gas systems will not be penalized by this requirement and therefore, the cost of construction will decrease.

Bibliography: [1] McLaughlin, T. (2022), "Creaky U.S. power grid threatens progress on renewables, EVs", Reuters, https://www.reuters.com/investigates/special-report/usa-renewables-electric-grid/
[2] Hyman, L. and Tilles, W. (2021), "The $7 Trillion Cost Of Upgrading The U.S. Power Grid", Oilprice.com, https://oilprice.com/Energy/Energy-General/The-7-Trillion-Cost-Of-Upgrading-The-US-Power-Grid.html .

[3] https://www.brown.edu/news/2021-09-01/costsofwar

[4] US Energy Information Administration (2022), "Table 11.2. Reliability metrics using IEEE of U.S. distribution system by state", https://www.eia.gov/electricity/annual/ .

Workgroup Recommendation

RED1-50-22

Proponents: Ian Casey, representing NW Natural

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R405.2 Simulated performance compliance. Compliance based on total building performance requires that a *proposed design* meets all of the following:

1. The requirements of the sections indicated within Table R405.2.
2. The proposed total building thermal envelope UA, which is the sum of the 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 1.08 in Climate Zones 0, 1, and 2, and 1.15 in Climate Zones 3 through 8 in accordance with Equation 4-2. The area-weighted maximum fenestration SHGC permitted in Climate Zones 0 through 3 shall be 0.30.

(Equation 4-2)

$$\text{For Climate Zones 0-2: } UA_{\text{Proposed design}} \leq 1.08 \text{ x } UA_{\text{Prescriptive reference design}}$$

$$\text{For Climate Zones 3-8: } UA_{\text{Proposed design}} \leq 1.15\text{x } UA_{\text{Prescriptive reference design}}$$

3. ~~For buildings without a fuel burning appliance for space heating or water heating, the~~ The annual energy cost of the proposed design that is less than or equal to 85 percent of the annual energy cost of the *standard reference design*. ~~For buildings with a fuel burning appliance for space heating or water heating, the annual energy cost of the proposed design that is less than or equal to 80 percent of the annual energy cost of the standard reference design.~~ For dwelling units with greater than 5,000 square feet (465 m^2) of living space floor area located above grade plane, the annual energy cost of the proposed design shall be reduced by an additional 5 percent of annual energy cost of the standard reference design. Energy prices shall be taken from a source *approved* by the *code official*, such as the Department of Energy, 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 multipliers for all energy sources shall be obtained from ASHRAE Standard 105 (Tables K2~~, K4,~~ and/or K6 ~~or K8~~) or from another data source approved by the *code official*.
   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 for an all-electric building with on-site renewable energy installed.

Reason: This proposal places an unnecessary cost burden on builders who choose to use gas equipment for space and water heating by requiring them to achieve 5% more energy savings over an all-electric home. A simulated reduction in energy % should not be dependent on fuel choice. Furthermore, Tables K4 and K8 for "Average and Projected Emissions" are not the appropriate metric to use for evaluation on impact of energy policy's actual influence on Greenhouse Gas Emissions. As referenced in ASHRAE Standard-105, "Avoided Emissions" are the correct metric for this purpose. For this reason, it is suggested that Tables K2 and K6 be used.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
No anticipated cost increase or decrease as a result of this proposed change in code language.

Bibliography: ANSI / ASHRAE Standard 105-2021 - "Standard Methods of Determining, Expressing, and Comparing Building Energy Performance and Greenhouse Gas Emissions"

Workgroup Recommendation

RED1-51-22

Proponents: Ted Williams, representing ONE Gas (ngdllc@outlook.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R405.2 Simulated performance compliance. Compliance based on total building performance requires that a *proposed design* meets all of the following:

1. The requirements of the sections indicated within Table R405.2.
2. The proposed total building thermal envelope UA, which is the sum of the 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 1.08 in Climate Zones 0, 1, and 2, and 1.15 in Climate Zones 3 through 8 in accordance with Equation 4-2. The area-weighted maximum fenestration SHGC permitted in Climate Zones 0 through 3 shall be 0.30.

(Equation 4-2)

$$\text{For Climate Zones 0-2: } UA_{\text{Proposed design}} \leq 1.08 \text{ x } UA_{\text{Prescriptive reference design}}$$
$$\text{For Climate Zones 3-8: } UA_{\text{Proposed design}} \leq 1.15\text{x } UA_{\text{Prescriptive reference design}}$$

3. ~~For buildings without a fuel burning appliance for space heating or water heating,~~ T~~t~~he annual energy cost of the proposed design that is less than or equal to ~~85~~ 80 percent of the annual energy cost of the *standard reference design*. ~~For buildings with a fuel burning appliance for space heating or water heating, the annual energy cost of the proposed design that is less than or equal to 80 percent of the annual energy cost of the standard reference design.~~ For dwelling units with greater than 5,000 square feet (465 m^2) of living space floor area located above grade plane, the annual energy cost of the proposed design shall be reduced by an additional 5 percent of annual energy cost of the standard reference design. Energy prices shall be taken from a source *approved* by the *code official*, such as the Department of Energy, 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 multipliers for all energy sources shall be obtained from ASHRAE Standard 105 (Tables K2, K4, or K8) or from another data source approved by the *code official*.
   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 for an all-electric building with on-site renewable energy installed.

Reason: The new language discriminates against installation of natural gas burning space heating and water heating by providing a larger increment of energy cost reduction than for electric space heating and water heating. Since natural gas is already a lower operating cost energy source, this additional stringency in annual operating cost for the standard reference design provides an additional burden for compliance of natural gas-served standard reference designs. No energy savings or emissions benefits are claimed or can be justified by the proposal since the bias toward a standard reference design in favor of electric space heating and water heating is likely to increase energy consumption over the full fuel cycle and increase operating cost from an energy choice in favor of electricity. Based upon most U. S. electricity grid primary energy sources, decision making created by the bias in favor of electric space heating and water heating is likely to increase carbon emissions.

Cost Impact: The code change proposal will decrease the cost of construction.
The proposed language will reduce costs of construction by levelizing requirements across end use energy forms.

Workgroup Recommendation

RED1-52-22

Proponents: Ted Williams, representing ONE Gas (ngdllc@outlook.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R405.2 Simulated performance compliance. Compliance based on total building performance requires that a *proposed design* meets all of the following:

1. The requirements of the sections indicated within Table R405.2.
2. The proposed total building thermal envelope UA, which is the sum of the 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 1.08 in Climate Zones 0, 1, and 2, and 1.15 in Climate Zones 3 through 8 in accordance with Equation 4-2. The area-weighted maximum fenestration SHGC permitted in Climate Zones 0 through 3 shall be 0.30.

(Equation 4-2)

$$\text{For Climate Zones 0-2: } UA_{\text{Proposed design}} \leq 1.08 \text{ x } UA_{\text{Prescriptive reference design}}$$
$$\text{For Climate Zones 3-8: } UA_{\text{Proposed design}} \leq 1.15\text{x } UA_{\text{Prescriptive reference design}}$$

3. For buildings without a fuel burning appliance for space heating or water heating, the annual energy cost of the proposed design that is less than or equal to 85 percent of the annual energy cost of the *standard reference design*. For buildings with a fuel burning appliance for space heating or water heating, the annual energy cost of the proposed design that is less than or equal to 80 percent of the annual energy cost of the standard reference design. For dwelling units with greater than 5,000 square feet (465 m^2) of living space floor area located above grade plane, the annual energy cost of the proposed design shall be reduced by an additional 5 percent of annual energy cost of the standard reference design. Energy prices shall be taken from a source *approved* by the *code official*, such as the Department of Energy, 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 multipliers for all energy sources shall be obtained from ASHRAE Standard 105 ~~(Tables K2, K4, or K8)~~ or from another data source approved by the *code official*.
   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 for an all-electric building with on-site renewable energy installed.

Reason: While the replacement of the outdated source energy multiplier for grid electricity with reference to multipliers from ASHRAE Standard 105 is an improvement for more granular source energy considerations, the specification of ASHRAE Standard 105 Tables K2, K4, and K8 is unjustified and removes from consideration other multipliers covered by the Standard (e.g., Table K6). All source energy coverage by ASHRAE Standard 105 is equally informative, useful, and benefiting by the ASHRAE Consensus Standards Process. As a result, a simple reference to ASHRAE Standard 105 is appropriate and retains code official flexibility to specify appropriate multipliers, both within the ASHRAE Standard 105 tables and from other sources.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
Reference to the entire ASHRAE 105 Standard will not increase costs of construction.

Workgroup Recommendation

Proposal # 1410

RED1-53-22

Proponents: Renee Lani, representing American Public Gas Association (rlani@apga.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R405.2 Simulated performance compliance. Compliance based on total building performance requires that a *proposed design* meets all of the following:

1. The requirements of the sections indicated within Table R405.2.
2. The proposed total building thermal envelope UA, which is the sum of the 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 1.08 in Climate Zones 0, 1, and 2, and 1.15 in Climate Zones 3 through 8 in accordance with Equation 4-2. The area-weighted maximum fenestration SHGC permitted in Climate Zones 0 through 3 shall be 0.30.

(Equation 4-2)

$$\text{For Climate Zones 0-2: } UA_{\text{Proposed design}} \leq 1.08 \text{ x } UA_{\text{Prescriptive reference design}}$$
$$\text{For Climate Zones 3-8: } UA_{\text{Proposed design}} \leq 1.15\text{x } UA_{\text{Prescriptive reference design}}$$

3. For buildings without a fuel burning appliance for space heating or water heating, the annual energy cost of the proposed design that is less than or equal to 85 percent of the annual energy cost of the *standard reference design*. For buildings with a fuel burning appliance for space heating or water heating, the annual energy cost of the proposed design that is less than or equal to 8~~0~~ 5 percent of the annual energy cost of the standard reference design. For dwelling units with greater than 5,000 square feet (465 m^2) of living space floor area located above grade plane, the annual energy cost of the proposed design shall be reduced by an additional 5 percent of annual energy cost of the standard reference design. Energy prices shall be taken from a source *approved* by the *code official*, such as the Department of Energy, 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 multipliers for all energy sources shall be obtained from ASHRAE Standard 105 (Tables K2, K4, or K8) or from another data source approved by the *code official*.
   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 for an all-electric building with on-site renewable energy installed.

Reason: Homes with fuel burning appliances should not be treated differently under the IECC than ones without. While APGA does not feel strongly whether it should be 80% or 85% in this provision, we do believe that all homes under the purview of the IECC should be treated similarly, no matter the energy source.

Cost Impact: The code change proposal will decrease the cost of construction.
This proposal will decrease the cost of construction as it places homes with fuel burning appliances at the same level of compliance as ones without (as opposed to a more stringent level).

Workgroup Recommendation

Proposal # 1491

RED1-54-22

Proponents: Glen Clapper, representing National Roofing Contractors Association (gclapper@nrca.net)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

TABLE R405.2 REQUIREMENTS FOR SIMULATED BUILDING PERFORMANCE

SECTION[a]	TITLE
General	
~~R401.2.5~~	~~Additional energy efficiency~~
R401.3	Certificate
Building Thermal Envelope	
R402.1.1	Vapor retarder
R402.2.3	Attic knee or pony wall
R402.2.4	Eave baffle
R402.2.5.1	Access hatches and doors
R402.2.9	Basement walls
R402.2.9.1	Basement wall insulation installation
R402.2.10.1	Slab-on-grade floor insulation installation
R402.2.11.1	Crawl space wall insulation installations
R402.5.1.1	Installation
R402.5.1.2	Testing
R402.5.2	Fireplaces
R402.5.3	Fenestration air leakage
R402.5.4	Room containing fuel burning applicances
R402.5.5	Recessed lighting
R402.5.6	Air-sealed electrical and communication outlet boxes
R402.6	Maximum fenestration *U*-factor and SHGC
Mechanical	
R403.1	Controls
R403.2	Hot water boiler temperature reset
R403.3	Duct systems
R403.4	Mechanical system piping insulation
R403.5 except Section R403.5.2 (staff note: this needs to be fixed with hot water pipe insulation)	Service hot water system
R403.5.2	Hot water pipe insulation
R403.6	Mechanical ventilation
R403.7, except Section R403.7.1	Equipment sizing and efficiency rating
R403.8	Systems serving multiple dwelling units
R403.9	Snow melt and ice system controls
R403.11	Energy consumption of pools and spas
R403.12	Portable spas
R403.13	Residential pools and permanent residential spas
Electrical Power and Lighting Systems	
R404.1	Lighting equipment
R404.2	Interior lighting controls
R404.5	Electric readiness
R404.6	Renewable energy infrastructure
R404.7	Electric Vehicle power transfer infrastructure

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

R408.1 Scope. This section establishes additional efficiency credits to achieve additional energy efficiency ~~in accordance with Section R401.2.5~~.

RE103.1 Application. Residential buildings shall be *all-electric buildings* and comply with ~~Section R401.2.5 and~~ either Sections R401.2.1, R401.2.2, R401.2.3 or R401.2.4.

Reason: Section R401.2.5 has been deleted in the current code change proposal draft and therefore is a ghost reference.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This code change proposal will neither increase nor decrease the cost of construction as it appears to be editorial.

Workgroup Recommendation

Proposal # 1422

RED1-55-22

Proponents: Ted Williams, representing ONE Gas (ngdllc@outlook.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

TABLE R405.2 REQUIREMENTS FOR SIMULATED BUILDING PERFORMANCE

SECTION[a]	TITLE
General	
R401.2.5	Additional energy efficiency
R401.3	Certificate
Building Thermal Envelope	
R402.1.1	Vapor retarder
R402.2.3	Attic knee or pony wall
R402.2.4	Eave baffle
R402.2.5.1	Access hatches and doors
R402.2.9	Basement walls
R402.2.9.1	Basement wall insulation installation
R402.2.10.1	Slab-on-grade floor insulation installation
R402.2.11.1	Crawl space wall insulation installations
R402.5.1.1	Installation
R402.5.1.2	Testing
R402.5.2	Fireplaces
R402.5.3	Fenestration air leakage
R402.5.4	Room containing fuel burning applicances
R402.5.5	Recessed lighting
R402.5.6	Air-sealed electrical and communication outlet boxes
R402.6	Maximum fenestration *U*-factor and SHGC
Mechanical	
R403.1	Controls
R403.2	Hot water boiler temperature reset
R403.3	Duct systems
R403.4	Mechanical system piping insulation
R403.5 except Section R403.5.2 (staff note: this needs to be fixed with hot water pipe insulation)	Service hot water system
R403.5.2	Hot water pipe insulation
R403.6	Mechanical ventilation
R403.7, except Section R403.7.1	Equipment sizing and efficiency rating
R403.8	Systems serving multiple dwelling units
R403.9	Snow melt and ice system controls
R403.11	Energy consumption of pools and spas
R403.12	Portable spas
R403.13	Residential pools and permanent residential spas
Electrical Power and Lighting Systems	
R404.1	Lighting equipment
R404.2	Interior lighting controls
~~R404.5~~	~~Electric readiness~~
~~R404.6~~	~~Renewable energy infrastructure~~
~~R404.7~~	~~Electric Vehicle power transfer infrastructure~~

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

Reason: The stricken measures do not implement specific energy efficiency measures but instead only prepare the building for uncertain future efficiency measures. As a result, their contribution to building energy efficiency, as designed, cannot be modeled with validity. Such measures would be more appropriately considered in existing building code coverage.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
Striking the three measures will not affect cost of construction.

Workgroup Recommendation

Proposal # 1411

RED1-56-22

Proponents: Gary Klein, representing Self (gary@garykleinassociates.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

TABLE R405.2 REQUIREMENTS FOR SIMULATED BUILDING PERFORMANCE

Portions of table not shown remain unchanged.

SECTION[a]	TITLE
Mechanical	
R403.1	Controls
R403.2	Hot water boiler temperature reset
R403.3	Duct systems
R403.4	Mechanical system piping insulation
R403.5 ~~except Section R403.5.2 (staff note: this needs to be fixed with hot water pipe insulation)~~	Service hot water system
~~R403.5.2~~	~~Hot water pipe insulation~~
R403.6	Mechanical ventilation
R403.7, except Section R403.7.1	Equipment sizing and efficiency rating
R403.8	Systems serving multiple dwelling units
R403.9	Snow melt and ice system controls
R403.11	Energy consumption of pools and spas
R403.12	Portable spas
R403.13	Residential pools and permanent residential spas

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

TABLE R406.2 REQUIREMENTS FOR ENERGY RATING INDEX

Portions of table not shown remain unchanged.

SECTION[a]	TITLE
General	
Mechanical	
R403.1	Controls
R403.2	Hot water boiler temperature reset
R403.3	Duct systems
R403.4	Mechanical system piping insulation
R403.5 ~~except Section R403.5.2 (staff note: this needs to be fixed with hot water pipe insulation)~~	Service hot water systems
~~R403.5.2~~	~~Hot water pipe insulation~~
R403.6	Mechanical ventilation
R403.7, except Section R403.7.1	Equipment sizing and efficiency rating
R403.8	Systems serving multiple dwelling units
R403.9	Snow melt and ice system controls
R403.11	Energy consumption of pools and spas
R403.12	Portable spas
R403.13	Residential pools and permanent residential spas
Electrical Power and Lighting Systems	
R404.1	Lighting equipment
R404.2	Interior lighting controls
R404.5	Electric readiness
R404.6	Renewable energy infrastructure
R404.7	Electric Vehicle power transfer infrastructure

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

Reason: Due to two REPI's affecting the same text in Table R405.2 and Table R406.2, staff noted a conflict that would need to be addressed via Public Comment. This Public Comment proposes to remove the dedicated row for HW pipe insulation and also remove the text "except Section R403.5.2 (staff note: this needs to be fixed with hot water pipe insulation)"
This would be consistent with the approved REPI which added the row for HW pipe insulation, such that the insulation requirement is met even when using a modeling pathway.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
Since this is clarifying a previously approved REPI, this public comment has no additional cost impact.

Bibliography: None.

Workgroup Recommendation

Proposal # 1053

RED1-57-22

Proponents: Vladimir Kochkin, representing NAHB (vkochkin@nahb.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

TABLE R405.2 REQUIREMENTS FOR SIMULATED BUILDING PERFORMANCE

Portions of table not shown remain unchanged.

SECTION[a]	TITLE
General	
~~R401.2.5~~	~~Additional energy efficiency~~
R401.3	Certificate

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

Reason: This is a coordination/errata item removing a pointer to a section that no longer exists.
The revised Section R401.2 delineates each of the four compliance options such that the additional measures of Section R408 apply only to the Prescriptive Compliance Option (R401.2.1). The revised Simulated Building Performance Option (R401.2.2) is a standalone path with the performance target set using a multiplier applied to the standard reference design (R405.2(3)).

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This is a coordination item/errata.

Workgroup Recommendation

Proposal # 992

RED1-58-22

Proponents: Robert Salcido, representing DOE (victor.salcido@pnnl.gov)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R405.4 Calculation procedure. Calculations of the <u>reference and </u>proposed design shall be in accordance with Sections R405.4.1 and R405.4.2.

Reason: Section R405.4 only mentions the proposed design procedures but the proceeding sections of R405.4.1 and R405.4.2 both list the proposed and reference designs for calculation procedures. This warrants that the reference home design be part of the language in Section R405.4.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
No Cost Impact

Workgroup Recommendation

Proposal # 1189

RED1-59-22

Proponents: Andrea Papageorge, representing Southern Company Gas (apapageo@southernco.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R405.4 Calculation procedure. Calculations of the ~~proposed~~ performance design shall be in accordance with Sections R405.4.1 and R405.4.2.

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 Table R402.1.2.	As proposed
	Solar absorptance = 0.75.	As proposed
	Emittance = 0.90.	As proposed
Basement and crawl space walls	Type: same as proposed.	As proposed
	Gross area: same as proposed.	As proposed
	U-factor: as specified in Table R402.1.2, with the insulation layer on the interior side of the walls.	As proposed
Above-grade floors	Type: wood frame.	As proposed
	Gross area: same as proposed.	As proposed
	U-factor: as specified in Table R402.1.2.	As proposed
Ceilings	Type: wood frame.	As proposed
	Gross area: same as proposed.	As proposed
	U-factor: as specified in Table R402.1.2.	As proposed
Roofs	Type: composition shingle on wood sheathing.	As proposed
	Gross area: same as proposed.	As proposed
	Solar absorptance = 0.75.	As proposed
	Emittance = 0.90.	As proposed
Attics	Type: vented with an aperture of 1 ft^2 per 300 ft^2 of ceiling area.	As proposed
Foundations	Type: same as proposed.	As proposed
	Foundation wall area above and below grade and soil characteristics: same as proposed.	As proposed
Opaque doors	Area: 40 ft^2.	As proposed
	Orientation: North.	As proposed
	U-factor: same as fenestration as specified in Table R402.1.2.	As proposed
Vertical fenestration other than opaque doors	Total area[h] = (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 Table R402.1.2.	As proposed
	SHGC: as specified in Table R402.1.2 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 × SHGC for the standard reference design).	Interior shade fraction: 0.92 – (0.21 × SHGC as proposed)
	External shading: none	As proposed
Skylights	None	As proposed
Thermally isolated sunrooms	None	As proposed
	The air leakage rate at a pressure of 0.2 inch w.g. (50 Pa) shall be Climate Zones 0 through 2: 5.0 air changes per hour. ~~Climate Zones 3 , 4, and 5: 3.0 air changes per hour. Climate Zones 6 through 8: 2.5 air changes per hour.~~ Cimate Zones 3 through 8: 3.0 air changes per hour.	The measured air exchange rate.[a]
	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 B x M 0.01 × CFA + 7.5 ×	

Air exchange rate	the same as in the proposed design, but not greater than ~~B × M~~ 0.01 × CFA + 7.5 × (Nbr + 1) where: ~~B = 0.01 × CFA + 7.5 × (Nbr + 1), cfm.~~ ~~M = 1.0 where the measured air exchange rate is > = 3.0 air changes per hour at 50 Pascals, and otherwise, M = minimum (1.7, Q/B)~~ Q = the proposed mechanical ventilation rate, cfm. CFA = conditioned floor area, ft2. Nbr = number of bedrooms. The mechanical ventilation system type shall be the same as in the proposed design. ~~Heat recovery or e~~ Energy recovery shall ~~be modeled for mechanical ventilation where required by Section R403.6.1. Heat recovery or energy recovery shall not be modeled for mechanical ventilation where not required by Section R403.6.1.~~ not be assumed for mechanical ventilation.	The mechanical ventilation rate[b] , ~~Q,~~ shall be in addition to the air leakage rate and shall be as proposed.
Mechanical ventilation	Where mechanical ventilation is not specified in the proposed design: None Where mechanical ventilation is specified in the proposed design, the annual vent fan energy use, in units of kWh/yr, shall equal ~~(8.76 × B × M)/ef~~ (1/ef) ×[0.0876 × CFA + 65.7 × (Nbr + 1)] where: ~~B and M are determined in accordance with the Air Exchange Rate row of this table.~~ e_f = the minimum fan efficacy, as specified in Table 403.6.2, corresponding to the system type at a flow rate of ~~B × M~~ (0.01 × CFA + 7.5 × (Nbr+1)). *CFA* = conditioned floor area, ft^2. N_{br} = number of bedrooms.	As proposed
Internal gains	IGain, in units of Btu/day per dwelling unit, shall equal 17,900 + 23.8 ×*CFA* + 4,104 × N_{br} where: *CFA* = conditioned floor area, ft^2. N_{br} = number of bedrooms.	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[c] but not integral to the building 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 Table R402.1.3, 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[d, e, j, k]	For other than electric heating without a heat pump: as proposed. 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 Section R403.7.	
	~~Fuel Type/Capacity: Same as proposed design~~	~~As proposed~~
	~~Product class: Same as proposed design~~	~~As proposed~~
	~~Efficiencies:~~	~~As proposed~~
	~~Heat pump: Complying with 10 CFR §430.32~~	~~As proposed~~
	~~Non-electric furnaces: Complying with 10 CFR §430.32~~	~~As proposed~~
	~~Non-electric boilers: Complying with 10 CFR §430.32~~	~~As proposed~~
Cooling systems[d, f, k]	As proposed. Capacity: sized in accordance with Section R403.7.	As proposed
	~~Fuel Type: Electric~~ ~~Capacity: Same as proposed design~~	~~As proposed~~
	~~Efficiencies: Complying with 10 CFR §430.32~~	~~As proposed~~
		As proposed

<table>
<tr>
<td rowspan="6">Service water heating[d, g, k]</td>
<td>As proposed.
Use, in units of gal/day = 25.5 + (8.5 × N_{br})
where: N_{br} = number of bedrooms.</td>
<td>As proposed
Use, in units of gal/day = 25.5 + (8.5 × N_{br}) × (1 – $HWDS$)
where:
N_{br} = number of bedrooms.
$HWDS$ = factor for the compactness of the hot water distribution system.
<table>
<tr><th colspan="2">Compactness ratio[i] factor</th><th>HWDS</th></tr>
<tr><td>1 story</td><td>2 or more stories</td><td></td></tr>
<tr><td>> 60%</td><td>> 30%</td><td>0</td></tr>
<tr><td>> 30% to ≤ 60%</td><td>> 15% to ≤ 30%</td><td>0.05</td></tr>
<tr><td>> 15% to ≤ 30%</td><td>> 7.5% to ≤ 15%</td><td>0.10</td></tr>
<tr><td>< 15%</td><td>< 7.5%</td><td>0.15</td></tr>
</table></td>
</tr>
<tr><td>~~Fuel Type: Same as proposed design~~</td><td>~~As proposed~~</td></tr>
<tr><td>~~Rated Storage Volume: Same as proposed design~~</td><td>~~As proposed~~</td></tr>
<tr><td>~~Draw Pattern: Same as proposed design~~</td><td>~~As proposed~~</td></tr>
<tr><td>~~Efficiencies: Uniform Energy Factor complying with 10 CFR §430.32~~</td><td>~~As proposed~~</td></tr>
<tr><td>~~Tank Temperature: 120° F (48.9° C)~~</td><td>~~Same as standard reference design~~</td></tr>
<tr>
<td rowspan="3">Thermal distribution systems</td>
<td>Duct location: same as proposed design
<table>
<tr><td>~~Foundation Type~~</td><td>~~Slab on grade~~</td><td>~~Unconditioned crawl space~~</td><td>~~Basement or conditioned crawl space~~</td></tr>
<tr><td>~~Duct location (supply and return)~~</td><td>~~One-story building: 100% in unconditioned attic~~

~~All other: 75% in unconditioned attic and 25% inside conditioned space~~</td><td>~~One-story building: 100% in unconditioned crawlspace~~

~~All other: 75% in unconditioned crawlspace and 25% inside conditioned space~~</td><td>~~50% inside conditioned space~~

~~50% unconditioned attic~~</td></tr>
</table></td>
<td>Duct location: as proposed.</td>
</tr>
<tr>
<td>Duct insulation: in accordance with Section R403.3.1.

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.

Duct location: same as proposed design.

Exception: 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 ft2 (9.29 m2) of conditioned floor area at a pressure of differential of 0.1 inch w.g. (25 Pa).</td>
<td>Duct insulation: as proposed.

As tested or, where not tested, as specified in

Table R405.4.2(2).</td>
</tr>
<tr>
<td>Duct system leakage to outside:
For duct systems serving > 1,000ft2 of conditioned floor area, the duct leakage to outside rate shall be 4 cfm (113.3 L/min) per 100 ft2 (9.29 m2) of conditioned floor area.
For duct systems serving ≤ 1,000ft2 of conditioned floor area, the duct leakage to outside rate shall be 40 cfm (1132.7 L/min).</td>
<td>Duct System Leakage to Outside: The measure total duct system leakage rate shall be entered into the software as the duct system leakage to outside rate.
~~**Exceptions:**~~
<table>
<tr><td>1.</td><td>~~When duct system leakage to outside is tested in accordance ANSI/ RESNET/ICC 380 or ASTM E1554, the measured value shall be permitted to be entered.~~</td></tr>
<tr><td>2.</td><td>~~When total duct system leakage is measured without the air handler installed, the simulation value shall be~~</td></tr>
</table></td>
</tr>
</table>

		~~4 cfm (113.3 L/min) per 100 ft² (9.29 m²) of conditioned floor area.~~
	~~For hydronic systems and ductless systems a~~ A thermal distribution system efficiency (DSE) of 0.88 shall be applied to both the heating and cooling system efficiencies f or all systems other than tested ducted systems.	~~For hydronic systems and ductless systems, DSE shall be as~~ As tested or where not tested, specified in Table R405.4.2(2).
Thermostat	Type: Manual, cooling temperature setpoint = 75°F; Heating temperature setpoint = 72°F.	Same as standard reference design.
Dehumidistat	Where a mechanical ventilation system with latent heat recovery is not specified in the proposed design: None. Where the proposed design utilizes a mechanical ventilation system with latent heat recovery: Dehumidistat type: manual, setpoint = 60% relative humidity. Dehumidifier: whole-dwelling with integrated energy factor = 1.77 liters/kWh.	Same as standard reference design.

For SI: 1 square foot = 0.93 m^2, 1 British thermal unit = 1055 J, 1 pound per square foot = 4.88 kg/m^2, 1 gallon (US) = 3.785 L, °C = (°F-32)/1.8, 1 degree = 0.79 rad.

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.

g. For a proposed 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 ~~the following assumptions shall be made~~ for both the proposed design and standard reference design.

   ~~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 §130.32~~

h. For residences with conditioned basements, R-2 and R-4 residences, and for townhouse units, 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.

i. 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 Table R405.4.2(1), the standard reference design shall be the same as proposed design.~~

TABLE R405.4.2(2) DEFAULT DISTRIBUTION SYSTEM EFFICIENCIES FOR PROPOSED DESIGNS[a]

DISTRIBUTION SYSTEM CONFIGURATION AND CONDITION	FORCED AIR SYSTEMS	HYDRONIC SYSTEMS[b]
Distribution system components located in unconditioned space	~~NA~~	0.95
~~Distribution system components~~ entirely located in conditioned space[c]	0.88 ~~NA~~	1
“Ductless” systems[d]	1	~~NA~~

a. Default values in this table are for untested distribution systems, which must still meet minimum requirements for duct system insulation.

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 allowed to have forced airflow across a coil but shall not have any ducted airflow external to the manufacturer’s air-handler enclosure.

Reason: Revert to the 2021 language.
The proposed changes would result in an unfair and unsubstantiated burden on homes using natural gas appliances. Using natural gas heating/water would be required to be 20% more efficient; electric would be required to be 15% more efficient. There is no sound logic or reasoning for this higher burden on homes with natural gas appliances. In addition, there is no demonstrated and guaranteed energy savings.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
It simply reinstates the 2021 language.

Workgroup Recommendation

Proposal # 1402

RED1-60-22

Proponents: Amy Boyce, representing Energy Efficient Codes Coalition (EECC) (amy.boyce@imt.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

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 Table R402.1.2.	As proposed
	Solar absorptance = 0.75.	As proposed
	Emittance = 0.90.	As proposed
Basement and crawl space walls	Type: same as proposed.	As proposed
	Gross area: same as proposed.	As proposed
	U-factor: as specified in Table R402.1.2, with the insulation layer on the interior side of the walls.	As proposed
Above-grade floors	Type: wood frame.	As proposed
	Gross area: same as proposed.	As proposed
	U-factor: as specified in Table R402.1.2.	As proposed
Ceilings	Type: wood frame.	As proposed
	Gross area: same as proposed.	As proposed
	U-factor: as specified in Table R402.1.2.	As proposed
Roofs	Type: composition shingle on wood sheathing.	As proposed
	Gross area: same as proposed.	As proposed
	Solar absorptance = 0.75.	As proposed
	Emittance = 0.90.	As proposed
Attics	Type: vented with an aperture of 1 ft^2 per 300 ft^2 of ceiling area.	As proposed
Foundations	Type: same as proposed.	As proposed
	Foundation wall area above and below grade and soil characteristics: same as proposed.	As proposed
Opaque doors	Area: 40 ft^2.	As proposed
	Orientation: North.	As proposed
	U-factor: same as fenestration as specified in Table R402.1.2.	As proposed
Vertical fenestration other than opaque doors	Total area[h] = (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 Table R402.1.2.	As proposed
	SHGC: as specified in Table R402.1.2 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 × SHGC for the standard reference design).	Interior shade fraction: 0.92 – (0.21 × SHGC as proposed)
	External shading: none	As proposed
Skylights	None	As proposed
Thermally isolated sunrooms	None	As proposed
	The air leakage rate at a pressure of 0.2 inch w.g. (50 Pa) shall be Climate Zones 0 through 2: 5.0 air changes per hour. Climate Zones 3 , 4, and 5: 3.0 air changes per hour. Climate Zones 6 through 8: 2.5 air changes per hour.	The measured air exchange rate.[a]
	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 B x M where:	

Air exchange rate	where: B = 0.01 × CFA + 7.5 × (Nbr + 1), cfm. M = 1.0 where the measured air exchange rate is > = 3.0 air changes per hour at 50 Pascals, and otherwise, M = minimum (1.7, Q/B) Q = the proposed mechanical ventilation rate, cfm. CFA = conditioned floor area, ft2. Nbr = number of bedrooms. 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 Section R403.6.1. Heat recovery or energy recovery shall not be modeled for mechanical ventilation where not required by Section R403.6.1.	The mechanical ventilation rate[b], Q, shall be in addition to the air leakage rate and shall be as proposed.
Mechanical ventilation	Where mechanical ventilation is not specified in the proposed design: None Where mechanical ventilation is specified in the proposed design, the annual vent fan energy use, in units of kWh/yr, shall equal (8.76 × B × M)/ef where: B and M are determined in accordance with the Air Exchange Rate row of this table. e_f = the minimum fan efficacy, as specified in Table 403.6.2, corresponding to the system type at a flow rate of B × M. *CFA* = conditioned floor area, ft^2. N_{br} = number of bedrooms.	As proposed
Internal gains	IGain, in units of Btu/day per dwelling unit, shall equal 17,900 + 23.8 ×*CFA* + 4,104 × N_{br} where: *CFA* = conditioned floor area, ft^2. N_{br} = number of bedrooms.	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[c] but not integral to the building 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 Table R402.1.3, 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[d, e, j, k]	For other than electric heating without a heat pump: as proposed. 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 Section R403.7.	
	Fuel Type/Capacity: Same as proposed design	As proposed
	Product class: Same as proposed design	As proposed
	Efficiencies:	As proposed
	Heat pump: Complying with 10 CFR §430.32	As proposed
	Non-electric furnaces: Complying with 10 CFR §430.32	As proposed
	Non-electric boilers: Complying with 10 CFR §430.32	As proposed
Cooling systems[d, f, k]	As proposed. Capacity: sized in accordance with Section R403.7.	
	Fuel Type: Electric Capacity: Same as proposed design	As proposed
	Efficiencies: Complying with 10 CFR §430.32	As proposed
		As proposed Use, in units of gal/day = 25.5 + (8.5 × N_{br}) × (1 – *HWDS*) where:

<table>
<tr>
<td rowspan="6">Service water heating[d, g, k]</td>
<td>As proposed.
Use, in units of gal/day = 25.5 + (8.5 × N_{br})
where: N_{br} = number of bedrooms.</td>
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N_{br} = number of bedrooms.
HWDS = factor for the compactness of the hot water distribution system.
<table>
<tr><th colspan="2">Compactness ratio[i] factor</th><th>HWDS</th></tr>
<tr><td>1 story</td><td>2 or more stories</td><td></td></tr>
<tr><td>> 60%</td><td>> 30%</td><td>0</td></tr>
<tr><td>> 30% to ≤ 60%</td><td>> 15% to ≤ 30%</td><td>0.05</td></tr>
<tr><td>> 15% to ≤ 30%</td><td>> 7.5% to ≤ 15%</td><td>0.10</td></tr>
<tr><td>< 15%</td><td>< 7.5%</td><td>0.15</td></tr>
</table>
</td>
</tr>
<tr><td>Fuel Type: Same as proposed design</td><td>As proposed</td></tr>
<tr><td>Rated Storage Volume: Same as proposed design</td><td>As proposed</td></tr>
<tr><td>Draw Pattern: Same as proposed design</td><td>As proposed</td></tr>
<tr><td>Efficiencies: Uniform Energy Factor complying with 10 CFR §430.32</td><td>As proposed</td></tr>
<tr><td>Tank Temperature: 120° F (48.9° C)</td><td>Same as standard reference design</td></tr>
<tr>
<td rowspan="4">Thermal distribution systems</td>
<td>Duct location: 100% inside conditioned space.
<table>
<tr><td>~~Foundation Type~~</td><td>~~Slab on grade~~</td><td>~~Unconditioned crawl space~~</td><td>~~Basement or conditioned crawl space~~</td></tr>
<tr><td>~~Duct location (supply and return)~~</td><td>~~One-story building: 100% in unconditioned attic~~

~~All other: 75% in unconditioned attic and 25% inside conditioned space~~</td><td>~~One-story building: 100% in unconditioned crawlspace~~

~~All other: 75% in unconditioned crawlspace and 25% inside conditioned space~~</td><td>~~50% inside conditioned space~~

~~50% unconditioned attic~~</td></tr>
</table>
</td>
<td>Duct location: as proposed.</td>
</tr>
<tr><td>Duct insulation: in accordance with Section R403.3.1.</td><td>Duct insulation: as proposed.</td></tr>
<tr>
<td>Duct system leakage to outside:
For duct systems serving > 1,000ft2 of conditioned floor area, the duct leakage to outside rate shall be 4 cfm (113.3 L/min) per 100 ft2 (9.29 m2) of conditioned floor area.
For duct systems serving ≤ 1,000ft2 of conditioned floor area, the duct leakage to outside rate shall be 40 cfm (1132.7 L/min).</td>
<td>Duct System Leakage to Outside: The measure total duct system leakage rate shall be entered into the software as the duct system leakage to outside rate.
Exceptions:
<table>
<tr><td>1.</td><td>When duct system leakage to outside is tested in accordance ANSI/ RESNET/ICC 380 or ASTM E1554, the measured value shall be permitted to be entered.</td></tr>
<tr><td>2.</td><td>When total duct system leakage is measured without the air handler installed, the simulation value shall be 4 cfm (113.3 L/min) per 100 ft^2 (9.29 m^2) of conditioned floor area.</td></tr>
</table>
</td>
</tr>
<tr><td>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.</td><td>For hydronic systems and ductless systems, DSE shall be as specified in Table R405.4.2(2).</td></tr>
<tr><td>Thermostat</td><td>Type: Manual, cooling temperature setpoint = 75°F;
Heating temperature setpoint = 72°F.</td><td>Same as standard reference design.</td></tr>
<tr><td>Dehumidistat</td><td>Where a mechanical ventilation system with latent heat recovery is not specified in the proposed design: None. Where the proposed design utilizes a mechanical ventilation system with latent heat recovery:
Dehumidistat type: manual, setpoint = 60% relative humidity.
Dehumidifier: whole-dwelling with integrated energy factor = 1.77 liters/kWh.</td><td>Same as standard reference design.</td></tr>
</table>

For SI: 1 square foot = 0.93 m^2, 1 British thermal unit = 1055 J, 1 pound per square foot = 4.88 kg/m^2, 1 gallon (US) = 3.785 L, °C = (°F-32)/1.8, 1 degree = 0.79 rad.

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.

g. For a proposed design the following assumptions shall be made for both the proposed design and standard reference design.

   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 §130.32

h. For residences with conditioned basements, R-2 and R-4 residences, and for townhouse units, 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.

i. 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 Table R405.4.2(1), the standard reference design shall be the same as proposed design.

TABLE R408.2 CREDITS FOR ADDITIONAL ENERGY EFFICIENCY

Portions of table not shown remain unchanged.

Measure Number	Measure Description	Credit Value								
		Climate Zone 0 & 1	Climate Zone 2	Climate Zone 3	Climate Zone 4	Climate Zone 4C	Climate Zone 5	Climate Zone 6	Climate Zone 7	Climate Zone 8
R408.2.1.1(1)	≥2.5% Reduction in total UA	0	0	0	1	1	1	1	1	1
R408.2.1.1(2)	≥5% reduction in total UA	0	1	1	2	2	3	3	3	3
R408.2.1.1(3)	>7.5% reduction in total UA	0	1	2	2	2	3	3	4	4
R408.2.1.2(1)	0.22 U-factor windows	1	2	2	3	3	4	4	4	5
R408.2.1.2(2)	U-factor and SHGC for windows per Table R408.2.1	1	1	1	0	0	0	0	1	2
R408.2.1.3	Cool Roof	TBD	TBD	TBD	TBD	TBD	0	0	0	0
R408.2.2(1)	High performance cooling system option 1	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(2)	High performance cooling system option 2	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(3)	High performance gas furnace option 1	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(4)	High performance gas furnace option 2	0	0	0	0	0	TBD	TBD	TBD	0
R408.2.2(5)	High performance gas furnace and cooling system option 2	TBD	TBD	TBD	TBD	TBD	0	0	0	TBD
R408.2.2(6)	High performance gas furnace and heat pump system option 1	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(7)	High performance gas furnace option 2	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(8)	High performance heat pump system option 1	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(9)	High performance heat pump system option 2	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(10)	High performance heat pump system option 3	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(11)	Ground source heat pump	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(12)	Ductless - Single zone	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(13)	Ductless - Multizone (Non-ducted indoor unit)	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(14)	Ductless – Multizone (Ducted or Mixed)	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.3(1)	Gas-fired storage water heaters	7	6	5	3	3	2	2	3	1
R408.2.3(2)	Gas-fired instantaneous water heaters	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.3(3)	Electric water heaters	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.3(4)	Electric water heaters	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.3(5)	Solar hot water heating system	4	5	6	6	6	6	5	5	4
R408.2.3(6)	Compact hot water distribution	2	2	2	2	2	2	2	2	2
R408.2.4(1)	More efficient distribution system	4	6	7	10	10	12	13	15	16
R408.2.4(2)	100% of ducts in conditioned space	~~4~~ TBD	~~6~~ TBD	~~8~~ TBD	~~12~~ TBD	~~12~~ TBD	~~15~~ TBD	~~17~~ TBD	~~19~~ TBD	~~20~~ TBD
R408.2.4(3)	Reduced total duct leakage	1	1	1	1	1	1	2	2	2
R408.2.5(1)	2 ACH50 air leakage rate with ERV or HRV installed	1	4	5	10	10	13	15	8	8
[illegible]	2 ACH50 air leakage rate with	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

R408.2.5(2)	balanced ventilation	2	3	2	4	4	5	6	6	6
R408.2.5(3)	1.5 ACH50 air leakage rated with ERV or HRV installed	2	4	6	12	12	15	18	11	11
R408.2.5(4)	1 ACH50 air leakage rate with ERV or HRV installed	2	5	6	14	14	17	21	14	14
R408.2.6	Energy efficient appliances	9	8	8	7	7	5	5	5	4
R408.2.7	Renewable energy measures	17	16	17	11	11	9	8	7	4
R408.2.9	Demand responsive thermostat	1	1	1	1	1	1	1	1	1

Reason: This proposal improves the IECC by encouraging builders and design professionals to keep most or all of duct systems inside conditioned space. Although we would support maintaining the 2021 IECC's agnostic approach to duct location, we could support including duct location in the standard reference design baseline if the baseline assumes all ducts and air handling equipment (or at least a significant percentage of them) are located inside conditioned space. It has long been recognized that keeping ducts inside is one of the most effective means of reducing building energy use and maintaining occupant comfort. And it is clear from recent DOE Residential Field Studies that a significant percentage of builders already construct homes with some or all ducts inside conditioned space. For example, the DOE Field Studies of Pennsylvania found that, on average, over 73% of supply and return ducts are already inside conditioned space. (See https://www.energycodes.gov/sites/default/files/2022-11/Combined_Residential_Energy_Code_Field_Study_Report_Final%20v3.pdf) Yet the Public Comment Draft of the 2024 IECC sets the standard reference design at 50% inside conditioned space – creating instant trade-off credit that will be used to reduce efficiency (and likely not changing building practice at all.) This public comment would not mandate the location of ducts inside, but builders who select this compliance path would need to make up for any energy losses due to locating ducts outside conditioned space.

Cost Impact: The code change proposal will increase the cost of construction.
This proposal would increase the cost of construction as compared to the 2021 IECC. For homes with ducts inside conditioned space already, this proposal will not have any impact on cost. For builders who intend to locate some portion of the duct system outside conditioned space, and who select the performance path as the compliance option, construction costs could increase somewhat, depending on how much of the system is located outside conditioned space and what other measures are undertaken to compensate for the efficiency losses. Builders may still select the prescriptive or Total UA compliance options, neither of which would be impacted by duct location.

Workgroup Recommendation

Proposal # 1315

RED1-61-22

Proponents: Robert Salcido, representing DOE (victor.salcido@pnnl.gov)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

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 Table R402.1.2.	As proposed
	Solar absorptance = 0.75.	As proposed
	Emittance = 0.90.	As proposed
Basement and crawl space walls	Type: same as proposed.	As proposed
	Gross area: same as proposed.	As proposed
	U-factor: as specified in Table R402.1.2, with the insulation layer on the interior side of the walls.	As proposed
Above-grade floors	Type: wood frame.	As proposed
	Gross area: same as proposed.	As proposed
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Ceilings	Type: wood frame.	As proposed
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Roofs	Type: composition shingle on wood sheathing.	As proposed
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	Solar absorptance = 0.75.	As proposed
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Attics	Type: vented with an aperture of 1 ft^2 per 300 ft^2 of ceiling area.	As proposed
Foundations	Type: same as proposed.	As proposed
	Foundation wall area above and below grade and soil characteristics: same as proposed.	As proposed
Opaque doors	Area: 40 ft^2.	As proposed
	Orientation: North.	As proposed
	U-factor: same as fenestration as specified in Table R402.1.2.	As proposed
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	External shading: none	As proposed
Skylights	None	As proposed
Thermally isolated sunrooms	None	As proposed
	The air leakage rate at a pressure of 0.2 inch w.g. (50 Pa) shall be Climate Zones 0 through 2: 5.0 air changes per hour. Climate Zones 3 , 4, and 5: 3.0 air changes per hour. Climate Zones 6 through 8: 2.5 air changes per hour.	The measured air exchange rate.[a]
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$HWDS$ = factor for the compactness of the hot water distribution system.<table><tr><th colspan="2">Compactness ratio[i] factor</th><th>HWDS</th></tr><tr><td>1 story</td><td>2 or more stories</td><td></td></tr><tr><td>> 60%</td><td>> 30%</td><td>0</td></tr><tr><td>> 30% to ≤ 60%</td><td>> 15% to ≤ 30%</td><td>0.05</td></tr><tr><td>> 15% to ≤ 30%</td><td>> 7.5% to ≤ 15%</td><td>0.10</td></tr><tr><td>< 15%</td><td>< 7.5%</td><td>0.15</td></tr></table></td></tr>
<tr><td>Fuel Type: Same as proposed design</td><td>As proposed</td></tr>
<tr><td>Rated Storage Volume: Same as proposed design</td><td>As proposed</td></tr>
<tr><td>Draw Pattern: Same as proposed design</td><td>As proposed</td></tr>
<tr><td>Efficiencies: Uniform Energy Factor complying with 10 CFR §430.32</td><td>As proposed</td></tr>
<tr><td>Tank Temperature: 120° F (48.9° C)</td><td>Same as standard reference design</td></tr>
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All other: 75% in unconditioned attic and 25% inside conditioned space</td><td>One-story building: 100% in unconditioned crawlspace

All other: 75% in unconditioned crawlspace and 25% inside conditioned space</td><td>50% inside conditioned space

50% unconditioned attic</td></tr></table></td><td>Duct location: as proposed.</td></tr>
<tr><td>Duct insulation: in accordance with Section R403.3.1.</td><td>Duct insulation: as proposed.</td></tr>
<tr><td>Duct system leakage to outside:
For duct systems serving > 1,000ft2 of conditioned floor area, the duct leakage to outside rate shall be 4 cfm (113.3 L/min) per 100 ft2 (9.29 m2) of conditioned floor area.
For duct systems serving ≤ 1,000ft2 of conditioned floor area, the duct leakage to outside rate shall be 40 cfm (1132.7 L/min).</td><td>Duct System Leakage to Outside: The measure total duct system leakage rate shall be entered into the software as the duct system leakage to outside rate.
Exceptions:<table><tr><td>1.</td><td>When duct system leakage to outside is tested in accordance ANSI/ RESNET/ICC 380 or ASTM E1554, the measured value shall be permitted to be entered.</td></tr><tr><td>2.</td><td>When total duct system leakage is measured without the air handler installed, the simulation value shall be 4 cfm (113.3 L/min) per 100 ft^2 (9.29 m^2) of conditioned floor area.</td></tr></table></td></tr>
<tr><td>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.</td><td>For hydronic systems and ductless systems, DSE shall be as specified in Table R405.4.2(2).</td></tr>
<tr><td>Thermostat</td><td>Type: Manual, cooling temperature setpoint = 75°F;
Heating temperature setpoint = 72°F.</td><td>Same as standard reference design.</td></tr>
<tr><td>Dehumidistat</td><td>Where a mechanical ventilation system with latent heat recovery is not specified in the proposed design: None. Where the proposed design utilizes a mechanical ventilation system with latent heat recovery:
Dehumidistat type: manual, setpoint = 60% relative humidity.
Dehumidifier: whole-dwelling with integrated energy factor = 1.77 liters/kWh.</td><td>Same as standard reference design.</td></tr>
</table>

For SI: 1 square foot = 0.93 m^2, 1 British thermal unit = 1055 J, 1 pound per square foot = 4.88 kg/m^2, 1 gallon (US) = 3.785 L, °C = (°F-32)/1.8, 1 degree = 0.79 rad.

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.

g. For a proposed design with a nonstorage-type water heater, the following assumptions shall be made for both the proposed design and standard reference design.

   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 §130.32

h. For residences with conditioned basements, R-2 and R-4 residences, and for townhouse units, 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.

i. 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 Table R405.4.2(1), the standard reference design shall be the same as proposed design.

Reason: Footnote (g) for Table R405.4.2(1) is in conflict with the water heating section. Too much language was removed from the original footnote so this needs to be fixed. Suggestion to keep the language to identify that when the proposed design has a non-storage water heater, then the assumed language is valid. If this fix is not placed, then ALL proposed design and reference design water heaters would require the design specifications above.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
No Cost Impact

Workgroup Recommendation

Proposal # 1190

RED1-62-22

Proponents: Greg Johnson, representing National Multifamily Housing Council (gjohnsonconsulting@gmail.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

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

Portions of table not shown remain unchanged.

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Heating systems[d, e, j, k]	For other than electric heating without a heat pump: as proposed. 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 Section R403.7.	
	Fuel Type/Capacity: Same as proposed design	As proposed
	Product class: Same as proposed design	As proposed
	Efficiencies:	As proposed
	Heat pump: Complying with 10 CFR §430.32	As proposed
	Non-electric furnaces: Complying with 10 CFR §430.32	As proposed
	Non-electric boilers: Complying with 10 CFR §430.32	As proposed

For SI: 1 square foot = 0.93 m^2, 1 British thermal unit = 1055 J, 1 pound per square foot = 4.88 kg/m^2, 1 gallon (US) = 3.785 L, °C = (°F-32)/1.8, 1 degree = 0.79 rad.

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.

g. For a proposed design the following assumptions shall be made for both the proposed design and standard reference design.

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 §130.32

h. For residences with conditioned basements, R-2 and R-4 residences, and for townhouse units, 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.

i. 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 Table R405.4.2(1), the standard reference design shall be the same as proposed design.

Reason: The provisions of the IECC-residential need to be self-contained because of commitments to industry and because the IECC-commercial may not be adopted in the jurisdiction that is administering the IECC-R. Section R101.5 is clear that residential buildings must comply with IECC—Residential provisions.
I'll leave it to the technical experts as to how exactly the stricken reference can be inserted as requirements into the table.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This about code formatting, there should be no $ impact.

Workgroup Recommendation

RED1-63-22

Proponents: Ted Williams, representing ONE Gas (ngdllc@outlook.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

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 Table R402.1.2.	As proposed
	Solar absorptance = 0.75.	As proposed
	Emittance = 0.90.	As proposed
Basement and crawl space walls	Type: same as proposed.	As proposed
	Gross area: same as proposed.	As proposed
	U-factor: as specified in Table R402.1.2, with the insulation layer on the interior side of the walls.	As proposed
Above-grade floors	Type: wood frame.	As proposed
	Gross area: same as proposed.	As proposed
	U-factor: as specified in Table R402.1.2.	As proposed
Ceilings	Type: wood frame.	As proposed
	Gross area: same as proposed.	As proposed
	U-factor: as specified in Table R402.1.2.	As proposed
Roofs	Type: composition shingle on wood sheathing.	As proposed
	Gross area: same as proposed.	As proposed
	Solar absorptance = 0.75.	As proposed
	Emittance = 0.90.	As proposed
Attics	Type: vented with an aperture of 1 ft^2 per 300 ft^2 of ceiling area.	As proposed
Foundations	Type: same as proposed.	As proposed
	Foundation wall area above and below grade and soil characteristics: same as proposed.	As proposed
Opaque doors	Area: 40 ft^2.	As proposed
	Orientation: North.	As proposed
	U-factor: same as fenestration as specified in Table R402.1.2.	As proposed
Vertical fenestration other than opaque doors	Total area[h] = (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 Table R402.1.2.	As proposed
	SHGC: as specified in Table R402.1.2 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 × SHGC for the standard reference design).	Interior shade fraction: 0.92 – (0.21 × SHGC as proposed)
	External shading: none	As proposed
Skylights	None	As proposed
Thermally isolated sunrooms	None	As proposed
	The air leakage rate at a pressure of 0.2 inch w.g. (50 Pa) shall be Climate Zones 0 through 2: 5.0 air changes per hour. Climate Zones 3 , 4, and 5: 3.0 air changes per hour. Climate Zones 6 through 8: 2.5 air changes per hour.	The measured air exchange rate.[a]
	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 B x M where:	

Air exchange rate	where: B = 0.01 × CFA + 7.5 × (Nbr + 1), cfm. M = 1.0 where the measured air exchange rate is > = 3.0 air changes per hour at 50 Pascals, and otherwise, M = minimum (1.7, Q/B) Q = the proposed mechanical ventilation rate, cfm. CFA = conditioned floor area, ft2. Nbr = number of bedrooms. 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 Section R403.6.1. Heat recovery or energy recovery shall not be modeled for mechanical ventilation where not required by Section R403.6.1.	The mechanical ventilation rate[b], Q, shall be in addition to the air leakage rate and shall be as proposed.
Mechanical ventilation	Where mechanical ventilation is not specified in the proposed design: None Where mechanical ventilation is specified in the proposed design, the annual vent fan energy use, in units of kWh/yr, shall equal (8.76 × B × M)/ef where: B and M are determined in accordance with the Air Exchange Rate row of this table. e_f = the minimum fan efficacy, as specified in Table 403.6.2, corresponding to the system type at a flow rate of B × M. *CFA* = conditioned floor area, ft^2. N_{br} = number of bedrooms.	As proposed
Internal gains	IGain, in units of Btu/day per dwelling unit, shall equal 17,900 + 23.8 ×*CFA* + 4,104 × N_{br} where: *CFA* = conditioned floor area, ft^2. N_{br} = number of bedrooms.	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[c] but not integral to the building 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 Table R402.1.3, 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[d, e, ~~j, k~~]	For other than electric heating without a heat pump: as proposed. 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 Section R403.7.	
	Fuel Type/Capacity: Same as proposed design	As proposed
	~~Product class: Same as proposed design~~	~~As proposed~~
	Efficiencies:	~~As proposed~~
	Heat pump: Complying with 10 CFR §430.32	As proposed
	Non-electric furnaces: Complying with 10 CFR §430.32	As proposed
	Non-electric boilers: Complying with 10 CFR §430.32	As proposed
Cooling systems[d, f, k]	As proposed. Capacity: sized in accordance with Section R403.7.	
	Fuel Type: Electric Capacity: Same as proposed design	As proposed
	Efficiencies: Complying with 10 CFR §430.32	As proposed
		As proposed Use, in units of gal/day = 25.5 + (8.5 × N_{br}) × (1 − *HWDS*)

<table>
<tr>
<td rowspan="6">Service water heating[d, g, k]</td>
<td>As proposed.
Use, in units of gal/day = 25.5 + (8.5 × N_{br})
where: N_{br} = number of bedrooms.</td>
<td>(1 − HWDS)
where:
N_{br} = number of bedrooms.
HWDS = factor for the compactness of the hot water distribution system.
<table>
<tr><th colspan="2">Compactness ratio[i] factor</th><th>HWDS</th></tr>
<tr><td>1 story</td><td>2 or more stories</td><td></td></tr>
<tr><td>> 60%</td><td>> 30%</td><td>0</td></tr>
<tr><td>> 30% to ≤ 60%</td><td>> 15% to ≤ 30%</td><td>0.05</td></tr>
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<tr><td>< 15%</td><td>< 7.5%</td><td>0.15</td></tr>
</table>
</td>
</tr>
<tr><td>Fuel Type: Same as proposed design</td><td>As proposed</td></tr>
<tr><td>Rated Storage Volume: Same as proposed design</td><td>As proposed</td></tr>
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<tr><td>Efficiencies: Uniform Energy Factor complying with 10 CFR §430.32</td><td>As proposed</td></tr>
<tr><td>Tank Temperature: 120° F (48.9° C)</td><td>Same as standard reference design</td></tr>
<tr>
<td rowspan="4">Thermal distribution systems</td>
<td>Duct location:
<table>
<tr><td>Foundation Type</td><td>Slab on grade</td><td>Unconditioned crawl space</td><td>Basement or conditioned crawl space</td></tr>
<tr><td>Duct location (supply and return)</td><td>One-story building: 100% in unconditioned attic

All other: 75% in unconditioned attic and 25% inside conditioned space</td><td>One-story building: 100% in unconditioned crawlspace

All other: 75% in unconditioned crawlspace and 25% inside conditioned space</td><td>50% inside conditioned space

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<td>Duct location: as proposed.</td>
</tr>
<tr><td>Duct insulation: in accordance with Section R403.3.1.</td><td>Duct insulation: as proposed.</td></tr>
<tr>
<td>Duct system leakage to outside:
For duct systems serving > 1,000ft2 of conditioned floor area, the duct leakage to outside rate shall be 4 cfm (113.3 L/min) per 100 ft2 (9.29 m2) of conditioned floor area.
For duct systems serving ≤ 1,000ft2 of conditioned floor area, the duct leakage to outside rate shall be 40 cfm (1132.7 L/min).</td>
<td>Duct System Leakage to Outside: The measure total duct system leakage rate shall be entered into the software as the duct system leakage to outside rate.
Exceptions:
<table>
<tr><td>1.</td><td>When duct system leakage to outside is tested in accordance ANSI/ RESNET/ICC 380 or ASTM E1554, the measured value shall be permitted to be entered.</td></tr>
<tr><td>2.</td><td>When total duct system leakage is measured without the air handler installed, the simulation value shall be 4 cfm (113.3 L/min) per 100 ft^2 (9.29 m^2) of conditioned floor area.</td></tr>
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<tr><td>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.</td><td>For hydronic systems and ductless systems, DSE shall be as specified in Table R405.4.2(2).</td></tr>
<tr><td>Thermostat</td><td>Type: Manual, cooling temperature setpoint = 75°F;
Heating temperature setpoint = 72°F.</td><td>Same as standard reference design.</td></tr>
<tr><td>Dehumidistat</td><td>Where a mechanical ventilation system with latent heat recovery is not specified in the proposed design: None. Where the proposed design utilizes a mechanical ventilation system with latent heat recovery:
Dehumidistat type: manual, setpoint = 60% relative humidity.
Dehumidifier: whole-dwelling with integrated energy factor = 1.77 liters/kWh.</td><td>Same as standard reference design.</td></tr>
</table>

For SI: 1 square foot = 0.93 m^2, 1 British thermal unit = 1055 J, 1 pound per square foot = 4.88 kg/m^2, 1 gallon (US) = 3.785 L, °C = (°F-32)/1.8, 1 degree = 0.79 rad.

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.

g. For a proposed design the following assumptions shall be made for both the proposed design and standard reference design.

   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 §130.32

h. For residences with conditioned basements, R-2 and R-4 residences, and for townhouse units, 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.

i. 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 Table R405.4.2(1), the standard reference design shall be the same as proposed design.

Reason: Inclusion of “Fuel Type,” “Product class…,” and “Efficiencies” among the heating system table entries is extraneous information in light of the inclusion of product class specifications and the initial guidance in the table, “For other than electric heating without a heat pump: as proposed…”

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
The changes will not increase the cost of construction.

Workgroup Recommendation

Proposal # 1413

RED1-64-22

Proponents: Eric Tate, representing Atmos Energy (eric.tate@atmosenergy.com)

2024 International Energy Conservation Code [RE Project]

CHAPTER 4 [RE]
RESIDENTIAL ENERGY EFFICIENCY

Revise as follows:

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 Table R402.1.2.	As proposed
	Solar absorptance = 0.75.	As proposed
	Emittance = 0.90.	As proposed
Basement and crawl space walls	Type: same as proposed.	As proposed
	Gross area: same as proposed.	As proposed
	U-factor: as specified in Table R402.1.2, with the insulation layer on the interior side of the walls.	As proposed
Above-grade floors	Type: wood frame.	As proposed
	Gross area: same as proposed.	As proposed
	U-factor: as specified in Table R402.1.2.	As proposed
Ceilings	Type: wood frame.	As proposed
	Gross area: same as proposed.	As proposed
	U-factor: as specified in Table R402.1.2.	As proposed
Roofs	Type: composition shingle on wood sheathing.	As proposed
	Gross area: same as proposed.	As proposed
	Solar absorptance = 0.75.	As proposed
	Emittance = 0.90.	As proposed
Attics	Type: vented with an aperture of 1 ft^2 per 300 ft^2 of ceiling area.	As proposed
Foundations	Type: same as proposed.	As proposed
	Foundation wall area above and below grade and soil characteristics: same as proposed.	As proposed
Opaque doors	Area: 40 ft^2.	As proposed
	Orientation: North.	As proposed
	U-factor: same as fenestration as specified in Table R402.1.2.	As proposed
Vertical fenestration other than opaque doors	Total area[h] = (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 Table R402.1.2.	As proposed
	SHGC: as specified in Table R402.1.2 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 × SHGC for the standard reference design).	Interior shade fraction: 0.92 – (0.21 × SHGC as proposed)
	External shading: none	As proposed
Skylights	None	As proposed
Thermally isolated sunrooms	None	As proposed
	The air leakage rate at a pressure of 0.2 inch w.g. (50 Pa) shall be Climate Zones 0 through 2: 5.0 air changes per hour. Climate Zones 3 , 4, and 5: 3.0 air changes per hour. Climate Zones 6 through 8: 2.5 air changes per hour.	The measured air exchange rate.[a]
	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 B x M where:	

Air exchange rate	where: B = 0.01 × CFA + 7.5 × (Nbr + 1), cfm. M = 1.0 where the measured air exchange rate is > = 3.0 air changes per hour at 50 Pascals, and otherwise, M = minimum (1.7, Q/B) Q = the proposed mechanical ventilation rate, cfm. CFA = conditioned floor area, ft2. Nbr = number of bedrooms. 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 Section R403.6.1. Heat recovery or energy recovery shall not be modeled for mechanical ventilation where not required by Section R403.6.1.	The mechanical ventilation rate[b], Q, shall be in addition to the air leakage rate and shall be as proposed.
Mechanical ventilation	Where mechanical ventilation is not specified in the proposed design: None Where mechanical ventilation is specified in the proposed design, the annual vent fan energy use, in units of kWh/yr, shall equal (8.76 × B × M)/ef where: B and M are determined in accordance with the Air Exchange Rate row of this table. e_f = the minimum fan efficacy, as specified in Table 403.6.2, corresponding to the system type at a flow rate of B × M. *CFA* = conditioned floor area, ft^2. N_{br} = number of bedrooms.	As proposed
Internal gains	IGain, in units of Btu/day per dwelling unit, shall equal 17,900 + 23.8 ×*CFA* + 4,104 × N_{br} where: *CFA* = conditioned floor area, ft^2. N_{br} = number of bedrooms.	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[c] but not integral to the building 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 Table R402.1.3, 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[d, e, j, k]	For other than electric heating without a heat pump: as proposed. 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 Section R403.7.	
	Fuel Type/Capacity: Same as proposed design	As proposed
	~~Product class: Same as proposed design~~	~~As proposed~~
	~~Efficiencies:~~	~~As proposed~~
	Heat pump: Complying with 10 CFR §430.32	As proposed
	Non-electric furnaces: Complying with 10 CFR §430.32	As proposed
	Non-electric boilers: Complying with 10 CFR §430.32	As proposed
Cooling systems[d, f, k]	As proposed. Capacity: sized in accordance with Section R403.7.	
	Fuel Type: Electric Capacity: Same as proposed design	As proposed
	Efficiencies: Complying with 10 CFR §430.32	As proposed
		As proposed Use, in units of gal/day = 25.5 + (8.5 × N_{br}) × (1 – *HWDS*) where:

<table>
<tr>
<td rowspan="6">Service water heating[d, g, k]</td>
<td>As proposed.
Use, in units of gal/day = 25.5 + (8.5 × N_{br})
where: N_{br} = number of bedrooms.</td>
<td>where:
N_{br} = number of bedrooms.
HWDS = factor for the compactness of the hot water distribution system.
<table>
<tr><th colspan="2">Compactness ratio[i] factor</th><th>HWDS</th></tr>
<tr><td>1 story</td><td>2 or more stories</td><td></td></tr>
<tr><td>> 60%</td><td>> 30%</td><td>0</td></tr>
<tr><td>> 30% to ≤ 60%</td><td>> 15% to ≤ 30%</td><td>0.05</td></tr>
<tr><td>> 15% to ≤ 30%</td><td>> 7.5% to ≤ 15%</td><td>0.10</td></tr>
<tr><td>< 15%</td><td>< 7.5%</td><td>0.15</td></tr>
</table></td>
</tr>
<tr><td>Fuel Type: Same as proposed design</td><td>As proposed</td></tr>
<tr><td>Rated Storage Volume: Same as proposed design</td><td>As proposed</td></tr>
<tr><td>Draw Pattern: Same as proposed design</td><td>As proposed</td></tr>
<tr><td>Efficiencies: Uniform Energy Factor complying with 10 CFR §430.32</td><td>As proposed</td></tr>
<tr><td>Tank Temperature: 120° F (48.9° C)</td><td>Same as standard reference design</td></tr>
<tr>
<td rowspan="4">Thermal distribution systems</td>
<td>Duct location:
<table>
<tr><td>Foundation Type</td><td>Slab on grade</td><td>Unconditioned crawl space</td><td>Basement or conditioned crawl space</td></tr>
<tr><td>Duct location (supply and return)</td><td>One-story building: 100% in unconditioned attic

All other: 75% in unconditioned attic and 25% inside conditioned space</td><td>One-story building: 100% in unconditioned crawlspace

All other: 75% in unconditioned crawlspace and 25% inside conditioned space</td><td>50% inside conditioned space

50% unconditioned attic</td></tr>
</table></td>
<td>Duct location: as proposed.</td>
</tr>
<tr><td>Duct insulation: in accordance with Section R403.3.1.</td><td>Duct insulation: as proposed.</td></tr>
<tr>
<td>Duct system leakage to outside:
For duct systems serving > 1,000ft2 of conditioned floor area, the duct leakage to outside rate shall be 4 cfm (113.3 L/min) per 100 ft2 (9.29 m2) of conditioned floor area.
For duct systems serving ≤ 1,000ft2 of conditioned floor area, the duct leakage to outside rate shall be 40 cfm (1132.7 L/min).</td>
<td>Duct System Leakage to Outside: The measure total duct system leakage rate shall be entered into the software as the duct system leakage to outside rate.
Exceptions:
<table>
<tr><td>1.</td><td>When duct system leakage to outside is tested in accordance ANSI/ RESNET/ICC 380 or ASTM E1554, the measured value shall be permitted to be entered.</td></tr>
<tr><td>2.</td><td>When total duct system leakage is measured without the air handler installed, the simulation value shall be 4 cfm (113.3 L/min) per 100 ft^2 (9.29 m^2) of conditioned floor area.</td></tr>
</table></td>
</tr>
<tr><td>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.</td><td>For hydronic systems and ductless systems, DSE shall be as specified in Table R405.4.2(2).</td></tr>
<tr><td>Thermostat</td><td>Type: Manual, cooling temperature setpoint = 75°F;
Heating temperature setpoint = 72°F.</td><td>Same as standard reference design.</td></tr>
<tr><td>Dehumidistat</td><td>Where a mechanical ventilation system with latent heat recovery is not specified in the proposed design: None. Where the proposed design utilizes a mechanical ventilation system with latent heat recovery:
Dehumidistat type: manual, setpoint = 60% relative humidity.
Dehumidifier: whole-dwelling with integrated energy factor = 1.77 liters/kWh.</td><td>Same as standard reference design.</td></tr>
</table>

For SI: 1 square foot = 0.93 m^2, 1 British thermal unit = 1055 J, 1 pound per square foot = 4.88 kg/m^2, 1 gallon (US) = 3.785 L, °C = (°F-32)/1.8, 1 degree = 0.79 rad.

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.

g. For a proposed design the following assumptions shall be made for both the proposed design and standard reference design.

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 §130.32

h. For residences with conditioned basements, R-2 and R-4 residences, and for townhouse units, 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.

i. 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 Table R405.4.2(1), the standard reference design shall be the same as proposed design.

Reason: Inclusion of “Fuel Type,” “Product class…,” and “Efficiencies” among the heating system table entries is extraneous information in light of the inclusion of product class specifications and the initial guidance in the table, “For other than electric heating without a heat pump: as proposed…”

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
The deleted text would not affect the cost of construction.

Workgroup Recommendation

Proposal # 1464

RED1-65-22

Proponents: Gayathri Vijayakumar, representing Steven Winter Associates, Inc. (gvijayakumar@swinter.com)

2024 International Energy Conservation Code [RE Project]

CHAPTER 2 [RE]
DEFINITIONS

SECTION R202
GENERAL DEFINITIONS

Revise as follows:

ENERGY RATING INDEX (ERI). A numerical integer value that represents the relative energy performance of a *rated design* ~~Rated Home~~ 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* ~~home~~ with zero net energy performance.

ERI REFERENCE DESIGN. A version of the *rated design* that meets the minimum requirements of the 2006 *International Energy Conservation Code*.

Revise as follows:

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

CHAPTER 4 [RE]
RESIDENTIAL ENERGY EFFICIENCY

SECTION R406
ENERGY RATING INDEX COMPLIANCE ALTERNATIVE

Revise as follows:

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 R401 through R404.

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

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

TABLE R406.2 REQUIREMENTS FOR ENERGY RATING INDEX

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

R406.3 Building thermal envelope. 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 1.08 in Climate Zones 0, 1, and 2, and by 1.15 in Climates Zones 3 through 8, in accordance with Equation 4-3. The area-weighted maximum fenestration SHGC permitted in Climate Zones 0 through 3 shall be 0.30.

(Equation 4-3)

$$\text{For Climate Zones 0-2: } UA_{\text{Proposed design}} \leq 1.08 \text{ x } UA_{\text{Prescriptive reference design}}$$

$$\text{For Climate Zones 3-8: } UA_{\text{Proposed design}} \leq 1.15\text{x } UA_{\text{Prescriptive reference design}}$$

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.
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*.

Revise as follows:

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 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 twenty 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

Revise as follows:

R406.6 Verification by approved agency. Verification of compliance with Section R406 as outlined in Sections R406.4 and R406.5~~6~~ shall be completed by an *approved* third party. Verification of compliance with Section R406.2 shall be completed by the authority having jurisdiction or an *approved* third-party inspection agency in accordance with Section R105.4.

R406.7 Documentation. Documentation of the software used to determine the ~~ERI~~ *ERI* and the parameters for the *ERI Reference Design* ~~*residential building*~~ 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* ~~ERI~~ shall be *Approved* Software Rating Tools in accordance with ANSI/RESNET/ICC 301 and shall have documentation that the software tool has been validated using the Class II, Tier 1 test procedure in ANSI/ASHRAE Standard 140-2017.

R406.7.2 Compliance report. Compliance software tools shall generate a report that documents that the ~~home and the ERI score~~ *ERI* of the *rated design* and as-built *dwelling unit* complies with Sections R406.2, R406.3 , R406.4 and R406. 5~~4~~. Compliance documentation shall be created for the proposed design and shall be submitted with the application for the building permit. Confirmed compliance documents of the 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~~/or~~ the *rated design* ~~home~~.
6. A certificate indicating that the proposed design has an ERI less than or equal to the appropriate score indicated in Table R406.5 when compared to the *ERI reference design*. The certificate shall document the building component energy specifications that are included in the calculation, including: component level insulation *R*-values or *U*-factors; assumed duct system and building envelope air leakage testing results; and the type and rated efficiencies of proposed heating, cooling, mechanical ventilation, and service water-heating equipment to be installed. If on-site renewable energy systems will be installed, the certificate shall report the type and production size of the proposed system.
7. When a site-specific report is not generated, the proposed design shall be based on the worst-case orientation and configuration of the rated *dwelling unit* ~~home~~.

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~~/or~~ the as-built *dwelling unit*~~rated home~~.
6. A final confirmed certificate indicating that the as-built building ~~confirmed rated design of the built home~~ complies with Sections R406.2 , R406.4 and R406. 5~~4~~. The certificate shall report the energy features that were confirmed to be in the building~~home~~, including: component-level insulation *R*-values or *U*-factors; results from any required duct system and building envelope air leakage testing; and the type and rated efficiencies of the heating, cooling, mechanical ventilation, and service water-heating equipment installed. Where on-site renewable energy systems have been installed on or in the building ~~home~~, the certificate shall report the type and production size of the installed system.

R406.7.3 Renewable energy certificate (REC) documentation. Where renewable energy power production is included in the calculation of an ERI, documentation shall comply with Section R404.4.

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.

Revise as follows:

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.

CHAPTER 6 [RE]
REFERENCED STANDARDS

ANSI

American National Standards Institute
25 West 43rd Street, 4th Floor
New York, NY 10036

Add new standard(s) as follows:

ANSI

American National Standards Institute
25 West 43rd Street, 4th Floor
New York, NY 10036

R406.7.1	ANSI/ASHRAE 140-2017 **Standard Method of Test for the Evaluation of Building Energy Analysis Computer Programs**

Reason: Similar to a clean-up proposal for R405, R406 needs to be clear for multifamily that an ERI is only performed on a dwelling unit and that common spaces are still subject to the other code requirements in R402 through R404.
In addition, for large MF, the average ERI of all dwelling units in the building should be permitted to be used to demonstrate compliance with the maximum ERI (rather than each indvidual dwelling unit being required to meet the max ERI).

Finally, some edits are made to maintain consistency, use defined terms, and underscore that the as-built dwelling unit is also required to be compliant, not just the 'rated design' ERI.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
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Bibliography: None

Workgroup Recommendation

Proposal # 1400

RED1-66-22

Proponents: Steven Rosenstock, representing Edison Electric Institute (srosenstock@eei.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

TABLE R406.2 REQUIREMENTS FOR ENERGY RATING INDEX

SECTION[a]	TITLE
General	
R401.3	Certificate
Building Thermal Envelope	
R402.1.1	Vapor retarder
R402.2.4	Eave baffle
R402.2.5.1	Access hatches and doors
R402.2.9	Basement walls
R402.2.9.1	Basement wall insulation installation
R402.2.10.1	Slab-on-grade floor insulation installation
R402.2.11.1	Crawl space wall insulation installation
R402.5.1.1	Installation
R402.5.1.2	Testing
R402.5.2	Fireplaces
R402.5.3	Fenestration air leakage
R402.5.4	Rooms containing fuel burning appliances
R402.5.5	Recessed lighting
R402.5.6	Air-sealed electrical and communication outlet boxes(air sealed boxes)
R406.3	Building thermal envelope
Mechanical	
R403.1	Controls
R403.2	Hot water boiler temperature reset
R403.3	Duct systems
R403.4	Mechanical system piping insulation
R403.5 except Section R403.5.2(staff note: this needs to be fixed with hot water pipe insulation)	Service hot water systems
R403.5.2	Hot water pipe insulation
R403.6	Mechanical ventilation
R403.7, except Section R403.7.1	Equipment sizing and efficiency rating
R403.8	Systems serving multiple dwelling units
R403.9	Snow melt and ice system controls
R403.11	Energy consumption of pools and spas
R403.12	Portable spas
R403.13	Residential pools and permanent residential spas
Electrical Power and Lighting Systems	
R404.1	Lighting equipment
R404.2	Interior lighting controls
R404.5	Electric readiness
R404.6	Renewable energy infrastructure
~~R404.7~~	~~Electric Vehicle power transfer infrastructure~~

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

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.

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*.

Reason: It is necessary to remove this row from Table R406.2 because it creates a conflict with the language in Section R406.4 that states the following: "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*."
Since it is not required for the ERI, based on the clear language in R406.4, it should be removed from the table showing it to be a requirement. If it is not removed, it will cause confusion and issues for designers and owners that would like to use this section.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This is a correction to a table to remove conflicting code language, and does not have any impact on the cost of construction.

Workgroup Recommendation

Proposal # 1069

RED1-67-22

Proponents: Greg Johnson, representing National Multifamily Housing Council (gjohnsonconsulting@gmail.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R406.5 ERI-based compliance. Compliance based on an ERI analysis requires that the *rated proposed design* and confirmed built dwelling be shown to have an ERI less than or equal to the ~~appropriate~~ applicable 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 maximum ENERGY RATING INDEX NOT INCLUDING OPP applies.
2. Where on-site renewables are installed, the maximum ENERGY RATING INDEX INCLUDING OPP applies.

Exception: Where the ERI analysis excludes OPP, the maximum ENERGY RATING INDEX NOT INCLUDING OPP shall be permitted.

Reason: Editorial:
1."Appropriate" is not appropriate, it is subjective.
2. "When" is only time specific. "Where" is condition - including time - specific.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
Editorial

Workgroup Recommendation

Proposal # 1431

RED1-68-22 Part I

Proponents: Tom Ortiz, representing National Propane Gas Association (tortiz@npga.org); Bruce Swiecicki, representing National Propane Gas Association (bswiecicki@npga.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

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

~~**Exception:**~~

~~Where the ERI analysis excludes OPP, the maximum ENERGY RATING INDEX NOT INCLUDING OPP shall be permitted.~~

Reason: There is no scientific basis to exclude on-site power production from buildings which include it for purposes of energy efficiency rating. The goal is that non-renewable energy consumption should always be minimized irrespective of the availability of auxiliary sources.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
There could be no effect on the cost of construction.

Workgroup Recommendation

Proposal # 1255

RED1-68-22 Part II

Proponents: Tom Ortiz, representing National Propane Gas Association (tortiz@npga.org); Bruce Swiecicki, representing National Propane Gas Association (bswiecicki@npga.org)

2024 ENERGY Chapter11

Revise as follows:

N1106.5 ERI-based compliance. Compliance based on an ERI analysis requires that the *rated proposed design* and confirmed built dwelling be shown to have an ERI less than or equal to the appropriate value indicated in Table N1106.5 when 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.

~~**Exception:**~~

~~Where the ERI analysis excludes OPP, the maximum ENERGY RATING INDEX NOT INCLUDING OPP shall be permitted.~~

Reason: There is no scientific basis to exclude on-site power production from buildings which include it for purposes of energy efficiency rating. The goal is that non-renewable energy consumption should always be minimized irrespective of the availability of auxiliary sources.

Cost Impact: The code change proposal will decrease the cost of construction.
Not requiring additional systems or equipment will decrease the cost of construction.

Workgroup Recommendation

Proposal # 1292

RED1-69-22

Proponents: Amy Boyce, representing Energy Efficient Codes Coalition (EECC) (amy.boyce@imt.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

TABLE R406.5 MAXIMUM ENERGY RATING INDEX

CLIMATE ZONE	ENERGY RATING INDEX NOT INCLUDING OPP	ENERGY RATING INDEX WITH OPP
0-1	~~51~~ 49	40
2	~~51~~ 49	40
3	~~50~~ 48	40
4	~~53~~ 51	40
5	~~54~~ 52	40
6	~~53~~ 51	40
7	~~52~~ 50	40
8	~~52~~ 50	40

Reason: The purpose of this proposal is to maintain the same ERI targets required in the 2021 IECC, in order to help ensure that the ERI path is no less efficient in the 2024 IECC. Table R406.5 of the 2021 IECC establishes maximum ERI targets, and Section R401.2.5 applies a 5% improvement to the scores in this table. This improvement was adopted as part of a 5% efficiency improvement for prescriptive, performance, and ERI compliance paths and was overwhelmingly approved by Governmental Member Voting Representatives in RE209-19. In the current update cycle, the supporters of REPI-21 argued that the 5% improvement to the ERI scores belonged in Table R406.5, and not in R401.2.5, but when broad changes were adopted into the ERI in proposal REPI-126, the updated ERI targets did not include the full 5% improvement.
We believe an additional 5% improvement (beyond the scores above) is warranted, since the target for the 2024 IECC prescriptive path is roughly a 5% improvement as well. And given the change in mechanical ventilation assumptions brought about by proposal REPI-131, the scores above will still be easier to achieve than under the 2021 IECC. However, this proposal would at least maintain the same ERI targets in Table R406.5. Without this change, the ERI path will be objectively less stringent in the 2024 IECC than in the 2021 IECC, in direct conflict with the ICC Board of Director’s assurances that “Efficiency must increase every edition” of the IECC. *See* https://www.iccsafe.org/wp-content/uploads/ICC_Advancing_Energy_Efficiency.pdf

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This proposal will neither increase nor decrease the cost of construction because it maintains the same ERI targets that are required in the 2021 IECC.

Workgroup Recommendation

Proposal # 1349

RED1-70-22

Proponents: Craig Conner, representing self (craig.conner@mac.com)

2024 International Energy Conservation Code [RE Project]

Delete without substitution:

~~**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 RESNET/ICC 301.~~

Reason: Section R406.7.6 "Input values" is confusing and redundant. This Section specifies required calculation input values not specified by IECC Sections R402, R403, R404, and R405 be taken from RESNET 301. What calculation input values? I can't think of any such calculation input values.
Or maybe I'm reading it wrong because R406 is only in the IECC's ERI section; therefore, does R406.7.6 only apply to the ERI? If its just the ERI, then R406.7.6 is redundant since IECC Section R406.4 already says to use RESNET 301 to calculate the ERI.

IECC Section R405.5.3 "Input values" says to use an "*approved source*" for calculations requiring input values not in IECC Sections R402, R403, R404, and R405. An "*approved source*" is all that is needed for general direction. If a specific code section should point to another source, inside the IECC or outside the IECC, name that other source in that specific IECC code section.

Best to remove confusion by deleting Section R406.7.6.

Craig Conner, from Building Quality, is representing self.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This removes confusion.

Workgroup Recommendation

Proposal # 1353

RED1-71-22

Proponents: Gayathri Vijayakumar, representing Steven Winter Associates, Inc. (gvijayakumar@swinter.com)

2024 International Energy Conservation Code [RE Project]

SECTION R408
ADDITIONAL EFFICIENCY REQUIREMENTS

Revise as follows:

R408.1 Scope. This section establishes additional efficiency credits to achieve additional energy efficiency in accordance with Section R401.2.1~~5~~.

R408.2 Additional energy efficiency credit requirements . No less than t~~T~~wo ~~of the additional~~ measures shall be selected from Table R408.2 that meet or exceed a total of ten credits. Five additional credits shall be selected for dwelling units with greater than 5,000 square feet (465 m^2) of living space floor area located above grade plane. Each measure selected shall meet the relevant subsections of Section R408 and receive credit as specified in Table R408.2 for the specific Climate Zone. For *dwelling units* in Group R-2 buildings, where applicable, the requirements shall be met in each dwelling unit in order to receive credit. Interpolation of credits between measures shall not be permitted.

TABLE R408.2 CREDITS FOR ADDITIONAL ENERGY EFFICIENCY

Portions of table not shown remain unchanged.

Measure Number	Measure Description	Credit Value								
		Climate Zone 0 & 1	Climate Zone 2	Climate Zone 3	Climate Zone 4	Climate Zone 4C	Climate Zone 5	Climate Zone 6	Climate Zone 7	Climate Zone 8
R408.2.1.1(1)	≥2.5% Reduction in total UA	0	0	0	1	1	1	1	1	1
R408.2.1.1(2)	≥5% reduction in total UA	0	1	1	2	2	3	3	3	3
R408.2.1.1(3)	>7.5% reduction in total UA	0	1	2	2	2	3	3	4	4
R408.2.1.2(1)	0.22 U-factor windows	1	2	2	3	3	4	4	4	5
R408.2.1.2(2)	U-factor and SHGC for windows per Table R408.2.1	1	1	1	0	0	0	0	1	2
R408.2.1.3	Cool Roof	TBD	TBD	TBD	TBD	TBD	0	0	0	0
R408.2.1.4	Reduced air leakage	TBD	TBD	TBD	TBD	TBD	TBD	0	0	0

R408.2.1 Enhanced envelope options. For the enhanced envelope credits, t~~T~~he *building thermal envelope* shall meet the applicable requirements of the following:

1. Either Section R408.2.1.1 or R408.2.1.2 and credit shall only be permitted from one measure.
2. Section R408.2.1.3.
3. Section R408.2.1.4.

R408.2.1.1 Enhanced envelope performance UA. The proposed total building thermal envelope UA shall be calculated in accordance with Section R402.1.5 and shall meet one of the following:

1. Not less than 2.5 percent of the total UA of the *building thermal envelope*.
2. Not less than 5 percent of the total UA of the *building thermal envelope*.
3. Not less than 7.5 percent of the total UA of the *building thermal envelope*.

R408.2.1.2 Improved fenestration. Vertical fenestration shall meet one of the following:

1. U-factor equal to or less than 0.22.
2. U-factor and SHGC equal or less than that specified in Table R408.2.1.2.

R408.2.1.3 Roof reflectance. Roofs shall comply with one or more of the options in Table R408.2.1.3.

Add new text as follows:

R408.2.1.4 Reduced air leakage. For the reduced air leakage credit, the building or each *dwelling unit* in the building shall have a measured air leakage rate no less than 2.0 ACH50 and no greater than 2.5 ACH50.

Reason: This public comment proposes credit for achieving airtightness below the prescriptive air leakage rates in CZ 0-5, as defined in Section R402.5.1.3. However, this credit is not being proposed for values less than 2.0 ACH50 given that another R408 section provides credit for that level airtightness when combined with balanced ventilation. In addition, this credit is not being proposed where sampling is used in Group R-2 buildings, but instead a whole building test could be used to earn this credit.

Other edits are editorial to provide better clarity of the original intent of this section.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
Where selected as a measure, some additional labor cost associated with the greater attention to air-sealing practices would be applicable. Where not deemed cost-effective, this measure simply would not be selected.

Bibliography: None.

Workgroup Recommendation

RED1-72-22

Proponents: Robert Salcido, representing DOE (victor.salcido@pnnl.gov)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R408.2 Additional energy efficiency credit requirements . A minimum of t~~T~~wo of the additional energy efficiency measures shall be selected from Table R408.2 and a total credit value of all selected measures installed on the building or building site shall ~~that~~ meet or exceed a total of ten credits. Five additional credits shall be selected for dwelling units with greater than 5,000 square feet (465 m^2) of living space floor area located above grade plane. Each measure selected shall meet the relevant subsections of Section R408 and receive credit as specified in Table R408.2 for the specific Climate Zone. Interpolation of credits between measures shall not be permitted.

Reason: Editorial clarification of what is required

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
No Cost Impact

Workgroup Recommendation

Proposal # 1192

RED1-73-22

Proponents: Alex Smith, representing NAHB (asmith@nahb.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R408.2 Additional energy efficiency credit requirements . Two ~~of the~~ additional measures shall be selected from Table R408.2 that meet or exceed a total of ten credits. Five additional credits shall be selected for dwelling units with greater than 5,000 square feet (465 m^2) of living space floor area located above grade plane. Each measure selected shall meet the relevant subsections of Section R408 and receive credit as specified in Table R408.2 for the specific Climate Zone. Interpolation of credits between measures shall not be permitted.

Reason: This change removes the words "of the." Those words are unnecessary.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This change is editorial and will have no impact on construction costs.

Workgroup Recommendation

Proposal # 1369

RED1-74-22

Proponents: Aaron Phillips, representing Asphalt Roofing Manufacturers Association (aphillips@asphaltroofing.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

TABLE R408.2 CREDITS FOR ADDITIONAL ENERGY EFFICIENCY

Measure Number	Measure Description	Credit Value								
		Climate Zone 0 & 1	Climate Zone 2	Climate Zone 3	Climate Zone 4	Climate Zone 4C	Climate Zone 5	Climate Zone 6	Climate Zone 7	Climate Zone 8
R408.2.1.1(1)	≥2.5% Reduction in total UA	0	0	0	1	1	1	1	1	1
R408.2.1.1(2)	≥5% reduction in total UA	0	1	1	2	2	3	3	3	3
R408.2.1.1(3)	>7.5% reduction in total UA	0	1	2	2	2	3	3	4	4
R408.2.1.2(1)	0.22 U-factor windows	1	2	2	3	3	4	4	4	5
R408.2.1.2(2)	U-factor and SHGC for windows per Table R408.2.1	1	1	1	0	0	0	0	1	2
R408.2.1.3	Roof reflectance~~Cool Roof~~	TBD	TBD	TBD	TBD	TBD	0	0	0	0
R408.2.2(1)	High performance cooling system option 1	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(2)	High performance cooling system option 2	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(3)	High performance gas furnace option 1	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(4)	High performance gas furnace option 2	0	0	0	0	0	TBD	TBD	TBD	0
R408.2.2(5)	High performance gas furnace and cooling system option 2	TBD	TBD	TBD	TBD	TBD	0	0	0	TBD
R408.2.2(6)	High performance gas furnace and heat pump system option 1	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(7)	High performance gas furnace option 2	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(8)	High performance heat pump system option 1	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(9)	High performance heat pump system option 2	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(10)	High performance heat pump system option 3	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(11)	Ground source heat pump	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(12)	Ductless - Single zone	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(13)	Ductless - Multizone (Non-ducted indoor unit)	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(14)	Ductless – Multizone (Ducted or Mixed)	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.3(1)	Gas-fired storage water heaters	7	6	5	3	3	2	2	3	1
R408.2.3(2)	Gas-fired instantaneous water heaters	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.3(3)	Electric water heaters	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.3(4)	Electric water heaters	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.3(5)	Solar hot water heating system	4	5	6	6	6	6	5	5	4
R408.2.3(6)	Compact hot water distribution	2	2	2	2	2	2	2	2	2
R408.2.4(1)	More efficient distribution system	4	6	7	10	10	12	13	15	16
R408.2.4(2)	100% of ducts in conditioned space	4	6	8	12	12	15	17	19	20
R408.2.4(3)	Reduced total duct leakage	1	1	1	1	1	1	2	2	2
R408.2.5(1)	2 ACH50 air leakage rate with ERV or HRV installed	1	4	5	10	10	13	15	8	8
R408.2.5(2)	2 ACH50 air leakage rate with balanced ventilation	2	3	2	4	4	5	6	6	6

R408.2.5(3)	1.5 ACH50 air leakage rated with ERV or HRV installed	2	4	6	12	12	15	18	11	11
R408.2.5(4)	1 ACH50 air leakage rate with ERV or HRV installed	2	5	6	14	14	17	21	14	14
R408.2.6	Energy efficient appliances	9	8	8	7	7	5	5	5	4
R408.2.7	Renewable energy measures	17	16	17	11	11	9	8	7	4
R408.2.9	Demand responsive thermostat	1	1	1	1	1	1	1	1	1

R408.2.1.3 Roof reflectance. Roofs shall comply with one or more of the options in Table R408.2.1.3.

2024 ENERGY Chapter11

Revise as follows:

TABLE N1108.2 CREDITS FOR ADDITIONAL ENERGY EFFICIENCY

Measure Number	Measure Description	Credit Value								
Climate Zone 0 & 1	Climate Zone 2	Climate Zone 3	Climate Zone 4	Climate Zone 4C	Climate Zone 5	Climate Zone 6	Climate Zone 7	Climate Zone 8		
N1108.2.1.1(1)	≥2.5% Reduction in total UA	0	0	0	1	1	1	1	1	1
N1108.2.1.1(2)	≥5% reduction in total UA	0	1	1	2	2	3	3	3	3
N1108.2.1.1(3)	>7.5% reduction in total UA	0	1	2	2	2	3	3	4	4
N1108.2.1.2(1)	0.22 U-factor windows	1	2	2	3	3	4	4	4	5
N1108.2.1.2(2)	U-factor and SHGC for windows per Table R408.2.1	1	1	1	0	0	0	0	1	2
N1108.2.1.3	Roof reflectance~~Cool Roof~~	TBD	TBD	TBD	TBD	TBD	0	0	0	0
N1108.2.2(1)	High performance cooling system option 1	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
N1108.2.2(2)	High performance cooling system option 2	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
N1108.2.2(3)	High performance gas furnace option 1	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
N1108.2.2(4)	High performance gas furnace and cooling system option 1	0	0	0	0	0	TBD	TBD	TBD	0
N1108.2.2(5)	High performance gas furnace and cooling system option 2	TBD	TBD	TBD	TBD	TBD	0	0	0	TBD
N1108.2.2(6)	High performance gas furnace and heat pump system option 1	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
N1108.2.2(7)	High performance gas furnace option 2	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
N1108.2.2(8)	High performance heat pump system option 1	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
N1108.2.2(9)	High performance heat pump system option 2	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
N1108.2.2(10)	High performance heat pump system option 3	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
N1108.2.2(11)	Ground source heat pump	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
N1108.2.2(12)	Ductless - Single zone	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
N1108.2.2(13)	Ductless - Multizone (Non-ducted indoor unit)	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
N1108.2.2(14)	Ductless - Multizone (Ducted or Mixed)	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
N1108.2.3(1)	Gas-fired storage water heaters	7	6	5	3	3	2	2	3	1
N1108.2.3(2)	Gas-fired instantaneous water heaters	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
N1108.2.3(3)	Electric water heaters	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
N1108.2.3(4)	Electric water heaters	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
N1108.2.3(5)	Solar hot water heating system	4	5	6	6	6	6	5	5	4
N1108.2.3(6)	Compact hot water distribution	2	2	2	2	2	2	2	2	2
N1108.2.4(1)	More efficient distribution system	4	6	7	10	10	12	13	15	16
N1108.2.4(2)	100% of ducts in conditioned space	4	6	8	12	12	15	17	19	20
N1108.2.4(3)	Reduced total duct leakage	1	1	1	1	1	1	2	2	2
N1108.2.5(1)	2 ACH50 air leakage rate with ERV or HRV installed	1	4	5	10	10	13	15	8	8
N1108.2.5(2)	2 ACH50 air leakage rate with balanced ventilation	2	3	2	4	4	5	6	6	6
N1108.2.5(3)	1.5 ACH50 air leakage rated with ERV or HRV installed	2	4	6	12	12	15	18	11	11
	1 ACH50 air leakage rate with ERV or									

N1108.2.5(4)	1 ACH50 air leakage rate with ERV or HRV installed	2	5	6	14	14	17	21	14	14
N1108.2.6	Energy efficient appliances	9	8	8	7	7	5	5	5	4
N1108.2.7	Renewable energy measures	17	16	17	11	11	9	8	7	4
N1108.2.9	Demand reponsive thermostat	1	1	1	1	1	1	1	1	1

N1108.2.1.3 Roof reflectance. Roofs shall comply with one or more of the options in Table N1108.2.1.3.

Reason: In Tables R408.2 and N1108.2, this comment aligns the "cool roof" measure description with the title of the measure number section to improve clarity. Sections R408.2.1.3 and N1108.2.1.3 are shown immediately after the associated tables to illustrate the resulting coordination.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This comment makes no technical change and does not affect cost of construction.

Workgroup Recommendation

Proposal # 969

RED1-75-22

Proponents: Amanda Hickman, representing Leading Builders of America (amanda@thehickmangroup.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

TABLE R408.2 CREDITS FOR ADDITIONAL ENERGY EFFICIENCY

Portions of table not shown remain unchanged.

Measure Number	Measure Description	Credit Value								
		Climate Zone 0 & 1	Climate Zone 2	Climate Zone 3	Climate Zone 4	Climate Zone 4C	Climate Zone 5	Climate Zone 6	Climate Zone 7	Climate Zone 8
R408.2.10	Homeowner Education	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD

R408.2 Additional energy efficiency credit requirements . Two of the additional measures shall be selected from Table R408.2 that meet or exceed a total of ten credits. Five additional credits shall be selected for dwelling units with greater than 5,000 square feet (465 m^2) of living space floor area located above grade plane. Each measure selected shall meet the relevant subsections of Section R408 and receive credit as specified in Table R408.2 for the specific Climate Zone. Interpolation of credits between measures shall not be permitted.
R408.2.10 Homeowner Education. Homeowners shall receive information educating them on the features of their newly constructed home and ways to save energy and reduce GHG emissions.

Reason: Numerous studies show the significant energy savings and reduction to GHG emissions that can come from homeowner best practices. Therefore it is critical to educate homeowners on the features of their homes and ways for them to save energy and reduce their carbon footprint within the home. This proposal gives credit (TBD) in the R408 table for a homeowner educational component.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This code change only adds an option to the R408 list.

Workgroup Recommendation

Proposal # 1354

RED1-76-22

Proponents: Alex Smith, representing NAHB (asmith@nahb.org)

2024 International Energy Conservation Code [RE Project]

ON-SITE RENEWABLE ENERGY. Energy from renewable energy resources harvested at the building site.

Revise as follows:

TABLE R408.2 CREDITS FOR ADDITIONAL ENERGY EFFICIENCY

Portions of table not shown remain unchanged.

Measure Number	Measure Description	Credit Value							
		Climate Zone 0 & 1	Climate Zone 2	Climate Zone 3	Climate Zone 4	Climate Zone 4C	Climate Zone 5	Climate Zone 6	Climate Zone 7
R408.2.7	On-site renewable energy measures	17	16	17	11	11	9	8	7
R408.2.8	Off-site renewable energy measuress	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD

R408.2.7 On-site renewable energy. Renewable energy resources shall be permanently installed that have the rated capacity to produce a minimum of 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 R404.4.

Add new text as follows:

R408.2.8 Off-site renewable energy. The building shall have 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 whole-building electric use on an annual basis.

Reason: This proposal adds off-site renewables to the list of options for compliance with Section R408. Off-site renewables have the potential to provide viable strategies for deploying renewable energy resources at-scale. On-site renewable energy measures are already acknowledged in Section R408. The proposed language was adopted from the existing Section R404.6.1 addressing off-site renewables via 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 whole-building electric use on an annual basis.

Cost Impact: The code change proposal will increase the cost of construction.
This change is in Section R408 and would not have an effect on construction costs.

Workgroup Recommendation

Proposal # 1038

RED1-77-22

Proponents: Amy Boyce, representing Energy Efficient Codes Coalition (EECC) (amy.boyce@imt.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

TABLE R408.2 CREDITS FOR ADDITIONAL ENERGY EFFICIENCY

Measure Number	Measure Description	Credit Value								
		Climate Zone 0 & 1	Climate Zone 2	Climate Zone 3	Climate Zone 4	Climate Zone 4C	Climate Zone 5	Climate Zone 6	Climate Zone 7	Climate Zone 8
R408.2.1.1(1)	≥2.5% Reduction in total UA	0	0	0	1	1	1	1	1	1
R408.2.1.1(2)	≥5% reduction in total UA	0	1	1	2	2	3	3	3	3
R408.2.1.1(3)	>7.5% reduction in total UA	0	1	2	2	2	3	3	4	4
R408.2.1.2(1)	0.22 U-factor windows	1	2	2	3	3	4	4	4	5
R408.2.1.2(2)	U-factor and SHGC for windows per Table R408.2.1	1	1	1	0	0	0	0	1	2
R408.2.1.3	Cool Roof	TBD	TBD	TBD	TBD	TBD	0	0	0	0
~~R408.2.2(1)~~	~~High performance cooling system option 1~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~
R408.2.2(2)	High performance cooling system option 2	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
~~R408.2.2(3)~~	~~High performance gas furnace option 1~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~
~~R408.2.2(4)~~	~~High performance gas furnace option 2~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~TBD~~	~~TBD~~	~~TBD~~	~~0~~
R408.2.2(5)	High performance gas furnace and cooling system option 2	TBD	TBD	TBD	TBD	TBD	0	0	0	TBD
R408.2.2(6)	High performance gas furnace and heat pump system option 1	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(7)	High performance gas furnace option 2	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(8)	High performance heat pump system option 1	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(9)	High performance heat pump system option 2	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(10)	High performance heat pump system option 3	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(11)	Ground source heat pump	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(12)	Ductless - Single zone	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(13)	Ductless - Multizone (Non-ducted indoor unit)	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(14)	Ductless – Multizone (Ducted or Mixed)	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.3(1)	Gas-fired storage water heaters	7	6	5	3	3	2	2	3	1
R408.2.3(2)	Gas-fired instantaneous water heaters	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.3(3)	Electric water heaters	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.3(4)	Electric water heaters	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.3(5)	Solar hot water heating system	4	5	6	6	6	6	5	5	4
R408.2.3(6)	Compact hot water distribution	2	2	2	2	2	2	2	2	2
R408.2.4(1)	More efficient distribution system	4	6	7	10	10	12	13	15	16
R408.2.4(2)	100% of ducts in conditioned space	4	6	8	12	12	15	17	19	20
R408.2.4(3)	Reduced total duct leakage	1	1	1	1	1	1	2	2	2
R408.2.5(1)	2 ACH50 air leakage rate with ERV or HRV installed	1	4	5	10	10	13	15	8	8
R408.2.5(2)	2 ACH50 air leakage rate with balanced ventilation	2	3	2	4	4	5	6	6	6

R408.2.5(3)	1.5 ACH50 air leakage rated with ERV or HRV installed	2	4	6	12	12	15	18	11	11
R408.2.5(4)	1 ACH50 air leakage rate with ERV or HRV installed	2	5	6	14	14	17	21	14	14
R408.2.6	Energy efficient appliances	9	8	8	7	7	5	5	5	4
R408.2.7	Renewable energy measures	17	16	17	11	11	9	8	7	4
R408.2.9	Demand responsive thermostat	1	1	1	1	1	1	1	1	1

R408.2.2 More efficient HVAC equipment performance option. Heating and cooling *equipment* shall meet one of the following efficiencies Centrally Ducted Systems:

~~1. Greater than or equal to 16~~

2. Greater than or equal to 18 SEER (16.9 SEER2) and 14 EER (13.4 EER2) air conditioner.

~~3. Greater than or equal to 92 AFUE natural gas furnace.~~

~~4. Greater than or equal to 95 AFUE natural gas furnace and 15.2 SEER2 in Climate Zones 5, 6 and 7~~

5. Greater than or equal to 95 AFUE natural gas furnace and 16.0 SEER2 in other Climate Zones for air conditioner.
6. Greater than or equal to 95 AFUE natural gas furnace and 8.5 HSPF2/16.0 SEER2 air source heat pump.
7. Greater than or equal to 96 AFUE natural gas furnace.
8. Greater than or equal to 8.5 HSPF2/16.0 SEER2 air source heat pump.
9. Greater than or equal to 9 HSPF (7.6 HSPF2) /16 SEER (15.2 SEER2) air source heat pump.
10. Greater than or equal to 10 HSPF (8.5 HSPF2) /16SEER (15.2 SEER2) air source heat pump.
11. Greater than or equal to 3.5 COP ground source heat pump.

Ductless Systems:

12. Single Zone: 8.5 HSPF2/16.9 SEER2 variable speed air source heat pump.
13. Multi Zone: 8.5 HSPF2/16.9 SEER2 variable speed air source heat pump (Non-Ducted Indoor Units).
14. Multi Zone: 8.5 HSPF2/15.2 SEER2 variable speed air source heat pump (Ducted or Mixed Indoor Units)

Reason: This proposal simplifies the IECC and helps prevent unintentional efficiency rollbacks by eliminating credits for additional efficiency measures that are less stringent than those included in Section R408 of the 2021 IECC. The ICC Governmental Member Voting Representatives approved five efficiency options in the 2021 IECC, each of which would provide a substantial improvement in energy savings for homeowners. Although the savings varied by climate zone and by measure selected, the proposal was simple to apply and enforce. (A parallel proposal that would have implemented a points table was also submitted, but it fell short of the 2/3 votes needed for approval.) While we understand that the Residential Consensus Committee has decided to apply a points-based R408 in the 2024 IECC, it is important that the addition of a points table does not result in a reduction in energy efficiency. We are concerned that several of the options included in the current draft fall short of the stringency of the 2021 IECC, and we recommend deleting them. We also believe that reducing the number of options, in favor of more efficient options where appropriate, will help streamline compliance and enforcement.
The above public comment deletes credits for cooling and heating equipment that does not qualify for credit under section R408.2.2 of the 2021 IECC. The 2021 IECC requires that heating and cooling equipment meet one of the following efficiencies:

1. Greater than or equal to 95 AFUE natural gas furnace and 16 SEER air conditioner.

2. Greater than or equal to 10 HSPF/16 SEER air source heat pump.

3. Greater than or equal to 3.5 COP ground source heat pump.

In option 1, the draft points table appears to award credit for only cooling equipment at the 2021 IECC level (rather than heating and cooling equipment); in options 3 and 4, the table awards credit for an efficiency level lower than the 2021 IECC requirement. Without these modifications, a code user could construct a new home under the 2024 IECC that would not have complied with the 2021 IECC, which is not an acceptable outcome. We believe that it is reasonable to require the 2024 IECC to be built upon the efficiency levels of the 2021 IECC, given that new section R101.3 Intent of the 2024 IECC, as written by the ICC Board of Directors, dictates that the code will be updated on a “three-year cycle with each subsequent edition providing increased energy savings over the prior edition.”

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This proposal neither increases nor decreases the cost of construction. These modifications would only help prevent efficiency reductions in the 2024 IECC.

Workgroup Recommendation

Proposal # 1239

RED1-78-22

Proponents: Amy Boyce, representing Energy Efficient Codes Coalition (EECC) (amy.boyce@imt.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

TABLE R408.2 CREDITS FOR ADDITIONAL ENERGY EFFICIENCY

Measure Number	Measure Description	Credit Value								
		Climate Zone 0 & 1	Climate Zone 2	Climate Zone 3	Climate Zone 4	Climate Zone 4C	Climate Zone 5	Climate Zone 6	Climate Zone 7	Climate Zone 8
R408.2.1.1(1)	≥2.5% Reduction in total UA	0	0	0	1	1	1	1	1	1
R408.2.1.1(2)	≥5% reduction in total UA	0	1	1	2	2	3	3	3	3
R408.2.1.1(3)	>7.5% reduction in total UA	0	1	2	2	2	3	3	4	4
R408.2.1.2(1)	0.22 U-factor windows	1	2	2	3	3	4	4	4	5
R408.2.1.2(2)	U-factor and SHGC for windows per Table R408.2.1	1	1	1	0	0	0	0	1	2
R408.2.1.3	Cool Roof	TBD	TBD	TBD	TBD	TBD	0	0	0	0
R408.2.2(1)	High performance cooling system option 1	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(2)	High performance cooling system option 2	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(3)	High performance gas furnace option 1	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(4)	High performance gas furnace option 2	0	0	0	0	0	TBD	TBD	TBD	0
R408.2.2(5)	High performance gas furnace and cooling system option 2	TBD	TBD	TBD	TBD	TBD	0	0	0	TBD
R408.2.2(6)	High performance gas furnace and heat pump system option 1	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(7)	High performance gas furnace option 2	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(8)	High performance heat pump system option 1	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(9)	High performance heat pump system option 2	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(10)	High performance heat pump system option 3	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(11)	Ground source heat pump	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(12)	Ductless - Single zone	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(13)	Ductless - Multizone (Non-ducted indoor unit)	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(14)	Ductless – Multizone (Ducted or Mixed)	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.3(1)	Gas-fired storage water heaters	7	6	5	3	3	2	2	3	1
R408.2.3(2)	Gas-fired instantaneous water heaters	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.3(3)	Electric water heaters	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.3(4)	Electric water heaters	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.3(5)	Solar hot water heating system	4	5	6	6	6	6	5	5	4
R408.2.3(6)	Compact hot water distribution	2	2	2	2	2	2	2	2	2
R408.2.4(1)	More efficient distribution system	4	6	7	10	10	12	13	15	16
R408.2.4(2)	100% of ducts in conditioned space	4	6	8	12	12	15	17	19	20
R408.2.4(3)	Reduced total duct leakage	1	1	1	1	1	1	2	2	2
R408.2.5(1)	2 ACH50 air leakage rate with ERV or HRV installed	1	4	5	10	10	13	15	8	8
R408.2.5(2)	2 ACH50 air leakage rate with balanced ventilation	2	3	2	4	4	5	6	6	6

R408.2.5(3)	1.5 ACH50 air leakage rated with ERV or HRV installed	2	4	6	12	12	15	18	11	11
R408.2.5(4)	1 ACH50 air leakage rate with ERV or HRV installed	2	5	6	14	14	17	21	14	14
~~R408.2.6~~	~~Energy efficient appliances~~	~~9~~	~~8~~	~~8~~	~~7~~	~~7~~	~~5~~	~~5~~	~~5~~	~~4~~
R408.2.7	Renewable energy measures	17	16	17	11	11	9	8	7	4
R408.2.9	Demand responsive thermostat	1	1	1	1	1	1	1	1	1

~~**R408.2.6 Energy efficient appliances.**~~ ~~Appliances installed in a dwelling unit shall meet the product energy efficiency specifications listed in Table R408.2.6, or equivalent energy efficiency specifications. Not less than three appliance types from Table R408.2.6 shall be installed for compliance with this section.~~

~~TABLE R408.2.6 APPLICANCE SPECIFICATION REFERENCE DOCUMENT~~

~~Refrigerator~~	~~Energy Star Program Requirements, Product Specification for Consumer Refrigeration Products, Version 5.1 (08/05/2021)~~
~~Dishwasher~~	~~Energy Star Program Requirements for Residential Dishwashers, Version 6.0 (01/29/2016)~~
~~Clothes dryer~~	~~Energy Star Program Requirements, Product Specification for Clothes Dryers, Version 1.1 (05/05/2017)~~
~~Clothes washer~~	~~Energy Star Program Requirements, Product Specification for Clothes Washers, Version 8.1 (02/05/2018)~~

Reason: This proposal helps maintain the efficiency of the 2021 IECC by removing a newly-added credit in Section R408 for appliances. Although we believe efficient appliances can help reduce a household's energy use, a credit for efficient appliances in Section R408 is inappropriate for several reasons:

· Adding appliances would expand the scope of R408 by awarding credit for plug loads, rather than more permanent features of the home. We are concerned that this could lead to future expansions of scope to other plug-in items, rather than maintaining the focus on long-term building efficiency.

· Appliances do not last as long as other improvements in R408, so they cannot guarantee the same long-term efficiency benefits.

· There is substantial free-ridership risk with this credit: Energy Star appliances are ubiquitous, and are likely already being installed in most new homes. To award R408 credit for these appliances, in place of other potential improvements, is a missed opportunity to improve the overall efficiency of the home.

· The credit values for installing only three Energy Star appliances appear to be extremely high. If this option is retained, the credits should be re-evaluated and based on more conservative estimates, especially given the widespread use of Energy Star appliances.

· Code users seeking efficiency credit for appliances should use the Energy Rating Index, where additional stringency requirements and reasonable trade-off backstops are in place.

Section R408 can and should continue to evolve in future editions of the code to incorporate new technologies and advances in building practices. However, new categories of credits should be carefully scrutinized to ensure that they are providing a similar level of efficiency improvement and longevity as the 2021 IECC R408 packages. We do not believe that appliances are an appropriate addition to this section of the code.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This proposal neither increases nor decreases the cost of construction. The R408 credit for appliances is new to the Public Comment Draft, and removing this credit will not affect the cost of construction.

Workgroup Recommendation

Proposal # 1242

RED1-79-22

Proponents: Amy Boyce, representing Energy Efficient Codes Coalition (EECC) (amy.boyce@imt.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

TABLE R408.2 CREDITS FOR ADDITIONAL ENERGY EFFICIENCY

Measure Number	Measure Description	Credit Value								
		Climate Zone 0 & 1	Climate Zone 2	Climate Zone 3	Climate Zone 4	Climate Zone 4C	Climate Zone 5	Climate Zone 6	Climate Zone 7	Climate Zone 8
R408.2.1.1(1)	≥~~2.~~5% Reduction in total UA	0	1 ~~0~~	1 ~~0~~	2 ~~1~~	2 ~~1~~	3 ~~1~~	3 ~~1~~	3 ~~1~~	3 ~~1~~
R408.2.1.1(2)	≥15% reduction in total UA	2 ~~0~~	4 ~~1~~	4 ~~1~~	4 ~~1~~	4 ~~2~~	5 ~~3~~	5 ~~3~~	6 ~~3~~	7 ~~3~~
R408.2.1.1(3)	>30 ~~7.5~~% reduction in total UA	3 ~~0~~	5 ~~1~~	6 ~~2~~	8 ~~2~~	8 ~~2~~	10 ~~3~~	11 ~~3~~	12 ~~4~~	13 ~~4~~
R408.2.1.2(1)	0.22 U-factor windows	1	2	2	3	3	4	4	4	5
R408.2.1.2(2)	U-factor and SHGC for windows per Table R408.2.1	1	1	1	0	0	0	0	1	2
R408.2.1.3	Cool Roof	TBD	TBD	TBD	TBD	TBD	0	0	0	0
R408.2.2(1)	High performance cooling system option 1	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(2)	High performance cooling system option 2	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(3)	High performance gas furnace option 1	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(4)	High performance gas furnace option 2	0	0	0	0	0	TBD	TBD	TBD	0
R408.2.2(5)	High performance gas furnace and cooling system option 2	TBD	TBD	TBD	TBD	TBD	0	0	0	TBD
R408.2.2(6)	High performance gas furnace and heat pump system option 1	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(7)	High performance gas furnace option 2	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(8)	High performance heat pump system option 1	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(9)	High performance heat pump system option 2	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(10)	High performance heat pump system option 3	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(11)	Ground source heat pump	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(12)	Ductless - Single zone	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(13)	Ductless - Multizone (Non-ducted indoor unit)	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(14)	Ductless – Multizone (Ducted or Mixed)	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.3(1)	Gas-fired storage water heaters	7	6	5	3	3	2	2	3	1
R408.2.3(2)	Gas-fired instantaneous water heaters	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.3(3)	Electric water heaters	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.3(4)	Electric water heaters	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.3(5)	Solar hot water heating system	4	5	6	6	6	6	5	5	4
R408.2.3(6)	Compact hot water distribution	2	2	2	2	2	2	2	2	2
R408.2.4(1)	More efficient distribution system	4	6	7	10	10	12	13	15	16
R408.2.4(2)	100% of ducts in conditioned space	4	6	8	12	12	15	17	19	20
R408.2.4(3)	Reduced total duct leakage	1	1	1	1	1	1	2	2	2
R408.2.5(1)	2 ACH50 air leakage rate with ERV or HRV installed	1	4	5	10	10	13	15	8	8
R408.2.5(2)	2 ACH50 air leakage rate with balanced ventilation	2	3	2	4	4	5	6	6	6

R408.2.5(3)	1.5 ACH50 air leakage rated with ERV or HRV installed	2	4	6	12	12	15	18	11	11
R408.2.5(4)	1 ACH50 air leakage rate with ERV or HRV installed	2	5	6	14	14	17	21	14	14
R408.2.6	Energy efficient appliances	9	8	8	7	7	5	5	5	4
R408.2.7	Renewable energy measures	17	16	17	11	11	9	8	7	4
R408.2.9	Demand responsive thermostat	1	1	1	1	1	1	1	1	1

R408.2.1.1 Enhanced envelope performance UA. The proposed total building thermal envelope UA shall be calculated in accordance with Section R402.1.5 and shall meet one of the following:

1. Not less than ~~2.~~5 percent of the total UA of the *building thermal envelope*.
2. Not less than 15 percent of the total UA of the *building thermal envelope*.
3. Not less than 30 ~~7.5~~ percent of the total UA of the *building thermal envelope*.

Reason: This proposal encourages code users to further improve the efficiency of the permanent thermal envelope by awarding credit for UA improvements of 15% and 30% as compared to the prescriptive baseline. We do not oppose the current UA improvement options (2.5%, 5%, 7.5%), but we are concerned that the current options are not differentiated enough from each other and do not capture enough of the potential envelope UA improvements possible. We recommend either adding these additional levels of credit or replacing two of the smaller increments with larger credits (as proposed above). A 15-30% improvement in Total UA is feasible and should be recognized in the code. Credit values are based on an analysis provided by Pacific Northwest National Laboratories.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This proposal neither increases nor decreases the cost of construction. Because the Total UA improvements are among several optional improvements in Section R408, they will not impact the overall cost of construction. We trust that code users will select the optimal combination of options under R408 for code compliance and cost-effectiveness.

Workgroup Recommendation

Proposal # 1252

RED1-80-22

Proponents: Alisa McMahon, representing self (mcmahon.gbac@cox.net)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

TABLE R408.2 CREDITS FOR ADDITIONAL ENERGY EFFICIENCY

Portions of table not shown remain unchanged.

Measure Number	Measure Description	Credit Value								
		Climate Zone 0 & 1	Climate Zone 2	Climate Zone 3	Climate Zone 4	Climate Zone 4C	Climate Zone 5	Climate Zone 6	Climate Zone 7	Climate Zone 8
~~R408.2.6~~	~~Energy efficient appliances~~	~~9~~	~~8~~	~~8~~	~~7~~	~~7~~	~~5~~	~~5~~	~~5~~	~~4~~

R408.2.6 Energy efficient appliances. ~~Appliances installed in a dwelling unit shall meet the product energy efficiency specifications listed in Table R408.2.6, or equivalent energy efficiency specifications. Not less than three appliance types from Table R408.2.6 shall be installed for compliance with this section.~~

TABLE R408.2.6 APPLICANCE SPECIFICATION REFERENCE DOCUMENT

~~Refrigerator~~	~~Energy Star Program Requirements, Product Specification for Consumer Refrigeration Products, Version 5.1 (08/05/2021)~~
~~Dishwasher~~	~~Energy Star Program Requirements for Residential Dishwashers, Version 6.0 (01/29/2016)~~
~~Clothes dryer~~	~~Energy Star Program Requirements, Product Specification for Clothes Dryers, Version 1.1 (05/05/2017)~~
~~Clothes washer~~	~~Energy Star Program Requirements, Product Specification for Clothes Washers, Version 8.1 (02/05/2018)~~

Reason: Because Section R408 is quite incomplete, I am limiting my comment to one item.
I object to the inclusion of appliances and the high level of their proposed points.

Three of the four appliances are not permanent to the building. I have moved refrigerators, clothes dryers and clothes washer many times. In addition, the lifespan of all four is far shorter than the lifespan of our buildings.

Building Science 101:

- Design and build to optimize energy efficiency first.
- Energy efficiency upgrades to the thermal envelope are more easily and cost effectively incorporated during initial construction.

Additional benefits of preserving energy efficiency in the building envelope:

- Improved occupant comfort
- Enhanced building resiliency
- Permanent energy savings for the life of the building
- Energy savings at all times, regardless of weather and time of day, without storage
- Reduced peak power demand

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
Items to be deleted are one of many options.

Workgroup Recommendation

Proposal # 1492

RED1-81-22

Proponents: Steven Rosenstock, representing Edison Electric Institute (srosenstock@eei.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

TABLE R408.2 CREDITS FOR ADDITIONAL ENERGY EFFICIENCY

Measure Number	Measure Description	Credit Value								
		Climate Zone 0 & 1	Climate Zone 2	Climate Zone 3	Climate Zone 4	Climate Zone 4C	Climate Zone 5	Climate Zone 6	Climate Zone 7	Climate Zone 8
R408.2.1.1(1)	≥2.5% Reduction in total UA	0	0	0	1	1	1	1	1	1
R408.2.1.1(2)	≥5% reduction in total UA	0	1	1	2	2	3	3	3	3
R408.2.1.1(3)	>7.5% reduction in total UA	0	1	2	2	2	3	3	4	4
R408.2.1.2(1)	0.22 U-factor windows	1	2	2	3	3	4	4	4	5
R408.2.1.2(2)	U-factor and SHGC for windows per Table R408.2.1	1	1	1	0	0	0	0	1	2
R408.2.1.3	Cool Roof	TBD	TBD	TBD	TBD	TBD	0	0	0	0
R408.2.2(1)	High performance cooling system option 1	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(2)	High performance cooling system option 2	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(3)	High performance gas furnace option 1	~~TBD~~ 0 or n/a	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(4)	High performance gas furnace ~~option 2~~ and cooling system for CZ 5-7 option	~~0~~ n/a	~~0~~ n/a	~~0~~ n/a	~~0~~ n/a	~~0~~ n/a	TBD	TBD	TBD	~~0~~ n/a
R408.2.2(5)	High performance gas furnace and cooling system option 2	TBD	TBD	TBD	TBD	TBD	0	0	0	TBD
R408.2.2(6)	High performance gas furnace and heat pump system option 1	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(7)	High performance gas furnace option 2	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(8)	High performance heat pump system option 1	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(9)	High performance heat pump system option 2	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(10)	High performance heat pump system option 3	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(11)	Ground source heat pump	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(12)	Ductless - Single zone	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(13)	Ductless - Multizone (Non-ducted indoor unit)	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(14)	Ductless – Multizone (Ducted or Mixed)	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.3(1)	Gas-fired storage water heaters	7	6	5	3	3	2	2	3	1
R408.2.3(2)	Gas-fired instantaneous water heaters	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.3(3)	Electric water heaters	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.3(4)	Electric water heaters	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.3(5)	Solar hot water heating system	4	5	6	6	6	6	5	5	4
R408.2.3(6)	Compact hot water distribution	2	2	2	2	2	2	2	2	2
R408.2.4(1)	More efficient distribution system	4	6	7	10	10	12	13	15	16
R408.2.4(2)	100% of ducts in conditioned space	4	6	8	12	12	15	17	19	20
R408.2.4(3)	Reduced total duct leakage	1	1	1	1	1	1	2	2	2
R408.2.5(1)	2 ACH50 air leakage rate with ERV or HRV installed	1	4	5	10	10	13	15	8	8
R408.2.5(2)	2 ACH50 air leakage rate with balanced ventilation	2	3	2	4	4	5	6	6	6
R408.2.5(3)	1.5 ACH50 air leakage rated with ERV or HRV installed	2	4	6	12	12	15	18	11	11
R408.2.5(4)	1 ACH50 air leakage rate with ERV or HRV installed	2	5	6	14	14	17	21	14	14

	installed									
R408.2.6	Energy efficient appliances	9	8	8	7	7	5	5	5	4
R408.2.7	Renewable energy measures	17	16	17	11	11	9	8	7	4
R408.2.9	Demand responsive thermostat	1	1	1	1	1	1	1	1	1

n/a - not applicable

Reason: This proposal updates a measure description to make it more clear about what the option is, and replaces "TBD" with a numerical value or "n/a" where the measure is not available for energy credits.
This is a "placeholder" to make sure that the values in the table get updated and measure descriptions are more clear to prevent any confusion. This code should not be published with "TBD" in any part of the table.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This change attempts to update the energy credit table and does not affect the cost of construction.

Workgroup Recommendation

Proposal # 1073

RED1-82-22

Proponents: Aaron Phillips, representing Asphalt Roofing Manufacturers Association (aphillips@asphaltroofing.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R408.2.1 Enhanced envelope options. The *building thermal envelope* shall meet the requirements of <u>one or more of</u> the following:

1. Section R408.2.1.1 or R408.2.1.2.
2. Section R408.2.1.3.

2024 ENERGY Chapter11

Revise as follows:

N1108.2.1 Enhanced envelope options. The *building thermal envelope* shall meet <u>the requirements of one or more of</u> the following:

1. Section N1108.2.1.1 or N1108.2.1.2
2. Section N1108.2.1.3

Reason: The existing language of Section R408.2.1 (N1108.2.1) for the enhanced envelope options indicates that both items 1 and 2 are triggered when an enhanced envelope option credit is selected. This comment clarifies that either item 1 or item 2 or both may be selected. This comment also removes a discrepancy in the language of the IECC and IRC Chapter 11.

Cost Impact: The code change proposal will decrease the cost of construction.
For situations where enhanced envelope credit options are desired, permitting selection of one option without requiring other provisions at the same time may reduce cost of construction.

Workgroup Recommendation

Proposal # 956

RED1-83-22

Proponents: Jay Crandell, representing Foam Sheathing Committee of the American Chemistry Council (jcrandell@aresconsulting.biz)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

TABLE R408.2 CREDITS FOR ADDITIONAL ENERGY EFFICIENCY

Portions of table not shown remain unchanged.

Measure Number	Measure Description	Credit Value								
		Climate Zone 0 & 1	Climate Zone 2	Climate Zone 3	Climate Zone 4	Climate Zone 4C	Climate Zone 5	Climate Zone 6	Climate Zone 7	Climate Zone 8
R408.2.1.1(1)	≥2.5% Reduction in total UA	0	0	0	1	1	1	1	1	1
R408.2.1.1(2)	≥5% reduction in total UA	0	1	1	2	2	3	3	3	3
R408.2.1.1(3)	>7.5% reduction in total UA	0	1	2	2	2	3	3	4	4
R408.2.1.1(4)	>10% reduction in total UA	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.1.1(5)	> 15% reduction in total UA	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.1.1(6)	>20% reduction in total UA	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD

R408.2.1.1 Enhanced envelope performance ~~UA~~. The proposed total building thermal envelope *thermal conductance* ~~UA~~ shall be calculated for the proposed building in accordance with Section R402.1.5 and it shall be reduced by not less than the percentage indicated in Table R408.2 in comparison to the reference building. ~~shall meet one of the following:~~

1. ~~Not less than 2.5 percent of the total UA of the *building thermal envelope*.~~
2. ~~Not less than 5 percent of the total UA of the *building thermal envelope*.~~
3. ~~Not less than 7.5 percent of the total UA of the *building thermal envelope*.~~

Reason: This proposal expands the building thermal envelope additional efficiency credits in Table R408.2 to include UA reductions of 10%, 15%, and 20%. The current credits are small because the addressed UA reductions are small (7.5% or less). Buildings can be be relatively easily constructed with a 10% UA reduction or more and credits should be provided for those cases. Many buildings are already doing this to minimize energy consumption, use smaller HVAC equipment, and maximize energy efficiency or effectively utilize renewable energy resources (or minimize impact of using fossil fuel energy sources). The values in the table are shown as "TBD" because the actual credits should be based on an analysis as done for other values in the table for consistency. Modification would be welcome to further improve this proposal, such as eliminating the 2.5% and 7.5% categories while retaining 5%, 10%, 15%, and 20% (possibly then also adding 25% or 30%) to cover a reasonable range of credits for building thermal envelope enhancements.
Finally, Section R408.2.1 is revised to align terminology with that used in Section R402.1.5 to address "total building thermal envelope thermal conductance" as a more comprehensive treatment of the Total UA concept that the code had previously used. Also, the list of UA % improvements is deleted in favor of referencing the same information already located in Table R408.2.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
Use of the building thermal envelope additional efficiency credits is optional and this proposal is only expanding the options available (which could actually reduce cost for complying with R408 for buildings which have a UA reduced by more than 7.5%). So, at worst, this proposal has no cost impact and, at best, it could reduce cost for some buildings by affording an appropriate amount of credits for a significantly improved building thermal envelope.

Workgroup Recommendation

Proposal # 1341

RED1-84-22

Proponents: Amy Boyce, representing Energy Efficient Codes Coalition (EECC) (amy.boyce@imt.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

TABLE R408.2 CREDITS FOR ADDITIONAL ENERGY EFFICIENCY

Portions of table not shown remain unchanged.

Measure Number	Measure Description	Credit Value								
		Climate Zone 0 & 1	Climate Zone 2	Climate Zone 3	Climate Zone 4	Climate Zone 4C	Climate Zone 5	Climate Zone 6	Climate Zone 7	Climate Zone 8
R408.2.1.1(1)	≥2.5% Reduction in total UA	0	0	0	1	1	1	1	1	1
R408.2.1.1(2)	≥5% reduction in total UA	0	1	1	2	2	3	3	3	3
R408.2.1.1(3)	>7.5% reduction in total UA	0	1	2	2	2	3	3	4	4
R408.2.1.2(1)	0.22 U-factor windows	1	2	2	3	3	4	4	4	5
R408.2.1.2(2)	U-factor and SHGC for windows per Table R408.2.1	~~1~~ TBD	~~1~~ TBD	~~1~~ TBD	~~0~~ TBD	~~0~~ TBD	~~0~~ TBD	~~0~~ TBD	~~1~~ TBD	~~2~~ TBD
R408.2.1.3	Cool Roof	TBD	TBD	TBD	TBD	TBD	0	0	0	0
R408.2.2(1)	High performance cooling system option 1	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(2)	High performance cooling system option 2	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(3)	High performance gas furnace option 1	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(4)	High performance gas furnace option 2	0	0	0	0	0	TBD	TBD	TBD	0
R408.2.2(5)	High performance gas furnace and cooling system option 2	TBD	TBD	TBD	TBD	TBD	0	0	0	TBD
R408.2.2(6)	High performance gas furnace and heat pump system option 1	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(7)	High performance gas furnace option 2	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(8)	High performance heat pump system option 1	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(9)	High performance heat pump system option 2	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(10)	High performance heat pump system option 3	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(11)	Ground source heat pump	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(12)	Ductless - Single zone	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(13)	Ductless - Multizone (Non-ducted indoor unit)	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(14)	Ductless – Multizone (Ducted or Mixed)	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.3(1)	Gas-fired storage water heaters	7	6	5	3	3	2	2	3	1
R408.2.3(2)	Gas-fired instantaneous water heaters	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.3(3)	Electric water heaters	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.3(4)	Electric water heaters	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.3(5)	Solar hot water heating system	4	5	6	6	6	6	5	5	4
R408.2.3(6)	Compact hot water distribution	2	2	2	2	2	2	2	2	2
R408.2.4(1)	More efficient distribution system	4	6	7	10	10	12	13	15	16
R408.2.4(2)	100% of ducts in conditioned space	4	6	8	12	12	15	17	19	20
R408.2.4(3)	Reduced total duct leakage	1	1	1	1	1	1	2	2	2
R408.2.5(1)	2 ACH50 air leakage rate with ERV or HRV installed	1	4	5	10	10	13	15	8	8
[illegible]	2 ACH50 air leakage rate with	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

R408.2.5(2)	balanced ventilation	2	3	2	4	4	5	6	6	6
R408.2.5(3)	1.5 ACH50 air leakage rated with ERV or HRV installed	2	4	6	12	12	15	18	11	11
R408.2.5(4)	1 ACH50 air leakage rate with ERV or HRV installed	2	5	6	14	14	17	21	14	14
R408.2.6	Energy efficient appliances	9	8	8	7	7	5	5	5	4
R408.2.7	Renewable energy measures	17	16	17	11	11	9	8	7	4
R408.2.9	Demand responsive thermostat	1	1	1	1	1	1	1	1	1

R408.2.1.2 Improved fenestration. Vertical fenestration shall meet one of the following:

1. U-factor equal to or less than 0.22
2. U-factor and SHGC equal or less than that specified in Table R408.2.1.2

Revise as follows:

TABLE R408.2.1.2 IMPROVED FENESTRATION

Climate Zone	Fenestration U-factor	Fenestration SHGC
0	~~0.32~~ 0.30	0.23
1	~~0.32~~ 0.30	0.23
2	0.30	0.23
3	~~0.25~~ 0.28	~~0.25~~ 0.23
4	~~NA~~ 0.28	~~NA~~ 0.40
5	~~NA~~ 0.26	NA
6	~~NA~~ 0.26	NA
7 and 8	0.25	NA

Reason: This proposal improves the draft 2024 IECC by encouraging moderate improvements in fenestration U-factor and SHGC in all climate zones. It builds upon a credit adopted as part of REPI-18, but with adjustments that parallel the updated prescriptive fenestration U-factor requirements adopted as part of REPI-27. The modifications are as follows:

· For climate zones 0-2, the maximum fenestration U-factor is set at 0.30, which is currently available and commonly installed in every climate zone of the U.S.

· For climate zones 3-8, the maximum fenestration U-factor is set at 0.02 lower than the prescriptive U-factors as modified by REPI-27. This will provide a credit across all climate zones.

· In climate zone 3, where the U-factor is increased from 0.25 to 0.28, a lower SHGC is specified. And in climate zone 4, a 0.40 SHGC is specified (which is consistent with the prescriptive requirement).

Code users seeking a larger credit may still choose R408.2.1.2 option 1 (0.22 U-factor in all climate zones), which is close to the Energy Star Most Efficient specification. But we believe it is worthwhile to offer an efficiency credit for a reasonable improvement over the updated prescriptive fenestration requirement, but not yet at levels of efficiency that would require triple-pane windows.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
Because this proposal modifies one of many options that may be selected by the code user, it will not increase or decrease the cost of construction.

Workgroup Recommendation

Proposal # 1271

RED1-85-22

Proponents: Fredric Zwerg, representing Southwest Gas Corporation (fredric.zwerg@swgas.com)

2024 International Energy Conservation Code [RE Project]

Delete without substitution:

~~TABLE R408.2 CREDITS FOR ADDITIONAL ENERGY EFFICIENCY~~

~~Measure Number~~	~~Measure Description~~	~~Credit Value~~								
		~~Climate Zone 0 & 1~~	~~Climate Zone 2~~	~~Climate Zone 3~~	~~Climate Zone 4~~	~~Climate Zone 4C~~	~~Climate Zone 5~~	~~Climate Zone 6~~	~~Climate Zone 7~~	~~Climate Zone 8~~
~~R408.2.1.1(1)~~	~~≥2.5% Reduction in total UA~~	~~0~~	~~0~~	~~0~~	~~1~~	~~1~~	~~1~~	~~1~~	~~1~~	~~1~~
~~R408.2.1.1(2)~~	~~≥5% reduction in total UA~~	~~0~~	~~1~~	~~1~~	~~2~~	~~2~~	~~3~~	~~3~~	~~3~~	~~3~~
~~R408.2.1.1(3)~~	~~>7.5% reduction in total UA~~	~~0~~	~~1~~	~~2~~	~~2~~	~~2~~	~~3~~	~~3~~	~~4~~	~~4~~
~~R408.2.1.2(1)~~	~~0.22 U-factor windows~~	~~1~~	~~2~~	~~2~~	~~3~~	~~3~~	~~4~~	~~4~~	~~4~~	~~5~~
~~R408.2.1.2(2)~~	~~U-factor and SHGC for windows per Table R408.2.1~~	~~1~~	~~1~~	~~1~~	~~0~~	~~0~~	~~0~~	~~0~~	~~1~~	~~2~~
~~R408.2.1.3~~	~~Cool Roof~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~0~~	~~0~~	~~0~~	~~0~~
~~R408.2.2(1)~~	~~High performance cooling system option 1~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~
~~R408.2.2(2)~~	~~High performance cooling system option 2~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~
~~R408.2.2(3)~~	~~High performance gas furnace option 1~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~
~~R408.2.2(4)~~	~~High performance gas furnace option 2~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~TBD~~	~~TBD~~	~~TBD~~	~~0~~
~~R408.2.2(5)~~	~~High performance gas furnace and cooling system option 2~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~0~~	~~0~~	~~0~~	~~TBD~~
~~R408.2.2(6)~~	~~High performance gas furnace and heat pump system option 1~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~
~~R408.2.2(7)~~	~~High performance gas furnace option 2~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~
~~R408.2.2(8)~~	~~High performance heat pump system option 1~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~
~~R408.2.2(9)~~	~~High performance heat pump system option 2~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~
~~R408.2.2(10)~~	~~High performance heat pump system option 3~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~
~~R408.2.2(11)~~	~~Ground source heat pump~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~
~~R408.2.2(12)~~	~~Ductless - Single zone~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~
~~R408.2.2(13)~~	~~Ductless - Multizone (Non-ducted indoor unit)~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~
~~R408.2.2(14)~~	~~Ductless – Multizone (Ducted or Mixed)~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~
~~R408.2.3(1)~~	~~Gas-fired storage water heaters~~	~~7~~	~~6~~	~~5~~	~~3~~	~~3~~	~~2~~	~~2~~	~~3~~	~~1~~
~~R408.2.3(2)~~	~~Gas-fired instantaneous water heaters~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~
~~R408.2.3(3)~~	~~Electric water heaters~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~
~~R408.2.3(4)~~	~~Electric water heaters~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~
~~R408.2.3(5)~~	~~Solar hot water heating system~~	~~4~~	~~5~~	~~6~~	~~6~~	~~6~~	~~6~~	~~5~~	~~5~~	~~4~~
~~R408.2.3(6)~~	~~Compact hot water distribution~~	~~2~~	~~2~~	~~2~~	~~2~~	~~2~~	~~2~~	~~2~~	~~2~~	~~2~~
~~R408.2.4(1)~~	~~More efficient distribution system~~	~~4~~	~~6~~	~~7~~	~~10~~	~~10~~	~~12~~	~~13~~	~~15~~	~~16~~
~~R408.2.4(2)~~	~~100% of ducts in conditioned space~~	~~4~~	~~6~~	~~8~~	~~12~~	~~12~~	~~15~~	~~17~~	~~19~~	~~20~~
~~R408.2.4(3)~~	~~Reduced total duct leakage~~	~~1~~	~~1~~	~~1~~	~~1~~	~~1~~	~~1~~	~~2~~	~~2~~	~~2~~
~~R408.2.5(1)~~	~~2 ACH50 air leakage rate with ERV or HRV installed~~	~~1~~	~~4~~	~~5~~	~~10~~	~~10~~	~~13~~	~~15~~	~~8~~	~~8~~
~~R408.2.5(2)~~	~~2 ACH50 air leakage rate with balanced ventilation~~	~~2~~	~~3~~	~~2~~	~~4~~	~~4~~	~~5~~	~~6~~	~~6~~	~~6~~
~~R408.2.5(3)~~	~~1.5 ACH50 air leakage rated with ERV or HRV installed~~	~~2~~	~~4~~	~~6~~	~~12~~	~~12~~	~~15~~	~~18~~	~~11~~	~~11~~
[illegible]	~~1 ACH50 air leakage rate with ERV or~~	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

~~R408.2.5(4)~~	~~HRV installed~~	~~2~~	~~5~~	~~6~~	~~14~~	~~14~~	~~17~~	~~21~~	~~14~~	~~14~~
~~R408.2.6~~	~~Energy-efficient appliances~~	~~9~~	~~8~~	~~8~~	~~7~~	~~7~~	~~5~~	~~5~~	~~5~~	~~4~~
~~R408.2.7~~	~~Renewable energy measures~~	~~17~~	~~16~~	~~17~~	~~11~~	~~11~~	~~9~~	~~8~~	~~7~~	~~4~~
~~R408.2.9~~	~~Demand responsive thermostat~~	~~1~~	~~1~~	~~1~~	~~1~~	~~1~~	~~1~~	~~1~~	~~1~~	~~1~~

Reason: Delete table as noted. Why is "TBD" listed? If you want this table to be critically reviewed it must have no "TBD" shown. Until it does, delete all.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
No cost impact

Workgroup Recommendation

Proposal # 1132

RED1-86-22

Proponents: Amy Boyce, representing Energy Efficient Codes Coalition (EECC) (amy.boyce@imt.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R408.2.9 ~~Opaque walls~~ Electrification Credit. For buildings in climate zones ~~4 and~~ 5 through 8, where ~~the maximum U-factor of 0.060 shall be permitted to be used for wood frame walls for compliance with Table R402.1.2 where complying with one or more of the following:~~

~~1.~~ ~~Primary~~ primary space heating is provided by a heat pump that meets one of the efficiencies in R408.2.2 , an additional 2 credits shall be applied to the project.

~~2.~~ For buildings in all climate zones, where all ~~All~~ installed water heaters are heat pumps that meet one of the efficiencies in R408.2.3 , an additional 3 credits shall be applied to the project.

~~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 R408.2.7.~~

Reason: Section R408 Additional Efficiency Options was designed to provide options for “additional” efficiency beyond the base prescriptive path—not to serve as a means of reducing the efficiency of the prescriptive path by trading off efficiency measures. Such trade-offs are why Sections R405 and R406 exist and why so many changes were made to add flexibility there and also divorce these compliance paths from the additional efficiency credits of R408. Section R408.2.9 of the current public review draft uses Section R408 Additional Efficiency Requirements as a means to trade off prescriptive wall efficiency requirements rather than to supplement the minimum prescriptive efficiency measures. Thus, Section R408.2.9 as currently drafted is inconsistent with the use of additional efficiency measures in Section R408. However, the electrification aspect of R408.2.9 has merit and we could support preserving it with a reasonable incentive that does not negatively impact efficiency in a way that would allow electrification and efficiency to work hand in hand.
To remedy the above concern, this public comment changes R408.2.9 to focus it on electrification and incentives to electrify (e.g., use heat pumps for heating in climate zone 5-8 and use heat pump water heaters in any climate zone). Heat pumps are already commonly used in Climate Zone 4, but not so much in Climate Zone 5-8 which is where encouraging electrification will have the most benefit with the least free-ridership (trading off energy efficiency for using a heat pump that would already typically be used in CZ 4). In this manner, cost-effective minimum efficiency requirements are not traded off in pursuit of electrification with the negative effect of increasing energy use overall. Consequently, goals for both efficiency and electrification are upheld without using one against the other.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This proposal will neither increase nor decrease the cost of construction relative to the 2021 code. But it will incentivize electrification (and associated carbon emissions savings, which the proposed electrification credits are based on) while also preserving the energy efficiency of the building envelope as cost-justified for the 2021 code.

Although we do not believe it is necessary to demonstrate the cost-effectiveness of current IECC provisions, a close look at the costs and energy savings related to the wall insulation requirements in the 2021 IECC shows that these measures are clearly cost-effective in Climate Zone 5 and marginally so in Climate Zone 4, even considering the recent changes in federal minimum equipment efficiencies for 2023. When evaluated using reasonable first costs estimates and weighting of construction practices as well as reasonable annual energy use savings estimates, the wall insulation requirements in Climate Zone 5 pass the IECC-R economic test for all but the highest 7% discount rate condition without social cost of carbon included. Findings are similar even when using a R408.2.2 higher-efficiency heat pump such that trading-off wall insulation (energy efficiency) for electrification as the current text in R408.2.9 promotes is unjustified and leaves cost-effective energy savings (and carbon emission savings) on the table. Electrification and energy efficiency must work together and not at odds with each other. In Climate Zone 4, the cost-effectiveness differs in that it passes the IECC-R economic criteria at both the 7% and 3% discount rates when a very low social cost of carbon is used. If a more realistic value is used, then the significant life-cycle economic benefits would be even better represented. As particularly relevant to Section R408.2.9, the current Public Comment Draft uses a “free trade” allowance to revert back to pre-2021 IECC-R wall insulation values. This “free trade” is particularly problematic in CZ 4 where, based on 2015 DOE data, 58% of housing starts already use heat pumps. It is for this reason (in addition to those enumerated above in the reason statement) that Section R408.2.9 is repurposed by this proposal to retain only its most valuable concept which is to encourage electrification in CZ’s 5 through 8. By keeping the wall insulation at 2021 IECC-R prescriptive levels and switching to heat pumps in CZ’s 5-8 such that both energy efficiency and electrification work together, significant economic benefits (as discussed above) and associated carbon emissions savings were found: 410 lbs of CO_2e/yr for CZ 4 and 540 lbs of CO_2e/yr for CZ 5. We also are not against further electrification for Climate Zone 4 and are open to modifications to properly assign it credit for cases where gas furnaces are currently being used, but not at the expense of long-term energy efficiency.

Workgroup Recommendation

RED1-87-22 Part I

Proponents: Fredric Zwerg, representing Southwest Gas Corporation (fredric.zwerg@swgas.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

RC103.1 ERI compliance (Replace R4062). 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 90.2 Table 6-1 without the use of on-site power production (OPP),

   2.2 The requirements of Sections R402.4.1.1, R402.4.1.2, R406.3, ~~R404.5 (Electric Readiness), R404.7 (Electric Vehicle Power Transfer Infrastructure),~~ and

   2.3 The maximum ERI including adjusted OPP of Table RC103.3 determined in accordance with RC103.3.

Reason: Delete the three electrification policy references since they are not energy conservation related. These requirements will add cost to construction.

Cost Impact: The code change proposal will decrease the cost of construction.
By deleting these three references, the cost of construction will decrease. All of these references will not guarantee any energy savings. According to the February 2021 Building Electrification study done by the Home Innovation Research Labs for the National Association of Home Builders (NAHB), home electrification is more expensive. Depending on the climate zone, it can range between $3,832 to $15,000 higher construction cost than a baseline mixed use (gas & electric) home. There is no justification for requiring homes to have electric readiness, solar PV readiness or EV readiness expecting sometime in the future, if at all, the current resident(s) decide they want it. This is an energy code, not a policy code.

Please note I tried to attach the NAHB report on electrification and it came back as a 32 bit error. I was able to upload it on my Electric Readiness proposal.

Workgroup Recommendation

Proposal # 1144

RED1-87-22 Part II

Proponents: Fredric Zwerg, representing Southwest Gas Corporation (fredric.zwerg@swgas.com)

2024 ENERGY Chapter11

Revise as follows:

AX103.1 ERI compliance (Replace N11062). Compliance based on the ERI requires that the rated design meets one of the following:

1. The requirements of the sections indicated within Table N1106.2 and Sections N1106.3 through N1106.7, or
2. The requirements of ASHRAE/IES Standard 90.2, including:

    2.1 The ERI requirements of ASHRAE/IES 90.2 Table 6-1 without the use of on-site power production (OPP),List item content...

    2.2 The requirements of Sections N1102.4.1.1, N1102.4.1.2, N1106.3, ~~N1104.5 (Electric Readiness), N1104.7 (Electric Vehicle Power Transfer Infrastructure),~~ and

    2.3 The maximum ERI including adjusted OPP of Table AX103.3 determined in accordance with AX103.3.

Reason: Delete the three electrification references. These are electrification policy proposals and not energy related requirements.

Cost Impact: The code change proposal will decrease the cost of construction.
Deleting the three electrification references will reduce the construction cost.

Workgroup Recommendation

Proposal # 1179

RED1-88-22

Proponents: Amy Boyce, representing Energy Efficient Codes Coalition (EECC) (amy.boyce@imt.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

RC103.3 Energy Rating Index zero net energy score. The Energy Rating Index (ERI) not including renewable energy resources shall be determined in accordance with RESNET/ICC 301.The Energy Rating Index (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 RC406.4.1, on-site power production (OPP) shall be adjusted in accordance with Equation RC-1. Where off-site renewable energy is procured to comply with Equation RC-1, the building thermal envelope shall be required to comply with the requirements of Section R402.

$$\text{Adjusted OPP} = OPP_{kWh} + CREF_{kWh} + PPPA_{kWh} + FPPA_{kWh}$$ **(Equation RC-1)**

OPP_{kWh} = Annual electrical energy from on-site renewable energy, in units of kilowatt-hours (kWh).
$CREF_{kwh}$ = Annual electrical energy from a community renewable energy facility (CREF), in units of kilowatt-hours (kWh).
$PPPA_{kwh}$ = Where not included as OPP, the annual electrical energy contracted from a physical renewable energy power purchase agreement, in units of kilowatt-hours (kWh).
$FPPA_{kwh}$ = 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).

Reason: This public comment would establish minimum envelope efficiency requirements for projects that use offsite renewable energy to comply with the zero net energy provisions of Appendix RC. Appendix RC permits code users to combine on-site and off-site renewable energy to achieve zero net energy, but does not place any new limitations on which trade-offs are allowed in base code compliance. We are concerned that buildings constructed with under-performing thermal envelopes will drive an increase in the amount of energy that should be offset, and thus run counter to the intent of Appendix RC. This becomes an even bigger problem when inefficient buildings are using market-purchased renewable energy to compensate for increased energy use (and competing with others in the market for existing renewable energy rather than causing the installation of new renewable energy that otherwise would not have been available). Moreover, while the building thermal envelope components can be expected to last for the lifetime of the building, purchased offsite energy cannot provide the same long-term guarantees. This will frustrate the nation's efforts to slow or reverse the growth of energy demand, and to convert generation to low- or zero-carbon sources. This public comment does not prohibit or limit the purchase of offsite renewable energy to satisfy the requirements of Appendix RC, but it does require that these buildings not consume excessive amounts of energy due to poor envelopes where offsite energy is purchased to offset energy use.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This public comment does not increase the baseline stringency of Appendix RC, but merely limits trade-offs between thermal envelope efficiency and offsite renewable energy, within an appendix that already requires compliance with base code requirements. As a result, whether costs of construction increase or decrease ultimately depends on choices made by the code user.

Workgroup Recommendation

Proposal # 1362

RED1-89-22

Proponents: Diana Burk, representing New Buildings Institute (diana@newbuildings.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

RC103.3 Energy Rating Index zero net energy score. The Energy Rating Index (ERI) not including renewable energy resources shall be determined in accordance with RESNET/ICC 301.The Energy Rating Index (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 RC406.4.1, on-site power production (OPP) shall be adjusted in accordance with Equation RC-1.

$$\text{Adjusted OPP} = OPP_{kWh} + CREF_{kWh} + \frac{CL_{yrs}}{15}\left(PPPA_{kWh} + FPPA_{kWh}\right)$$

(Equation RC-1)

where:

OPP_{kWh} = Annual electrical energy from on-site renewable energy, in units of kilowatt-hours (kWh).
CL_{yrs} = Length of renewable energy contract (years).
$CREF_{kwh}$ = Annual electrical energy from a community renewable energy facility (CREF), in units of kilowatt-hours (kWh).

$PPPA_{kwh}$ = Where not included as OPP, the annual electrical energy contracted from a physical renewable energy power purchase agreement, in units of kilowatt-hours (kWh).

$FPPA_{kwh}$ = 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).

RC103.3.1 ~~Power purchase agreement~~ 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 10 years. The contract shall be structured to survive a partial or full transfer of ownership of the building property.

Reason: This amendment creates greater equivalence between the amount of power procured by an off-site renewable energy contract and that provided throughout the life of an on-site renewable energy system, which can operate for up to 25-30 years. It requires buildings with contract lengths shorter than 15 years to purchase the same amount of power over the shorter contract length as would be purchased in a 15-year contract or produced in 15 years by an onsite system. This approach parallels the draft commercial 2024 IECC which requires building owners with contract lengths between 10 and 15 years to procure an equivalent total amount of renewable energy as building owners with a 15-year contract. Finally, this amendment amends the section title to be consistent with a similar section title in the commercial IECC.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This code change proposal will neither increase or decrease the cost of construction.

Workgroup Recommendation

Proposal # 1072

RED1-90-22

Proponents: Steven Cowen, representing Black Hills Energy

2024 International Energy Conservation Code [RE Project]

Revise as follows:

APPENDIX ~~RE~~
~~ALL-ELECTRIC RESIDENTIAL BUILDINGS~~

~~RE101~~
~~GENERAL~~

~~**RE101.1 Intent.** The intent of this Appendix 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.~~

~~**RE101.2 Scope.** This appendix applies to new residential buildings.~~

~~RE102~~
~~GENERAL DEFINTITIONS~~

~~**RE102.1 . 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 and/or lighting that uses fuel gas or fuel oil.~~
~~**EQUIPMENT.** Piping, ducts, vents, control devices and other components of systems other than appliances 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.~~
~~**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).~~

~~RE103~~
~~ALL-ELECTRIC RESIDENTIAL BUILDINGS~~

~~**RE103.1 Application.** Residential buildings shall be *all-electric buildings* and comply with Section R401.2.5 and either Sections R401.2.1, R401.2.2, R401.2.3 or R401.2.4.~~

Reason: At Black Hills Energy, we provide safe, reliable and cost-effective natural gas and electric service to over 1.3 million customers in eight states. Our mission of improving life with energy means we must be ready to make tomorrow even better than today. That is why we are committed to creating a cleaner energy future which builds upon our responsibility to provide the safe, reliable and cost-effective energy that improves our customers' lives
Building codes should not be utilized as a path for eliminating the energy access of Americans for their homes. Provisions in a building code such as electric-only construction explicitly eliminates affordable, reliable energy options for customers that best suit their needs, budgets and energy accessibility. Further, this provision also does not guarantee a reduction in energy consumption.

Black Hills Energy supports, and is a partner in, pursuing all sensible paths to reducing emissions and providing affordable, reliable energy for our customers today and tomorrow. Our natural gas systems are among the most advanced in the industry, and we continue to invest in clean and modern energy. This year we announced a new commitment to achieve Net Zero emissions by 2035 for our natural gas distribution system. This target replaces our previous commitment of a 50% reduction in GHG emissions intensity for mains and services by 2035, doubling our reduction target and expanding the boundary of the goal to all sources of emissions in our distribution system.

We have continued to achieve progress towards our goal to reduce electric utility emission intensity 40% by 2030 and 70% by 2040, already reducing emissions by more than a third since 2005.

Sustainably reducing greenhouse gas emissions will require continued efforts to reduce emissions from the natural gas sector; foster innovation of clean fuels, such as renewable natural gas and hydrogen; continued integration of clean energy sources like renewables and natural gas; utilization of our country's energy delivery infrastructure, and careful consideration of the impact to Americans.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This proposal removes a new provision.

Workgroup Recommendation

Proposal # 1268

RED1-91-22

Proponents: Michael Tillou, representing Pacific Northwest National Lab (michael.tillou@pnnl.gov)

2024 International Energy Conservation Code [RE Project]

Add new text as follows:

RP
On-Site Renewable Energy

RP101 SCOPE. These provisions shall be applicable for new construction where on-site renewable energy is required.

RP102 GENERAL DEFINITION. POTENTIAL SOLAR ZONE AREA. The combined area of any steep-sloped roofs oriented between 90 degrees and 300 degrees of true north and any low-sloped roofs where the *annual solar access* is 70 percent or greater.
ANNUAL SOLAR ACCESS. 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 building shall not be included in the determination of *annual solar access*. Shading from existing permanent natural or person-made obstructions that are external to the building, including but not limited to trees, hills, and adjacent structures, shall be considered for *annual solar access* calculations.

RP103
ON-SITE RENEWABLE ENERGY

RP103.1 General. New buildings shall shall comply with the requirements of RP103.1 through RP103.6

RP103.2 One and two family dwellings and townhouses and other R3 Occupancies. Install an on-site renewable energy system with a nameplate DC power rating measured under standard test conditions, of not less than 2kW.

Exceptions:

1. A building with a permanently installed domestic solar water heating system with a solar savings fraction of not less than 0.5.
2. A building in climate zone 4C, 5C or 8
3. A building where the *potential solar zone area* is less than 300 square feet (28 m^2)

RP103.3 Group R2 and R4 Occupancies. Buildings containing Group R-2 or R-4 shall install an on-site renewable energy system with a peak rated capacity calculated to be of not less than 0.75 W/ft2 multiplied by the gross conditioned floor area.

Exceptions:

1. A building with a permanently installed domestic solar water heating system with a solar savings fraction of not less than 0.5.
2. A building in climate zone 8.
3. A building where the *potential solar zone area* is less than 300 square feet(28 m^2).

RP103.4 Renewable energy certificate (REC) documentation. Where *RECs* are associated with *renewable energy* power production required by Section RP103.2 or RP103.3, documentation shall comply with Section R404.4 Renewable energy certificate (REC) documentation.

RP103.5 Total Building Performance. Where new buildings demonstrate compliance using Section R405 Total Building Performance, the applicable requirements of RP103.2, RP103.3 and RP103.4 shall be met.

RP103.6 Energy Rating Index. Where new buildings demonstrate compliance using Section R406 Energy Rating Index, the applicable requirements of RP103.2, RP103.3 and RP103.4 shall be met.

Reason: On-site electricity generation using photovoltaics is a key technology for reducing greenhouse gas emissions associated with Commercial and Residential buildings. According to the most recent assessment by the National Renewable Energy Lab (NREL) the cost of installed photovoltaics in 2020 was 3% lower than in 2019 and 65-70% lower than the cost of similar sized systems in 2010. With the continued drop in cost of installing on-site PV the cost per kilowatt hour of PV generated electricity is at parity with grid purchased electricity in many States throughout the country. This proposal describes requirements for prescriptive solar PV that must be installed at the time of construction. Analysis by PNNL shows that on-site renewable electricity generation is cost effective across all low-rise multifamily buildings and most single family and one or two unit townhouses. The analysis was done using each of the Residential prototypes in each ASHRAE climate zone. The capacity requirements were established by calculating the highest on-site solar PV capacity that limited electricity export back to the grid. The threshold used for determining these capacities was a grid export limit of less than 0.5% of total annual building electricity consumption. A review of the hourly results showed it was unrealistic to set a hard limit of zero overproduction. When calculating cost effectiveness no credit was taken for electricity that was exported back to the grid. The calculation of grid exports was done on an hourly basis. The proposed requirements reduce purchased energy from the electrical grid which will help reduce green house gas emissions and energy costs for building owners.

PVs provide substantial benefits to the consumer and society by helping to reduce GHG emissions associated with electricity generation. PV market growth combined with a cleaner grid will support goals of reduced GHG emissions established across the U.S. and others by federal agencies, as well as many states and local governments.

This public comment is in direct response to the feedback provided by the full Residential Committee that REPI-114 be brought back as an optional Appendix.

Cost Impact: The code change proposal will increase the cost of construction.
PNNL prepared a cost effectiveness analysis of the proposed changes as part of the original REPI-114 submission in October 2021. This original analysis of residential building solar PV cost effectiveness was calculated using the Life Cycle Cost methodology established by Pacific Northwest National Lab for determining National and State cost effectiveness of the 2021 International Energy Conservation Code. The DOE methodology accounts for the benefits of energy-efficient home construction over the life of a typical mortgage, balancing initial costs against longer term energy savings. The Life-Cycle Cost methodology provides a full accounting over a 30-year period of the cost savings, considering energy savings, the initial investment financed through increased mortgage costs, tax impacts, and residual values of energy efficiency measures. The installed cost of solar PV was based on costs reported in the U.S. Solar Photovoltaic System and Energy Storage Cost Benchmark: Q1 2020 published by NREL in 2021. Installed costs were scaled based on solar PV capacity from 2kW up to 200kW and applied based on the calculated capacity required for each prototype in each climate zone. The proposed solar PV capacities were shown to be cost effective for R occupancies in each ASHRAE climate zone except for climate zone 8 and for single family residences in all climate zones except 4C, 5C and 8.An updated analysis was provided to the full committee in May 2022 using the IECC Residential cost effectiveness methodology. The results of that analysis by climate zone are provided below. The analysis has not been updated to reflect any change in the national average cost of small-scale renewables or to capture the impact of the Inflation Reduction Act passed in November 2022 that included renewable tax credits through 2032.

Single Family Dwellings

	1A	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
PV Capacity (kW)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PV Generation (kWh)	3,189	3,082	3,480	3,000	3,651	3,458	2,669	3,593	2,304	2,510	3,154	2,355	2,611	2,775	2,444	1,885
PV Cost @ 3.55	$ 7,100	$ 7,100	$ 7,100	$ 7,100	$ 7,100	$ 7,100	$ 7,100	$ 7,100	$ 7,100	$ 7,100	$ 7,100	$ 7,100	$ 7,100	$ 7,100	$ 7,100	$ 7,100
IECC Cost effectiveness @ $3.55 per Watt																
3.84% Real w/o SCC	$2,956	$2,617	$3,881	$2,356	$4,424	$3,811	$1,305	$4,239	$146	$800	$2,845	$308	$1,121	$1,642	$591	($1,185)
3% Real w/o SCC	$2,164	$1,884	$2,927	$1,669	$3,374	$2,869	$802	$3,223	($154)	$386	$2,073	($20)	$650	$1,080	$213	($1,251)
7% Real w/o SCC	$871	$692	$1,358	$555	$1,645	$1,321	$0.30	$1,547	($611)	($266)	$812	($525)	($97)	$178	($376)	($1,312)
3.84% Real w/ SCC	$4,542	$4,149	$5,611	$3,848	$6,239	$5,531	$2,632	$6,026	$1,292	$2,048	$4,414	$1,479	$2,419	$3,022	$1,806	($247)
3% Real w/ SCC	$3,750	$3,417	$4,657	$3,161	$5,190	$4,589	$2,130	$5,009	$992	$1,634	$3,641	$1,151	$1,949	$2,460	$1,428	($314)
7% Real w/ SCC	$2,457	$2,225	$3,089	$2,047	$3,460	$3,041	$1,328	$3,334	$535	$982	$2,381	$646	$1,202	$1,558	$839	($375)

Low-Rise Multifamily

	1A	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
PV Capacity (kW)	16.22	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2
PV Generation (kWh)	25,921	25,050	28,286	24,388	29,675	28,108	21,699	29,208	18,728	20,403	25,634	19,145	21,221	22,554	19,863	15,322
PV Cost @ 2.26/W	$ 36,673	$ 36,673	$ 36,673	$ 36,673	$ 36,673	$ 36,673	$ 36,673	$ 36,673	$ 36,673	$ 36,673	$ 36,673	$ 36,673	$ 36,673	$ 36,673	$ 36,673	$ 36,673
IECC Cost effectiveness @ $2.26 per Watt																
3.84% Real w/o SCC	$45,279	$42,513	$52,789	$40,410	$57,201	$52,224	$31,871	$55,717	$22,436	$27,755	$44,367	$23,760	$30,353	$34,586	$26,040	$11,619
3% Real w/o SCC	$35,929	$33,648	$42,124	$31,914	$45,762	$41,658	$24,871	$44,539	$17,089	$21,476	$35,177	$18,181	$23,619	$27,110	$20,062	$8,167
7% Real w/o SCC	$20,320	$18,862	$24,280	$17,753	$26,606	$23,982	$13,251	$25,824	$8,276	$11,081	$19,840	$8,975	$12,451	$14,683	$10,177	$2,574
3.84% Real w/ SCC	$58,170	$54,971	$66,857	$52,539	$71,959	$66,203	$42,663	$70,244	$31,750	$37,902	$57,116	$33,281	$40,907	$45,803	$35,919	$19,239
3% Real w/ SCC	$48,821	$46,106	$56,192	$44,043	$60,521	$55,637	$35,662	$59,065	$26,403	$31,623	$47,926	$27,702	$34,173	$38,327	$29,940	$15,788
7% Real w/ SCC	$33,212	$31,320	$38,348	$29,883	$41,364	$37,961	$24,043	$40,350	$17,591	$21,228	$32,589	$18,496	$23,005	$25,900	$20,056	$10,194

The installed cost of photovoltaic systems was based on published NREL cost data that was furhter adjusted to account for streamlined permitting under the NREL SolarApp+ program and to account for differences between retrofit and new construction costs. A cost of $3.55 per installed watt was used for 2kW array capacity and $2.26 per installed watt was used for a 16kW array capacity.

Workgroup Recommendation

RED1-92-22

Proponents: Fredric Zwerg, representing Southwest Gas Corporation (fredric.zwerg@swgas.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R103.2.2 ~~**Solar-ready system.** The construction documents shall provide details for dedicated roof area, structural design for roof dead and live load, and routing of conduit or pre-wiring from solar-ready zone to electrical service panel or plumbing from solar-ready zone to service water heating system.~~

Reason: Delete the proposed section entirely. The added section is not needed. The home builder/designer has the choice to provide what is necessary for a solar-ready home (electrical, plumbing, mechanical, structural, etc.) and to show it on the design drawings. The jurisdiction plans examiner may require additional items or components. This section may actually complicate the design process since it only references solar water heating systems. In our Southwest dry climate (Las Vegas, Tucson, Phoenix), solar water heating systems have some unique design considerations that are required by the jurisdictions.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
None

Workgroup Recommendation

Proposal # 1103

RED1-93-22

Proponents: Tom Ortiz, representing National Propane Gas Association (tortiz@npga.org); Bruce Swiecicki, representing National Propane Gas Association (bswiecicki@npga.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R103.2.2 Solar-ready system. If the building design includes solar-ready features, then t~~T~~he construction documents shall provide details for dedicated roof area, structural design for roof dead and live load, and routing of conduit or pre-wiring from solar-ready zone to electrical service panel or plumbing from solar-ready zone to service water heating system.

Reason: Construction documents should not be required to include solar design information for buildings which do not elect to include this additional design cost.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This code change will have no effect on the cost of construction.

Workgroup Recommendation

Proposal # 1237

RED1-94-22

Proponents: Alex Smith, representing NAHB (asmith@nahb.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R103.2.2 Solar-ready system. The construction documents shall ~~provide details for~~ indicate dedicated roof area for a solar-ready zone, ~~structural design for~~ roof dead and live loads, wind loads and ground snow loads, and routing of conduit or pre-wiring from solar-ready zone to electrical service panel or plumbing from solar-ready zone to service water heating system.

Reason: This proposal clarifies the provisions and aligns structural load documentation requirements with other ICC codes.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This proposal will have no change on construction cost.

Workgroup Recommendation

Proposal # 972

RED1-95-22

Proponents: Adam Berry, representing Colorado Energy Office (adam.berry@state.co.us)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

ELECTRIC VEHICLE (EV). An automotive-type vehicle for on-road use, such as passenger automobiles, buses, trucks, vans, neighborhood electric vehicles, and electric motorcycles, fully or primarily powered by an electric motor that draws current from a building electrical service, EVSE, a rechargeable storage battery, a fuel cell, a photovoltaic array, or another source of electric current.

2024 ENERGY Chapter11

Revise as follows:

ELECTRIC VEHICLE (EV). An automotive-type vehicle for on-road use, such as passenger automobiles, buses, trucks, vans, neighborhood electric vehicles, and electric motorcycles, fully or primarily powered by an electric motor that draws current from a building electrical service, EVSE, a rechargeable storage battery, a fuel cell, a photovoltaic array, or another source of electric current.

Reason: Most electric vehicles are powered fully by electricity, and this proposed change reflects that.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This change would not impact cost of construction.

Workgroup Recommendation

Proposal # 1313

RED1-96-22

Proponents: Ingrid Malmgren, representing Plug In America (imalmgren@pluginamerica.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

ELECTRIC VEHICLE READY SPACE (EV READY SPACE). An automobile parking space that is provided with a branch circuit and ~~either an outlet, junction box or~~ receptacle that will support an ~~installed~~ EVSE.

ELECTRIC VEHICLE SUPPLY EQUIPMENT (EVSE). Equipment for plug-in power transfer including the ungrounded, grounded and equipment grounding conductors, and the electric vehicle connectors, attachment plugs, 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.

Revise as follows:

R404.7.1 Quantity. New one- and two-family dwellings and townhouses with a designated attached or detached garage or other onsite private parking provided adjacent to the dwelling unit shall be provided with one EV-capable, EV-ready, or EVSE installed space 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,~~ one EV ready space per dwelling unit.~~, or EVSE space for 40 percent of each dwelling units or automobile parking spaces, whichever is less.~~

R404.7.2 EV Capable Spaces. Each EV capable space used to meet the requirements of Section R404.7.1 shall comply with all of the following:

1. A continuous raceway or cable assembly shall be installed between an enclosure or outlet located within 3 feet (914 mm) of the EV capable space and a suitable panelboard or other onsite electrical distribution equipment.
2. Installed raceway or cable assembly shall be sized and rated to supply a minimum circuit capacity in accordance with R404.7.4
3. The electrical distribution equipment to which the raceway or cable assembly connects shall have sufficient dedicated space and spare electrical capacity for a 2-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)."

Revise as follows:

R404.7.3 EV Ready Spaces. Each branch circuit serving EV ready spaces shall comply with all of the following:

1. Terminate at a receptacle ~~an outlet or enclosure~~, located within 3 feet (914 mm) of each EV ready space it serves.
2. Have a minimum circuit capacity in accordance with R404.7.4.
3. The panelboard or other electrical distribution equipment directory shall designate the branch circuit as "For electric vehicle supply equipment (EVSE)" and the outlet or enclosure shall be marked "For electric vehicle supply equipment (EVSE)."

R404.7.4 Circuit Capacity. For one- and two-family dwellings and townhouses, the capacity of electrical infrastructure serving each EV capable space, EV ready space and EVSE space shall have a rated capacity not less than 3.3 kVA (or 16A at 208/240V). ~~8.3 kVA (or 40A at 208/240V) for each EV capable space, EV ready space or EVSE space it serves.~~ Where a circuit is shared or managed it shall be in accordance with NFPA 70. For R-2 occupancies or allocated parking for R-2 occupancies in mixed-use buildings, the capacity of electrical infrastructure serving each EV-ready space shall have a rated capacity not less than 3.3 kVA (or 16A at 208/240V) for each EV capable space, EV ready space or EVSE space it serves.For R-2 occupancies, the capacity of electrical infrastructure serving each EV capable space, EV ready space and EVSE space shall comply with one of the following:

1. A branch circuit shall have a rated capacity not less than 8.3kVA (or 40A at 208/240V) for each EV capable space, EV ready space or EVSE space it serves. Where a circuit is shared or managed it shall be in accordance with NFPA 70.
2. The requirements of R404.7.4.1.

Exceptions:

1. Where the local electric distribution entity has certified in writing that it is not able to provide 100 percent of the necessary distribution capacity within 2 years after the estimated date of the certificate of occupancy. The required EV charging infrastructure shall be reduced based on the available existing electric distribution capacity.Where such reductions in power delivery are necessary, 100% of units shall still be served with at least one EV Ready space per unit. If the requirements of Exception 1 or 2 require it, the minimum power delivered to EV Ready spaces may be lowered, but not below 2.1kVA per space.
2. ~~Where substantiation has been approved that meeting the requirements of Section R404.7.4.1 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 $400.00 per dwelling unit.~~

R404.7.4.1 **Wiring and** **circuit capacity management.** Whenever possible, wiring for EVSE spaces, EV ready spaces, and EV capable spaces should be run directly to the corresponding housing unit's meter. If such wiring is deemed infeasible, the capacity of each branch circuit serving multiple EVSE spaces, EV ready spaces or EV capable spaces designed to be controlled by an energy management system providing load management in accordance with NFPA 70, shall have a capacity of not less than 2.7 kVA per space.

Add new text as follows:

R404.7.6 **Signage.** Each EV Capable, EVSE, and EV Ready parking space shall contain prominent signage with adequate letter size to be legible from inside a vehicle. The sign should be adjacent to or painted directly on the parking space indicating the space is EV Capable, or EV Ready (as applicable). If 100% of spaces are EVSE and/or EV Ready, a single sign at each entrance to the parking area indicating that all spaces provide EV charging access is sufficient.

Reason: Section R.202 General Definitions (Electric Vehicle Ready Space)
This is an equity consideration, and also removes a significant barrier to adoption. Multi-family residents often do not have the agency, authority, resources, or financial incentive to successfully make this type of upgrade.

R.202 General Definitions: ELECTRIC VEHICLE SUPPLY EQUIPMENT (EVSE).

The definition of EVSE is not consistent with its usage in the proposed code. To address this inconsistency, a section should be added describing an "EVSE space" as distinct from "EV Ready" and "EV Capable" spaces.

R404.7.1 Quantity

Documentation: This creates equitable access to EV charging for residents of multi-family housing. These residents tend to be lower income and/or BIPOC, and stand to gain the most from the health and financial benefits of electrified driving.

R404.7.2
EV Capable Spaces: we are confused about this use of the term "outlet". Can you have an "outlet" without it being connected to the electrical panelboard? Referencing this code section:

Each EV Capable space used to meet the requirements of Section R404.7.1 shall comply with all of the following:

A continuous raceway or cable assembly shall be installed between an enclosure or outlet located within 3 feet (914 mm) of the EV capable space and a suitable panelboard or other onsite electrical distribution equipment.
Installed . . .

Section R404.7.3 EV Ready Spaces
IECC should follow CALGreen in defining EV Ready as plug-and-play, and disallow blind junction boxes that would require an electrician's upgrade in order to make it operable by the resident/driver. Again - this is an equity consideration, and also removes a significant barrier to adoption. Multi-family residents often do not have the agency, authority, resources, or financial incentive to successfully make this type of upgrade. Providing plug-and-play access for these residents is crucial for EV adoption.COMMENT: This section should also include a description of EVSE space (currently missing).Section R404.7.4 Circuit Capacity

Requiring a delivery of 40A, which would require a 50A breaker circuit, delivers a level of power dramatically exceeding what the typical driver needs overnight for a daily commute. It would be far more equitable and cost-effective to provide lower power access in order to serve all residents. Please note that reducing the power delivery requirement must go hand-in-hand with providing equitable access, e.g. 1 EV Ready space per housing unit with parking, and should not be used as a way to reduce up-front costs while maintaining inequities in the code.Given the $400 exception limit, 3.3 kVA is critically important as a minimum floor. Requiring higher power delivery is likely to trigger exceptions, resulting in less EV access than is the intent of this code update, and dramatically increasing retrofit costs for residents and property managers.

If power requirements are not able to be met, the first thing to go in this case should be power level, all the way down to 110v, before cutting out access by any of the units. Access to lower power is always better (for the resident/driver, and to increase EV adoption) than access to no power at all. A high proportion of existing EV drivers currently charge at home on 2.1kVA. If it is not possible to remove this second exception, at a bare minimum the $400 limit should be indexed to the R.S. Means cost index.

R404.7.4.1

Circuit capacity management

Direct-to-meter wiring provides multi-family housing (MFH) residents with access to the lowest cost electricity for charging. Without this equity measure, MFH residents (who tend to be lower-income and/or Black/Indigenous/People Of Color (BIPOC)) will be forced to pay more for charging than higher-income single-family housing residents. Running the wiring either directly via each unit's electric meter or subpanel or via a separate utility-provided meter for each unit enables the resident to select the electric utility tariff that suits their needs, including the least expensive rate. It eliminates the need for a third party vendor such as EV service providers (EVSPs) to provide billing services for an ongoing fee, or via higher electricity prices, or both. It also eliminates the burden of charging and billing management that would otherwise fall on to homeowners' associations and/or apartment managers.

Section R404.7.6: Signage

Prominent signage at the parking space ensures that residents are aware they have access (or potential access) to EV charging infrastructure. For EV Capable spaces, signage is particularly critical. Without signage, there is no indicator of the infrastructure available, leaving residents unaware of this capacity – making conversion to EVSE or EV Ready even more unlikely. For EV Ready spaces, signage is also crucial as it educates drivers that the receptacle is available for EV charging.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This equitable proposal could potentially result in a small increase or decrease in cost, depending on the parking ratios involved. However, the long term cost savings from avoided future retrofits are substantial, as are the cost savings from avoided climate and health costs.

Bibliography: White paper:
https://ppr.hkspublications.org/2021/08/28/narrowing-the-divide-addressing-inequities-in-californias-electric-vehicle-infrastructure/
Majority of EV drivers charge at home: https://afdc.energy.gov/fuels/electricity_charging_home.html

Consumer Reports nationwide survey: https://www.consumerreports.org/hybrids-evs/cr-survey-shows-strong-interest-in-evs/

"Despite concerns about a dearth of public charging stations, 71 percent of respondents said they would do most of their charging at home."

Where and how EVs are actually being charged:

https://www.fleetmanagementweekly.com/charge-anxiety-stop-worrying/

Cost benefits of owning an EV: the cost benefits of owning an EV

Workgroup Recommendation

Proposal # 1289

RED1-97-22 Part I

Proponents: Fredric Zwerg, representing Southwest Gas Corporation (fredric.zwerg@swgas.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

RENEWABLE ENERGY CERTIFICATE (REC). A market-based instrument that represents ~~and conveys~~ the property rights to the environmental, social, and other non-power attributes of ~~one megawatt hour of~~ renewable electricity generation. ~~and could be sold separately from the underlying physical electricity associated with renewable energy resources, also known as "energy attribute" and "energy attribute certificate" (EAC)~~ RECs are issued when one megawatt-hour (MWh) of electricity is generated and delivered to the electricity grid from a renewable energy resource.

Reason: Modify text as shown so the definition is consistent with the U. S. Environmental Protection Agency's (EPA) definition.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
No cost impact.

Workgroup Recommendation

Proposal # 1197

RED1-97-22 Part II

Proponents: Fredric Zwerg, representing Southwest Gas Corporation (fredric.zwerg@swgas.com)

2024 ENERGY Chapter11

Revise as follows:

RENEWABLE ENERGY CERTIFICATE (REC). A market-based instrument that represents ~~and conveys~~ the property rights to the environmental, social, and other non-power attributes of ~~one megawatt hour of~~ renewable electricity generation. ~~and could be sold separately from the underlying physical electricity associated with renewable energy resources ; also known as an energy attribute and energy attribute certificate (EAC).~~ RECs are issued when one megawatt-hour (MWh) of electricitiy is generated and delivered to the electricity grid from a renewable energy source.

Reason: Modify text as shown so the definition is consistent with the U. S. Environmental Protection Agency's (EPA) definition.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
No cost impact.

Workgroup Recommendation

Proposal # 1198

RED1-98-22

Proponents: Tom Ortiz, representing National Propane Gas Association (tortiz@npga.org); Bruce Swiecicki, representing National Propane Gas Association (bswiecicki@npga.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

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

Reason: There is no scientific or market-based rationale for preemptively excluding all renewable energy sources/carriers other than electricity from eligibility for a REC.We propose the following general principles as a pathway to achieving net zero carbon buildings:

1. It is highly doubtful that society, given the constraints of practicality and financial resources, would be able to fully upgrade the electric grid or provide enough on-site renewable energy to meet the demand that would be imposed with a "full-steam-ahead" electrification policy, which many are trying to achieve with the 2024 IECC.

2. The "real" issue we are addressing is not so much energy conservation, but carbon conservation in the form of limiting CO_2e emissions. No energy sources should be discounted if, on a source-basis, they can achieve a superior level of performance than other sources.

3. The code is revised and published every three years. A step-wise approach to be taken is the most prudent, as it allows the grid to be upgraded to handle the additional loads expected (much of it due to electrification of vehicles) and to allow implementation of two-way technology for returning electrons to the grid, which most locations to not currently permit.

It is very apparent that the huge ambitions held by some electrification advocates will outstrip the capacity of our infrastructure to deliver. The cost to build a "future-proof" grid will likely be somewhere between $1 trillion (Reuters[1]) and $7 trillion (Oilprice.com[2]). This is an expenditure on the order of what the US spent[3] on the wars in Iraq and Afghanistan between 2001 – 2021. The appetite for policymakers and ratepayers to absorb such costs is a question that is yet to be answered.

Meanwhile, the US EIA has documented that average electric transmission system outage times have roughly doubled between 2013 - 2021[4]. We therefore are facing the prospect of adding massive new load to a network that is already badly in need of maintenance, without knowing with any degree of certainty how much investment capital will be available to: a) enable safe and robust bi-directional power flow for distributed storage and generation; b) protect this new "smart" grid against cyberattack and other forms of sabotage; and c) procure enough domestic supplies of scarce critical minerals (e.g. lithium, cobalt, neodymium) to ensure a secure and affordable source for the—literally—billions of batteries that are intended to serve the electric vehicle, residential and commercial energy storage, utility-scale energy storage, and consumer electronics industries.

(And, not to be dismissed, when fusion energy becomes widespread, we will need yet more lithium from which to manufacture tritium—one necessary component of the most feasible fuel for any prospective fusion power plant.)

Therefore, we view inclusion of mandatory electrification in building codes as far more than an energy efficiency, or even a greenhouse gas, issue: it also has massive national security and health/safety implications that, in our opinions, are not being adequately analyzed. While building codes may not, per se, be tasked with solving all of those problems, they are nevertheless relied upon by decisionmakers as being rational, reliable, and conservative bases for managing the building stock of our nation's homes and businesses. Based on the foregoing, there should be consideration for more agnostically defining what is meant by a sustainable (rather than, strictly speaking, renewable) resource in the hope that we can use every feasible tool imaginable to optimize our energy system with respect to its myriad technical and environmental constraints.

[1]

McLaughlin, T. (2022), "Creaky U.S. power grid threatens progress on renewables, EVs", Reuters, https://www.reuters.com/investigates/special-report/usa-renewables-electric-grid/

[2] Hyman, L. and Tilles, W. (2021), "The $7 Trillion Cost Of Upgrading The U.S. Power Grid", Oilprice.com, https://oilprice.com/Energy/Energy-General/The-7-Trillion-Cost-Of-Upgrading-The-US-Power-Grid.html .

[3] https://www.brown.edu/news/2021-09-01/costsofwar

[4] US Energy Information Administration (2022), "Table 11.2. Reliability metrics using IEEE of U.S. distribution system by state", https://www.eia.gov/electricity/annual/ .

Cost Impact: The code change proposal will decrease the cost of construction.
More choices for energy means reduced cost of construction.

Bibliography: [1] McLaughlin, T. (2022), "Creaky U.S. power grid threatens progress on renewables, EVs", Reuters, https://www.reuters.com/investigates/special-report/usa-renewables-electric-grid/
[2] Hyman, L. and Tilles, W. (2021), "The $7 Trillion Cost Of Upgrading The U.S. Power Grid", Oilprice.com, https://oilprice.com/Energy/Energy-General/The-7-Trillion-Cost-Of-Upgrading-The-US-Power-Grid.html .

[3] https://www.brown.edu/news/2021-09-01/costsofwar

[4] US Energy Information Administration (2022), "Table 11.2. Reliability metrics using IEEE of U.S. distribution system by state", https://www.eia.gov/electricity/annual/ .

Workgroup Recommendation

Proposal # 1246

RED1-99-22

Proponents: Ted Williams, representing ONE Gas (ngdllc@outlook.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

RENEWABLE ENERGY CERTIFICATE (REC). A market based instrument as defined by the U. S. Environmental Protection Agency (EPA) that represents and conveys the environmental attributes of one megawatt hour of renewable electricity generation and could be sold separately from the underlying physical electricity associated with renewable energy resources ; also known as an energy attribute and energy attribute certificate (EAC).

Reason: A stable and traceable definition source for RECs is needed to clarify to authorities having jurisdiction (AHJ) the principles, legal basis, and unique operating considerations of RECs as compared to other offset procedures. The source of this background is the U. S. EPA (https://www.epa.gov/green-power-markets/renewable-energy-certificates-recs) and adds clarity and functional understanding of RECs, which largely is not appreciated by AHJs, and with consistent and coherent background.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
Zero

Bibliography: https://www.epa.gov/green-power-markets/renewable-energy-certificates-recs

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Workgroup Recommendation

Proposal # 1385

RED1-100-22

Proponents: Eric Tate, representing Atmos Energy (eric.tate@atmosenergy.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

RENEWABLE ENERGY CERTIFICATE (REC). A market based instrument as defined by the U. S. Environmental Protection Agency (EPA) that represents and conveys the environmental attributes of one megawatt hour of renewable electricity generation and could be sold separately from the underlying physical electricity associated with renewable energy resources ; also known as an energy attribute and energy attribute certificate (EAC).

Reason: A sdefinition source for RECs is needed to clarify to authorities having jurisdiction (AHJ) the principles, legal basis, and unique operating considerations of RECs as compared to other offset procedures. The source of this background is the U. S. EPA and adds clarity and functional understanding of RECs, which largely is not appreciated by AHJs, and with consistent and coherent background

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
The additional language will not affect cost of construction.

Bibliography: U. S. Environmental Protection Agency, https://www.epa.gov/green-power-markets/renewable-energy-certificates-recs

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Workgroup Recommendation

Proposal # 1438

RED1-101-22

Proponents: Ted Williams, representing ONE Gas (ngdllc@outlook.com)

2024 International Energy Conservation Code [RE Project]

Add new definition as follows:

ZERO NET ENERGY PERFORMANCE.
An energy-efficient building where, on a source energy basis, the actual annual consumed energy is less than or equal to the on-site renewable generated energy.

Reason: The newly-proposed "Energy Rating Index (ERI)" definition refers to homes with "zero net energy performance" but "zero net energy performance" is not defined. The proposed definition is taken from the definition used by the California Public Utilities Commission (CPUC) (https://www.cpuc.ca.gov/ZNE/) .

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
Zero

Bibliography: https://www.cpuc.ca.gov/ZNE/

Workgroup Recommendation

Proposal # 1381

RED1-102-22

Proponents: Eric Tate, representing Atmos Energy (eric.tate@atmosenergy.com)

2024 International Energy Conservation Code [RE Project]

Add new definition as follows:

ZERO NET ENERGY PERFORMANCE. An energy-efficient building where, on a source energy basis, the actual annual consumed energy is less than or equal to the on-site renewable generated energy.

Reason: The newly-proposed “Energy Rating Index (ERI)” definition refers to homes with “zero net energy performance” but “zero net energy performance” is not defined. The proposed definition is taken from the definition used by the California Public Utilities Commission (CPUC).

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
The proposal will not affect the cost of construction.

Bibliography: California Public Utilities Commission, https://www.cpuc.ca.gov/ZNE/

Workgroup Recommendation

Proposal # 1436

RED1-103-22

Proponents: Shannon Corcoran, representing American Gas Association (corcoransm@att.net)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

~~**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.~~

~~**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 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 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 R408.~~
8. ~~Where a solar-ready zone is provided, the certificate shall indicate the location, and dimensions.~~

~~**R404.6.1.1 Solar-ready zone area.** The total area of the solar-ready zone shall not be less than 250 square feet (23.2 m^2) 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^2) 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^2) per dwelling shall be permitted to have a solar-ready zone area of not less than 150 square feet (14 m^2).~~

~~**R404.6.1.2 Obstructions.** Solar-ready zones shall be free from obstructions, including but not limited to vents, chimneys, and roof-mounted equipment.~~

~~**R404.6.1.3 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 Solar Electric.” The reserved space shall be at the opposite (load) end of the busbar from the primary energy source.~~

~~**R404.6.1.4 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 minimum 1 inch (25 mm) nonflexible metallic conduit or permanently installed wire as approved by the code official. Where the interconnection terminates in the attic, location shall be no less than 12 inches (35 mm) above ceiling insulation. Both ends of the interconnection shall be labeled “For Future Solar Electric”.~~

Reason: These provisions should be located in an adoptable appendix or jurisdictional option in a new R409 section, The proposals do not contain exceptions for grid capacity and cost of infrastructure upgrade. By being in an adoptable appendix, this would allow jurisdictions that need and want solar energy to adopt the provisions while not mandating that all jurisdictions mandate solar panels in new construction
There is the potential for stranded assets for homes that never install solar-panels, which would add construction costs without the potential for energy reductions for the consumer or lower emissions.

Cost Impact: The code change proposal will increase the cost of construction.

When adopted, a solar-ready appendix will add to construction costs.

Workgroup Recommendation

Proposal # 1428

RED1-104-22

Proponents: Diana Burk, representing New Buildings Institute (diana@newbuildings.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R103.2.2 Solar-ready system. The construction documents shall provide details for dedicated roof area, structural design for roof dead and live load, and routing of conduit or pre-wiring from solar-ready zone to electrical service panel or plumbing from ~~solar-ready zone~~ *solar-ready zone* to service water heating system.

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 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 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 R408.
8. Where a ~~solar-ready zone~~ *solar-ready zone* is provided, the certificate shall indicate the location, and dimensions.

R404.6.1 One- and two- family dwellings and townhouses . One- and two-family dwellings and townhouses shall comply with Sections R404.6.1.1 through R404.6.1.4.
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^2) of roof area oriented between 110 degrees and 270 degrees of true north.
3. A dwelling unit with less than 500 square feet (46m^2) of roof area oriented between 110 degrees and 270 degrees of true north.
4. Dwelling units where 50 percent of the solar-ready area is shaded from direct-beam sunlight by natural objects or by structures that are not part of the building for more than 2500 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 contract ~~power purchase agreement~~ with a duration of not less than 15 years from a ~~utility~~ renewable electricity generator~~or a community renewable energy facility~~ and for not less than 80 percent of the estimated whole-building electric use on an annual basis. The energy contract shall be procured with a method listed in Section C405.15.2.1(1) through C405.15.2.1(4) and shall be structured to survive a partial or full transfer of ownership of the building property. Documentation for the renewable energy purchased shall comply with Section R404.4.
7. A dwelling unit less than or equal to 1,500 square feet (139 m^2) of living space floor area located above grade plane.

R404.6.1.1 Solar-ready zone area. The total area of the ~~solar-ready zone~~ *solar-ready zone* shall not be less than 250 square feet (23.2 m^2) 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^2) 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^2) per dwelling shall be permitted to have a ~~solar-ready zone~~ *solar-ready zone* area of not less than 150 square feet (14 m^2).

R404.6.1.2 Obstructions. ~~Solar-ready zones~~ *Solar-ready zones* shall be free from obstructions, including but not limited to vents, chimneys, and roof-mounted equipment.

Reason: The proposed amendment clarifies exception number 6 which allows a building that supplies 80% of their whole building electric use with off-site renewable energy to be exempt from solar-ready requirements in the residential code in the following way:

- The proposal cites a section in the commercial energy code which lists the four appropriate procurement methods for off-site renewable energy which include a physical power purchase agreement, virtual power purchase agreement, community renewable energy facility, or self-owned off-site renewable energy system.
- The proposal requires the contract survive a partial or full transfer of ownership.
- The proposal changes terminology to clarify the exception and introduces a pointer to Section R404.4 which requires that renewable energy credits created by the renewable energy used to comply with this exception must be retained or retired.
- Finally, the proposal also fixes an editorial mistake that failed to italicize the defined term "solar-ready zone."

NBI strongly believes that the solar-ready requirements are a new critical addition to the 2024 IECC. In 2020, 21% of the electricity used in the United States was sourced from renewable energy, primarily wind, an intermittent source of energy. [1] The Inflation Reduction Act of 2022 (IRA), which provides reliable tax credits for renewable energy until at least 2032, is estimated to double the deployment of renewable energy technology by making it more cost effective than ever. [2] This proposal requires residential construction to be solar-ready, which will support more reliable distributed energy generation and aligns with the incentives being provided in the IRA.

Requiring residential buildings to be solar-ready will:

1) Economically benefit individuals and communities by reducing retrofit costs as the country transitions towards a low-carbon economy;

2) Increase the resilience of communities during disruptions to centrally supplied power;

3) Reduce the impact of utility-scale renewables on critical wildlife habitat; and

4) Reduce building carbon emissions and improve air quality by ensuring that building's can easily install rooftop solar in the future.

In addition, this proposal will expand good paying jobs in one of the nation's fastest growing employment sectors. According to the Bureau of Labor Statistics, the two fastest growing occupations in the U.S. in 2019 were solar PV installers and wind turbine service technicians. [3] Because of the IRA, renewable energy manufacturers will be incentivized to locate their business in the U.S., and both renewable energy manufacturers and installers will be incentivized to provide good wages. This provision to require new residential buildings to be solar-ready will broaden and extend the IRA's positive impacts on the U.S. economy and positively impact our communities.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This proposal will not change the cost of construction.

Bibliography: [1] Renewables Became the Second-Most Prevalent U.S. Electricity Source in 2020 , U.S. Energy Information Administration, https://www.eia.gov/todayinenergy/detail.php?id=48896.
[2] Esposito, Daniel. "Inflation reduction act benefits: Clean Energy Tax Credits could double deployment." Forbes Magazine. 23 Aug. 2022, https://www.forbes.com/sites/energyinnovation/2022/08/23/inflation-reduction-act-benefits-clean-energy-tax-credits-could-double-deployment/?sh=6e7381c76727

[3] The National Solar Job Census 2020, Interstate Renewable Energy Council, May 2021, Richardson, Jake. Solar and Wind Tech Are the Fastest Growing Jobs in US, Red, Green, and Blue, 28 Jan. 2019, http://redgreenandblue.org/2019/01/27/solar-wind-tech-fastest-growing-jobs-us/.

Workgroup Recommendation

Proposal # 1074

RED1-105-22

Proponents: Adam Berry, representing Colorado Energy Office (adam.berry@state.co.us)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

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 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 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 R408.
8. Where a solar-ready zone is provided, the certificate shall indicate the location~~,~~ and dimensions of a solar ready zone; the pathways for conduit, wiring, or plumbing from the solar ready zone to the electrical panel or water heater, as appropriate; and the additional panel capacity necessary for installation of a solar photovoltaic system.

2024 ENERGY Chapter11

Revise as follows:

N1101.14 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*, c*rawl 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 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 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 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 N1106, 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 N1108.

8. Where a solar-ready zone is provided, the certificate shall indicate the location~~,~~ and dimensions of a solar ready zone; the pathways for conduit, wiring, or plumbing from the solar ready zone to the electrical panel or water heater, as appropriate; and the additional panel capacity necessary for installation of a solar photovoltaic system.

Reason: Certificates should not only identify the solar ready zone, but should also identify related infrastructure or at a minimum, the future locations of related infrastructure. They should contain the locations of conduit, wiring, or plumbing that will connect the electrical panel or water heater to any future solar photovoltaic or solar thermal system, and identify the reserved spaces and additional capacity of the electrical panel to support the future installation of a solar photovoltaic system.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This proposal is simply aligning the requirements of the certificate with the requirements of solar readiness under Sections R404.6 and N1104.6, which should not increase the cost of construction.

Workgroup Recommendation

Proposal # 1314

RED1-106-22

Proponents: Renee Lani, representing American Public Gas Association (rlani@apga.org)

2024 International Energy Conservation Code [RE Project]

Delete without substitution:

~~**R404.5 Electric readiness.**~~ ~~Systems using fossil fuel: water heaters, household clothes dryers, conventional cooking tops or conventional ovens shall comply with the requirements of Sections R404.5.1 through R404.5.4~~

~~**R404.5.1 Cooking products.**~~ ~~An individual branch circuit outlet with a rating not less than 250-volts, 40-amperes shall be installed, and terminate within three feet of conventional cooking tops, conventional ovens or cooking products combining both.~~

> ~~**Exception:**~~ ~~Cooking products not installed in an individual dwelling unit.~~

~~**R404.5.2 Household Clothes Dryers.**~~ ~~An individual branch circuit outlet with a rating not less than 240-volts, 30-amperes shall be installed, and terminate within three feet (304 mm) of each household clothes dryer.~~

> ~~**Exception:**~~ ~~Clothes dryers that serve more than one dwelling unit and are located outside of a dwelling unit.~~

~~**R404.5.3 Water heaters.**~~ ~~An individual branch circuit outlet with a rating not less than either 240-volts, 30-amperes or 120V, 20-amperes shall be installed, and terminate within three feet (304 mm) of each fossil fuel water heater.~~
~~**Exception:**~~ ~~Water heaters in a centralized water heating system serving multiple dwelling units in a R-2 occupancy.~~

~~**R404.5.4 Electrification-ready circuits.**~~ ~~The unused conductors required by Sections R404.5.1 through R404.5.3 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 R404.5.1 through R404.5.3 shall be included in the load calculations of the original installation.~~

Reason: Consistent with our comments in earlier code cycles, the American Public Gas Association (APGA) opposes mandatory provisions in the base IECC that do not guarantee energy savings, as is the case for electric ready provisions. Requiring the necessary electric hookups for potential future appliances adds costs to construction while failing to guarantee an increase in efficiency, which is required to be included in the base code. Furthermore, a homeowner may never choose to install an electric appliance, meaning that the added parts this proposal would require would become stranded assets, a cost borne by the consumer who built the home. The added cost requirement of installing this additional equipment may also force more homebuilders to forego utilizing fuel gas fired appliances. This would significantly limit consumer choice and could prevent Americans from buying new homes that are fit for their needs and budgets.

Building energy codes should remain flexible enough to be utilized by the broadest range of jurisdictions. Supplemental building energy code resources, such as the International Green Construction Code, already exist for jurisdictions or individuals with the resources and capability to pursue certain stretch code provisions. However, every jurisdiction has different resources and needs to serve, so overly prescriptive code language, such as electric ready requirements, will not only be economically burdensome to some communities but might also miss the mark on energy efficiency and decarbonization goals if all aspects of an energy source's life-cycle analysis are not taken into consideration.
This electric ready section should be struck from the base code in its entirety. If included at all, it should follow the lead of the commercial code consensus committee and be moved to the non-mandatory appendices - currently the only appropriate place for such proposals, as the base code of the IECC must only contain provisions that increase a building's efficiency.

Cost Impact: The code change proposal will decrease the cost of construction.
Not requiring what is additional infrastructure and what may also become stranded assets will lower the cost of construction.

Workgroup Recommendation

Proposal # 1489

RED1-107-22

Proponents: Nick Thompson, representing Colorado Chapter ICC (nick.thompson@cityofaspen.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R403.10 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 (4.8°C) ~~maximum~~ and that ~~shall~~ include one of the following:

1. A moisture sensor configured to shut off the system in the absence of moisture, or
2. ~~A programmable timer configured to shut off the system for 8 hours minimum at night.~~ A daylight sensor or other means configured to shut off the system between sunset and sunrise.

Reason: Aligns with the commercial section C403.14.3 which has improved grammar and sets the control option #2 to better meet the intent- which is to have the system off when the sun isn't shining.
The intent of roof and gutter deicing is to prevent ice dams from causing water damage to the building. Ice dams occur when roof eaves, valleys, and gutters get ice buildup from a combination of flowing water and freezing conditions. Ice on a roof or gutter is not a problem in and of itself. The problem is when liquid water flow occurs and is blocked from draining properly by ice. Water flow during freezing conditions occurs chiefly from the sun, thus the provision for controls to shut off the system at night. A moisture sensor is provided as an option for the designer if there is concern for free water flow during nighttime hours. If there is no water flow (moisture), there is no need to keep drainage pathways clear as there is no water to drain. To clarify the original reason statement, ice damming can occur even on new buildings built to current code provisions, such as warm roofs that are unvented.

Cost Impact: The code change proposal will increase the cost of construction.
The options provided are cost effective. There are many variables in judging payoff, including temperature, energy cost, and system size. Assuming $0.14 kWh electricity cost and $250 conservative install cost (including $75 in parts), in climate zone 7 a 200W system pays off in one year compared to one without controls left on all summer. If turned off all summer, a 390W system pays off in 1 year. 390W is about 50 LF of heat tape, which is a very small system. Many building management systems (BMS) are currently capable of time of day based control.

Workgroup Recommendation

Proposal # 1044

RED1-108-22

Proponents: Glenn Heinmiller, representing International Association of Lighting Designers (glenn@lampartners.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R404.1 Lighting efficacy and power ~~equipment~~. Other than for exterior lighting complying with Section R404.1.1 and R404.1.2,~~All~~ permanently installed luminaires , shall be capable of operation with an efficacy of not less than 45 lumens per watt or shall contain lamps capable of operation at 65 lumens per watt or greater.

Exceptions:

1. Kitchen appliance lighting.
2. Antimicrobial lighting used for the sole purpose of disinfecting.

R404.1.1 Exterior lighting power for R-2 and R-4 Occupancies. ~~Connected~~ Exterior lighting serving Group R-2 and R-4 occupancies ~~for Group R-2, R-3, and R-4 residential buildings~~ shall comply with Sections R404.1.1.1 ~~2~~ through R404.1. 1.3 ~~5~~

Exceptions:

~~1. detached one- and two-family dwellings,~~

~~2. Townhouses.~~

~~3. Group R-3 buildings that do not contain more than 2 dwelling units~~

~~4.~~ 1. Solar-powered ~~lamps~~ luminaires not connected to any electrical service.

~~5. Luminaires controlled by a motion sensor.~~

~~6. Lamps and luminaires that comply with Section R404.1.~~

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

R404.1.1.1 ~~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 R404.1.1.2** ~~3.~~ and **R404.1.1.3**. 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 because of safety considerations.~~

~~2. Exit signs.~~

~~3. Specialized signal, directional and marker lighting associated with transportation.~~

~~4. Temporary lighting.~~

~~5. Lighting for water features and swimming pools.~~

~~6. Lighting controlled from within dwelling units.~~

R404.1.1.2 ~~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.

R404.1.1.3 ~~4~~ Additional exterior lighting power. Additional exterior lighting power allowance shall be available for the building facades at 0.075 W/ft^2 (0.807 w/m^2) of gross above-grade wall area. This 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 ~~5~~ Gas lighting. Gas-fired lighting appliances shall not be equipped with continuously burning pilot ignition systems.

Reason: Summary:
As currently written, this section has a fatal flaw that renders the exterior lighting power requirements useless. This proposal fixes that flaw and reorganizes and renumbers the section, and removes redundant unnecessary language, making it more straightforward and logical.

Analysis:

Currently, R404.1 says that all luminaires and lamps must meet the efficacy requirements. Then in R404.1.1 exception #6, exterior lighting using lamps and luminaires that comply with the efficacy requirement are exempt from the exterior power requirements. Because all lamps and luminaires must comply with the efficacy requirements, all exterior lighting is inherently exempt from the exterior power requirements. This makes R404.1.2 through R404.1.4 useless. Obviously, this could not be the intent of the code

Even if the code is not interpreted this way (exterior lighting is automatically exempt), the option to exempt exterior lighting from the power requirements is still clear. Designers will always choose the simple and easy efficacy requirement, rather than perform the complex calculations required to meet the power density requirements. This makes R404.1.2 through R404.1.4 irrelevant because they will never be used.

The Committee should confirm if it is the intent of the code to exempt exterior lighting from the lighting power density requirements if it meets the efficacy requirements (R404.1.1 exception #6). If it is, then R404.1.1 through R404.1.4 should be removed from the code for the reasons mentioned above.

This Proposal

This proposal assumes (perhaps incorrectly) that the intent of the code is to require exterior lighting serving Group R-2 and R-4 occupancies to comply with the lighting power density requirements. If this is correct, then the Committee should approve this proposal. If not, then the committee should disapprove the proposal and simply delete R404.1.1 through R404.1.4 as discussed above.

There are several deletions and additions of text that should be explained:

In R404.1 the phrase "for Group R-2, R-3, and R-4 residential buildings" is redundant. R401.1 already states this as part of the scope of the code.

The exceptions for "detached one- and two-family dwellings", "Townhouses", and "Group R-3 buildings" are removed because they are now unnecessary due to the addition to the charging statement in R404.1.1, "Exterior lighting serving Group R-2 and R-4 occupancies", which clearly limits the scope of the section.

The phrase "that do not contain more than 2 dwelling units" in the current exception #3 is removed because it is redundant. By definition, Group R-3 buildings do not contain more than two dwelling units (see IBC 310.4)

The current exception #5 "Luminaires controlled by a motion sensor" is nonsensical. Why should luminaires be exempt from lighting power density limits just because they have automatic controls? There is no precedent for this in the commercial code, the source of the lighting power density requirements.

Additional exceptions were added to be consistent with the lighting power density requirements in IECC-C C405.5.1 Public Comments Draft #1

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
this proposal is a clarification of the intent of the code and does not fundamentally change the requirements

Workgroup Recommendation

Proposal # 1168

RED1-109-22

Proponents: Steven Rosenstock, representing Edison Electric Institute (srosenstock@eei.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R404.1 Lighting equipment. All permanently installed luminaires , including lighting installed in exhaust fans and range hoods, shall be capable of operation with an efficacy of not less than 45 lumens per watt or shall contain lamps capable of operation at 65 lumens per watt or greater.

Exceptions:

1. ~~Kitchen~~ Other appliance lighting.
2. Antimicrobial lighting used for the sole purpose of disinfecting.
3. Luminaires with a rated electric input of not greater than 3.0 Watts.

Reason: This proposed change is designed to align with changes proposed for the IECC Commercial energy code. This change expands the scope of the efficiency requirement to include LED lighting that is installed in exhaust fans and range hoods.
It also clarifies the exceptions, since a range hood could be considered to be a kitchen appliance and would cover other home appliances such as ovens and clothes dryers that are not able to use LED technology due to thermal issues.

It also adds an exception for very low wattage safety lighting that is used for stairs and bedrooms, which are not able to reach the required minimum efficiency values due to technical issues.

Cost Impact: The code change proposal will increase the cost of construction.
With the expanded scope, there may be a slight cost increase. However, LED lighting now has a market share of over 75% since early 2020 (see https://www.nema.org/analytics/lamp-indices), and under US law, all general service lighting sold in the US has to have an initial rated efficacy of at least 45 lumens/Watt as of July 1, 2023.

Workgroup Recommendation

Proposal # 1045

RED1-110-22

Proponents: Glenn Heinmiller, representing International Association of Lighting Designers (glenn@lampartners.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

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* ~~because of~~ for safety reasons ~~considerations~~.
2. Emergency lighting that is automatically off during normal operations

~~2.~~ 3. Exit signs.

~~3.~~ 4. Specialized signal, directional and marker lighting associated with transportation.

5. Lighting for athletic playing areas

~~4.~~ 6. Temporary lighting.

7. Lighting used to highlight features of art, public monuments and the national flag

~~5.~~ 8. Lighting for water features and swimming pools.

~~6.~~ 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 allowance shall be available for the building facades at 0.075 W/ft^2 (0.807 w/m^2) of gross above-grade wall area. This 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.

Revise as follows:

TABLE R404.1 LIGHTING POWER ALLOWANCES FOR BUILDING EXTERIORS

Base site allowance	~~400~~ 280 watts
Uncovered parking areas and drives	~~0.4~~ 0.026 W/ft^2
Building Grounds	
Walkways and ramps ~~less than 10 feet wide~~	0.50 W/linear foot
~~Walkways and ramps 10 feet wide or greater,~~ plaza areas~~, special feature areas~~	~~0.10~~ 0.049 W/ft^2
Dining areas	~~0.65~~ 0.273 W/ft^2
Stairways	~~0.70 W/ft^2~~ Exempt
Pedestrian tunnels	~~0.12~~ 0.110 W/ft^2
Landscaping	~~0.04~~ 0.025 W/ft^2
Building Entrances and Exits	
Pedestrian and vehicular entrances and exits	~~14~~ 9.8 W/linear foot of opening
Entry canopies	~~0.25~~ 0.126 W/ft^2

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

Reason: This proposal revises these sections and the table to match the equivalent requirements in IECC-C Public Comment Draft #1. Additional exceptions from IECC-C were added that could apply to these Group R occupancies

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
These changes do not affect the cost of lighting equipment required to meet code

Workgroup Recommendation

Proposal # 1013

RED1-111-22

Proponents: Glenn Heinmiller, representing International Association of Lighting Designers (glenn@lampartners.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R404.2 Interior lighting controls. All permanently installed luminaires shall be controlled as required in Sections R404.2.1 and R404.2.2. **Exception:** Lighting controls shall not be required for safety or security lighting ~~fixtures~~.

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

Reason: Editorial changes have been made to improve clarity and use the correct the defined terms

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This is only an editorial change.

Workgroup Recommendation

Proposal # 1101

RED1-112-22

Proponents: Greg Johnson, representing National Multifamily Housing Council (gjohnsonconsulting@gmail.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R404.3 Exterior lighting controls. Exterior lighting controlled from within individual dwelling units shall comply with Section R404.3.1. ~~Controls for all other exterior lighting shall comply with Sections C405.2.7 of the International Energy Conservation Code – Commercial Provisions instead of Section R404.3.1.~~

Reason: Section R101.5 clearly requires that residential buildings comply with the IECC-R rather than the IECC- commercial provisions.
The original proponent of this section should do the work of incorporating the actual requirements for the benefit of the code user instead of referencing a code that may not be adopted.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
There will be no impact if the original proponent actually brings the requirements into the body of the code.

Workgroup Recommendation

Proposal # 1096

RED1-113-22

Proponents: Steven Rosenstock, representing Edison Electric Institute (srosenstock@eei.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R404.3 Exterior lighting controls. Exterior lighting controlled from within individual dwelling units shall comply with Section R404.3.1. Controls for all other exterior lighting shall comply with Sections C405.2.7 of the International Energy Conservation Code – Commercial Provisions instead of Section R404.3.1.

Exception: Solar-powered outdoor lighting fixtures that are not connected to the building's electric service.

Reason: For a stand-alone solar outdoor lighting fixture that typically contains a PV array, photocell, battery, and high-efficacy LED light bulb or bulbs, the annual energy cost of the fixture is $0.00. Adding any sort of lighting controls will require the cost of the control, wiring, and trenching and/or conduit in some cases. The cost of each control may be well over $50 and the savings per year and over the life of the system will be $0.00 per year and over the life cycle.
Controls on outdoor solar light fixtures are not cost-effective and should not be required in the energy code.

Cost Impact: The code change proposal will increase the cost of construction.
Solar outdoor lighting fixtures may be more expensive than regular outdoor lighting fixtures that are connected to the building's electric service, but will have much lower installation costs due to no wiring, trenching, or conduit, and with the exception, will lower costs as lighting controls will not have to be purchased or installed. In addition, their annual energy costs are $0.00 compared to other controlled outdoor lighting fixtures.

Bibliography: Solar Outdoor Lighting Web sites:
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Workgroup Recommendation

Proposal # 1046

RED1-114-22

Proponents: Steven Rosenstock, representing Edison Electric Institute (srosenstock@eei.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

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

Reason: The current language is harmful to systems that are located in states with solar REC's, which are very helpful in meeting state renewable portfolio standards. REC's create a "win win" scenario for utilities required to meet RPS mandates and customers that are producing renewable electricity and/or have surplus renewable energy that can be exported to the local grid. In several states, the value of a solar REC is higher than the retail cost of electricity, providing more economic value to on-site renewable energy systems.
According to one web site, the value of a solar REC ranged from $150 to $500 per MWh ($0.15 to $0.50 per kWh) in 2019 (see https://news.energysage.com/srecs-overview-states/).

The proposed change makes sure that the property owner receives the benefits of the REC's. They can choose to retain or retire the REC's as they see fit in this minimum energy code.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This change has no impact on the cost of construction, only on the post-construction operational economics of an on-site renewable energy system.

Bibliography: US EPA https://www.epa.gov/greenpower/state-solar-renewable-energy-certificate-markets
DSIRE USA State and City Solar REC Programs https://programs.dsireusa.org/system/program?type=85&
SREC Trade https://www.srectrade.com/markets/rps/srec/
Energy Sage https://news.energysage.com/srecs-overview-states/

Workgroup Recommendation

Proposal # 1055

RED1-115-22 Part I

Proponents: Jeremy Clarkson, representing City of Corning

2024 International Energy Conservation Code [RE Project]

Revise as follows:

~~**R103.2.2 Solar-ready system.** The construction documents shall provide details for dedicated roof area, structural design for roof dead and live load, and routing of conduit or pre-wiring from solar-ready zone to electrical service panel or plumbing from solar-ready zone to service water heating system.~~

~~**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, 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, and 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 either an outlet, junction box or receptacle, that will support an installed EVSE.~~

~~**ELECTRIC VEHICLE SUPPLY EQUIPMENT (EVSE).** Equipment for plug-in power transfer including the ungrounded, grounded and equipment grounding conductors, and the electric vehicle connectors, attached plugs, 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~~

~~**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 R404
ELECTRICAL POWER, <u>AND</u> LIGHTING~~, AND RENEWABLE ENERGY~~ SYSTEMS

~~**R404.4 Renewable energy certificate (REC) documentation.** Where renewable energy generation is used to comply with this code, the documentation shall be provided to the *code official* by the property owner or owner's authorized agent which demonstrates that where RECs or 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.~~

~~**R404.5 Electric readiness**. Systems using fossil fuel: water heaters, household clothes dryers, conventional cooking tops or conventional ovens shall comply with the requirements of Sections R404.5.1 through R404.5.4~~

~~**R404.5.1 Cooking products.** An individual branch circuit outlet with a rating not less than 250-volts, 40-amperes shall be installed, and terminate within three feet of conventional cooking tops, conventional ovens or cooking products combining both.~~

~~**Exception:** Cooking products not installed in an individual dwelling unit.~~

~~**R404.5.2 Household Clothes Dryers.** An individual branch circuit outlet with a rating not less than 240-volts, 30-amperes shall be installed, and terminate within three feet (304 mm) of each household clothes dryer.~~

~~**Exception:** Clothes dryers that serve more than one dwelling unit and are located outside of a dwelling unit.~~

~~**R404.5.3 Water heaters.** An individual branch circuit outlet with a rating not less than either 240-volts, 30-amperes or 120V, 20-amperes shall be installed, and terminate within three feet (304 mm) of each fossil fuel water heater.~~

~~**Exception:** Water heaters in a centralized water heating system serving multiple dwelling units in a R-2 occupancy.~~

~~**R404.5.4 Electrification-ready circuits.** The unused conductors required by Sections R404.5.1 through R404.5.3 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 R404.5.1 through R404.5.3 shall be included in the load calculations of the original installation.~~

~~**R404.6 Renewable energy infrastructure.** The building shall comply with the requirements of R404.6.1 or R404.6.2.~~

~~**R404.6.1 One- and two- family dwellings and townhouses .** One- and two-family dwellings and townhouses shall comply with Sections~~

~~R404.6.1.1 through R404.6.1.4.~~

~~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^2) of roof area oriented between 110 degrees and 270 degrees of true north.~~
3. ~~A dwelling unit with less than 500 square feet (46m^2) of roof area oriented between 110 degrees and 270 degrees of true north.~~
4. ~~Dwelling units where 50 percent of the solar-ready area is shaded from direct-beam sunlight by natural objects or by structures that are not part of the building for more than 2500 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 whole-building electric use on an annual basis.~~
7. ~~A dwelling unit less than or equal to 1,500 square feet (139 m^2) of living space floor area located above grade plane.~~

~~R404.6.1.1 Solar-ready zone area.~~ ~~The total area of the solar-ready zone shall not be less than 250 square feet (23.2 m^2) 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^2) 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^2) per dwelling shall be permitted to have a solar-ready zone area of not less than 150 square feet (14 m^2).~~

~~R404.6.1.2 Obstructions.~~ ~~Solar-ready zones shall be free from obstructions, including but not limited to vents, chimneys, and roof-mounted equipment.~~

~~R404.6.1.3 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 Solar Electric." The reserved space shall be at the opposite (load) end of the busbar from the primary energy source.~~

~~R404.6.1.4 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 minimum 1 inch (25 mm) nonflexible metallic conduit or permanently installed wire as approved by the code official. Where the interconnection terminates in the attic, location shall be no less than 12 inches (35 mm) above ceiling insulation. Both ends of the interconnection shall be labeled "For Future Solar Electric".~~

~~R404.6.2 Group R occupancies.~~ ~~Buildings in Group R-2, R-3 and R-4 shall comply with Appendix CB.~~

~~R404.7 Electric Vehicle Power Transfer Infrastructure.~~ ~~New automobile parking spaces for one- and two-family dwellings and townhouses shall be provided in accordance with Sections R404.7.1 through R404.7.5. New residential automobile parking spaces for R-2 occupancies shall be provided with electric vehicle power transfer infrastructure in accordance with Sections R404.7.1 through R404.7.5.~~

~~R404.7.1 Quantity.~~ ~~New one- and two-family dwellings and townhouses with a designated attached or detached garage or other onsite private parking provided adjacent to the dwelling unit shall be provided with one EV-capable, EV-ready, or EVSE installed space 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 EVSE space for 40 percent of each dwelling units or automobile parking spaces, whichever is less.~~

~~R404.7.2 EV Capable Spaces.~~ ~~Each EV capable space used to meet the requirements of Section R404.7.1 shall comply with all of the following:~~

1. ~~A continuous raceway or cable assembly shall be installed between an enclosure or outlet located within 3 feet (914 mm) of the EV capable space and a suitable panelboard or other onsite electrical distribution equipment.~~
2. ~~Installed raceway or cable assembly shall be sized and rated to supply a minimum circuit capacity in accordance with R404.7.4~~
3. ~~The electrical distribution equipment to which the raceway or cable assembly connects shall have sufficient dedicated space and spare electrical capacity for a 2-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)."~~

~~R404.7.3 EV Ready Spaces.~~ ~~Each branch circuit serving EV ready spaces shall comply with all of the following:~~

1. ~~Terminate at an outlet or enclosure, located within 3 feet (914 mm) of each EV ready space it serves.~~
2. ~~Have a minimum circuit capacity in accordance with R404.7.4.~~
3. ~~The panelboard or other electrical distribution equipment directory shall designate the branch circuit as "For electric vehicle supply equipment (EVSE)" and the outlet or enclosure shall be marked "For electric vehicle supply equipment (EVSE)."~~

~~R404.7.4 Circuit Capacity.~~ ~~For one- and two-family dwellings and townhouses, the capacity of electrical infrastructure serving each EV capable~~

~~space, EV ready space and EVSE space shall have a rated capacity not less than 8.3 kVA (or 40A at 208/240V) for each EV capable space, EV ready space or EVSE space it serves. Where a circuit is shared or managed it shall be in accordance with NFPA 70. For R-2 occupancies, the capacity of electrical infrastructure serving each EV capable space, EV ready space and EVSE space shall comply with one of the following:~~

1. ~~A branch circuit shall have a rated capacity not less than 8.3kVA (or 40A at 208/240V) for each EV capable space, EV ready space or EVSE space it serves. Where a circuit is shared or managed it shall be in accordance with NFPA 70.~~
2. ~~The requirements of R404.7.4.1.~~

~~Exceptions:~~

1. ~~Where the local electric distribution entity has certified in writing that it is not able to provide 100 percent of the necessary distribution capacity within 2 years after the estimated date of the certificate of occupancy. The required EV charging infrastructure shall be reduced based on the available existing electric distribution capacity.~~
2. ~~Where substantiation has been approved that meeting the requirements of Section R404.7.4.1 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 $400.00 per dwelling unit.~~

~~R404.7.4.1 Circuit capacity management.~~ ~~The capacity of each branch circuit serving multiple EVSE spaces, EV ready space or EV capable spaces designed to be controlled by an energy management system providing load management in accordance with NFPA 70, shall have a capacity of not less than 2.7 kVA per space.~~

~~R404.7.5 EVSE installation.~~ ~~For one- and two-family dwellings and townhouses, EVSE shall be installed in accordance with NFPA 70 and shall be listed and labeled in accordance with UL 2202 or UL 2594. For R-2 occupancies, EVSE shall be installed in accordance with NFPA 70 and Section R404.7.5.1 and shall be listed and labeled in accordance with UL 2202 and UL 2594.~~

~~R404.7.5.1 EVSE minimum charging rate.~~ ~~Each installed EVSE shall comply with one of the following:~~

1. ~~Be capable of charging at a rate of not less than 6.2 kVA (or 30A at 208/240V).~~
2. ~~Where serving EVSE spaces allowed to have a circuit capacity of not less than 2.7 kVA in accordance with R404.7.4.1 and controlled by an energy management system providing load management, be capable of simultaneously charging each EVSE space at a rate of not less than 2.1 kVA.~~

Reason: <u>Reason: This language is out of scope and intent of the Code, and the Committee failed to meet the Goals and Objectives in their IECC Committee Procedures. Therefore these entire sections should be deleted or placed in a non-mandatory appendix.</u>
Point 1

ICC Council Policy 7 – Committees and Members, Section 9.1 – Scope of Work states The work of each committee shall be:

9.1.1 In accordance with the **committee's scope and objectives** statement,

9.1.2 In accordance with any instructions subsequently issued by the ICC Board, and

9.1.3 Consonant with the objectives of the ICC.

Point 2

Regarding 9.1.1 of Council Policy 7 - The Scope and Intent were provided to the Committee and posted on the International Energy Conservation Code (IECC) Residential Consensus Committee webpage as the “Committee Procedures”. The intent of the Residential Energy Provisions – IECC, R101.3 (page 2-3 of the Committee Procedures), and the intent of the Residential Energy Provision – Chapter 11 of the IRC, N1101.2 (page 3 of the Committee Procedures), state;

> “**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 **non-mandatory appendices** incorporating additional energy efficiency and **greenhouse gas reduction resources** developed by the Code Council and others.”

Point 3

Regarding 9.1.1 of Council Policy 7 - The Goals & Objectives were provided to the Committee and posted on the International Energy Conservation Code (IECC) Residential Consensus Committee webpage as the “Committee Procedures”. The Goals & Objectives (page 3 of the Committee Procedures), state;

The goals and objectives in the “Intent” provisions above note the following for inclusion in the code:

• **Optional requirements** that lead to achievement of zero energy buildings, presently, and through glidepaths that achieve zero energy buildings by 2030.

• The code may include **non-mandatory appendices** incorporating additional energy efficiency and greenhouse gas reduction resources.

These performance objectives are intended to provide jurisdictions with an **adoptable set of provisions to achieve net-zero** energy by 2030.

Point 4

Regarding 9.1.2 of Council Policy 7 - The ICC Board did not issue any instructions subsequently, however prior to the Committee work, the ICC Board approved “LEADING THE WAY TO ENERGY EFFICIENCY A Path Forward on Energy and Sustainability to Confront a Changing Climate”, which is referenced and linked in the “Committee Procedures”(Page 2). The last principle in the list of principles (located on page 5 of “LEADING THE WAY TO ENERGY EFFICIENCY A Path Forward on Energy and Sustainability to Confront a Changing Climate”.) that govern the work of the committee it states:

> The committee should develop **supplemental requirements** reflecting the diversity of energy efficiency goals made by adopting jurisdictions and the federal government. These shall include minimum requirements and **optional requirements aimed at achieving zero energy buildings** over multiple timeframes (e.g., through use of the current edition of the code, by 2030 and by 2050).

Furthermore, on page 7 of “LEADING THE WAY TO ENERGY EFFICIENCY A Path Forward on Energy and Sustainability to Confront a Changing Climate” it states;

> Building off the success of the IECC and IgCC, **the Code Council will develop a layered approach** that provides communities with **a menu of technical and policy resources**, which **integrate with the I-Codes**, to address their energy efficiency and GHG reduction goals, including those goals identified by the Energy and Carbon Advisory Council. The IECC will remain the minimum requirement.
>
> The **resources are intended to be useable independently and adopted alongside the baseline code** to support the policies of a community in specific areas. For example, a community could adopt the 2021 IECC with provisions from the Code Council resources developed for electric vehicles or electrification.

It is clear that the ICC Board’s instructions were that provisions for Electric Vehicles, electrification, electric ready, solar ready, mandatory onsite renewable energy and other Greenhouse Gas policy goals and zero energy building goals would be in supplemental, optional, non-mandatory appendices or resources and NOT in the baseline code.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This would decrease the cost of construction versus leaving these provisions in the code.

Attached Files

- **Leading the Way Energy Efficiency.pdf**
  https://energy.cdpaccess.com/proposal/1429/2656/files/download/484/
- **IECC Committee Procedures Directly from the Committee Website.pdf**
  https://energy.cdpaccess.com/proposal/1429/2656/files/download/483/
- **ICC Council Policy 7.pdf**
  https://energy.cdpaccess.com/proposal/1429/2656/files/download/482/

Workgroup Recommendation

RED1-115-22 Part II

Proponents: Jeremy Clarkson, representing City of Corning

2024 ENERGY Chapter11

Revise as follows:

~~**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, 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, and 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 either an outlet, junction box or receptacle, that will support an installed EVSE.~~

~~**ELECTRIC VEHICLE SUPPLY EQUIPMENT (EVSE).** Equipment for plug-in power transfer including the ungrounded, grounded and equipment grounding conductors, and the electric vehicle connectors, attached plugs, 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~~

~~**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~~

~~**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. Content~~

SECTION N1104
ELECTRICAL POWER, AND LIGHTING, ~~AND RENEWABLE ENERGY~~ SYSTEMS

~~**N1104.4 Renewable energy certificate (REC) documentation.** Where renewable energy generation is used to comply with this code, the documentation shall be provided to the code official by the property owner or owner's authorized agent which demonstrates that where RECs or 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.~~

~~**N1104.5 Electric readiness.** Systems using fossil fuel: water heaters, household clothes dryers, conventional cooking tops or conventional ovens shall comply with the requirements of Sections N1104.5.1 through N1104.5.4.~~

~~**N1104.5.1 Cooking products.** An individual branch circuit outlet with a rating not less than 250-volts, 40-amperes shall be installed, and terminate within three feet of conventional cooking tops, conventional ovens or cooking products combining both.~~

~~**Exception:** Cooking products not installed in an individual dwelling unit.~~

~~**N1104.5.2 Household Clothes Dryers.** An individual branch circuit outlet with a rating not less than 240-volts, 30-amperes shall be installed, and terminate within three feet (304 mm) of each household clothes dryer.~~

~~**Exception:** Clothes dryers that serve more than one dwelling unit and are located outside of a dwelling unit.~~

~~**N1104.5.3 Water heaters.** An individual branch circuit outlet with a rating not less than either 240-volts, 30-amperes or 120V, 20-amperes shall be installed, and terminate within three feet (304 mm) of each fossil fuel water heater.~~

~~**Exception:** Water heaters in a centralized water heating system serving multiple dwelling units in a R-2 occupancy.~~

~~**N1104.5.4 Electrification-ready circuits.** The unused conductors required by Sections N1104.5.1 through N1104.5.3 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 N1104.5.1 through N1104.5.3 shall be included in the load calculations of the original installation.~~

~~**N1104.6 Renewable energy infrastructure.** The building shall comply with the requirements of N1104.6.1 or N1104.6.2.~~

~~**N1104.6.1 One- and two- family dwellings and townhouses .** One- and two-family dwellings and townhouses shall comply with Sections N1104.6.1.1 through N1104.6.1.4.~~

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^2) of roof area oriented between 110 degrees and 270 degrees of true north.~~
3. ~~A dwelling unit with less than 500 square feet (46m^2) of roof area oriented between 110 degrees and 270 degrees of true north.~~
4. ~~Dwelling units where 50 percent of the solar-ready area is shaded from direct-beam sunlight by natural objects or by structures that are not part of the building for more than 2500 annual hours between 8:00 a.m. and 4:00 p.m.~~
5. ~~A dwelling unit that complies with Appendix AX.~~
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 whole-building electric use on an annual basis.~~
7. ~~A dwelling unit less than or equal to 1,500 square feet of living space floor area located above grade plane.~~

~~**N1104.6.1.1 Solar-ready zone area.** The total area of the solar-ready zone shall not be less than 250 square feet (23.2 m^2) 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^2) 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^2) per dwelling shall be permitted to have a solar-ready zone area of not less than 150 square feet (14 m^2).~~

~~**N1104.6.1.2 Obstructions.** Solar-ready zones shall be free from obstructions, including but not limited to vents, chimneys, and roof-mounted equipment.~~

~~**N1104.6.1.3 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 Solar Electric.” The reserved space shall be at the opposite (load) end of the busbar from the primary energy source.~~

~~**N1104.6.1.4 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 minimum 1 inch (25 mm) nonflexible metallic conduit or permanently installed wire as approved by the code official. Where the interconnection terminates in the attic, location shall be no less than 12 inches (35 mm) above ceiling insulation. Both ends of the interconnection shall be labeled “For Future Solar Electric”.~~

~~**N1104.6.2 Group R occupancies.** Buildings in Group R-2, R-3 and R-4 shall comply with *International Energy Conservation Code* Commercial Appendix CB.~~

~~**N1104.7 Electric Vehicle Power Transfer Infrastructure.** New automobile parking spaces for one- and two-family dwellings and townhouses shall be provided in accordance with Sections N1104.7.1 through N1104.7.5.~~

~~**N1104.7.1 Quantity.** New one- and two-family dwellings and townhouses with a designated attached or detached garage or other onsite private parking provided adjacent to the dwelling unit shall be provided with one EV-capable, EV-ready, or EVSE installed space per dwelling unit.~~

~~**N1104.7.2 EV Capable Spaces.** Each EV capable space used to meet the requirements of Section N1104.7.1 shall comply with all of the following:~~

1. ~~A continuous raceway or cable assembly shall be installed between an enclosure or outlet located within 3 feet (914 mm) of the EV capable space and a suitable panelboard or other onsite electrical distribution equipment.~~
2. ~~Installed raceway or cable assembly shall be sized and rated to supply a minimum circuit capacity in accordance with N1104.7.4.~~
3. ~~The electrical distribution equipment to which the raceway or cable assembly connects shall have sufficient dedicated space and spare electrical capacity for a 2-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)."~~

~~**N1104.7.3 EV Ready Spaces.** Each branch circuit serving EV ready spaces shall comply with all of the following:~~

1. ~~Terminate at an outlet or enclosure, located within 3 feet (914 mm) of each EV ready space it serves.~~
2. ~~Have a minimum circuit capacity in accordance with N1104.7.4.~~
3. ~~The panelboard or other electrical distribution equipment directory shall designate the branch circuit as "For electric vehicle supply equipment (EVSE)" and the outlet or enclosure shall be marked "For electric vehicle supply equipment (EVSE)."~~

~~**N1104.7.4 Circuit Capacity.** For one- and two-family dwellings and townhouses, the capacity of electrical infrastructure serving each EV capable space, EV ready space and EVSE space shall have a rated capacity not less than 8.3 kVA (or 40A at 208/240V) for each EV capable space, EV ready space or EVSE space it serves. Where a circuit is shared or managed it shall be in accordance with NFPA 70.~~

~~**Exceptions:**~~

1. ~~Where the local electric distribution entity has certified in writing that it is not able to provide 100% of the necessary distribution capacity within 2 years after the estimated date of the certificate of occupancy. The required EV charging infrastructure shall be reduced based on the available existing electric distribution capacity.~~
2. ~~Where substantiation has been approved that meeting the requirements of Section N1104.7.4.1 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 $400.00 per dwelling unit.~~

~~**N1104.7.4.1 Circuit capacity management.** The capacity of each branch circuit serving multiple EVSE spaces, EV ready space or EV capable spaces designed to be controlled by an energy management system providing load management in accordance with NFPA 70, shall have a capacity of not less than 2.7 kVA per space.~~

~~**N1104.7.5 EVSE installation.** For one- and two-family dwellings and townhouses, EVSE shall be installed in accordance with NFPA 70 and shall be listed and labeled in accordance with UL 2202 or UL 2594. For R-2 occupancies, EVSE shall be installed in accordance with NFPA 70 and Section N1104.7.5.1 and shall be listed and labeled in accordance with UL 2202 and UL 2594.~~

~~**N1104.7.5.1 EVSE minimum charging rate.** Each installed EVSE shall comply with one of the following:~~

1. ~~Be capable of charging at a rate of not less than 6.2 kVA (or 30A at 208/240V).~~
2. ~~Where serving EVSE spaces allowed to have a circuit capacity of not less than 2.7 kVA in accordance with N1104.7.4.1 and controlled by an energy management system providing load management, be capable of simultaneously charging each EVSE space at a rate of not less than 2.1 kVA.~~

Reason: <u>This language is out of scope and intent of the Code, and the Committee failed to meet the Goals and Objectives in their IECC Committee Procedures. Therefore these entire sections should be deleted or placed in a non-mandatory appendix.</u>

Point 1

ICC Council Policy 7 – Committees and Members, Section 9.1 – Scope of Work states The work of each committee shall be:
9.1.1 In accordance with the committee's scope and objectives statement,
9.1.2 In accordance with any instructions subsequently issued by the ICC Board, and
9.1.3 Consonant with the objectives of the ICC.

Point 2

Regarding 9.1.1 of Council Policy 7 - The Scope and Intent were provided to the Committee and posted on the International Energy Conservation Code (IECC) Residential Consensus Committee webpage as the “Committee Procedures”. The intent of the Residential Energy Provisions – IECC, R101.3 (page 2-3 of the Committee Procedures), and the intent of the Residential Energy Provision – Chapter 11 of the IRC, N1101.2 (page 3 of the Committee Procedures), state;

*“**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 **non-mandatory appendices** incorporating additional energy efficiency and **greenhouse gas reduction resources** developed by the Code Council and others.”*

Point 3

Regarding 9.1.1 of Council Policy 7 - The Goals & Objectives were provided to the Committee and posted on the International Energy Conservation Code (IECC) Residential Consensus Committee webpage as the “Committee Procedures”. The Goals & Objectives (page 3 of the Committee Procedures), state;

The goals and objectives in the “Intent” provisions above note the following for inclusion in the code:

- **Optional requirements** that lead to achievement of zero energy buildings, presently, and through glidepaths that achieve zero energy buildings by 2030.
- The code may include **non-mandatory appendices** incorporating additional energy efficiency and **greenhouse gas reduction resources**.

These performance objectives are intended to provide jurisdictions with an **adoptable set of provisions to achieve net-zero** energy by 2030.

Point 4

Regarding 9.1.2 of Council Policy 7 - The ICC Board did not issue any instructions subsequently, however prior to the Committee work, the ICC Board approved “LEADING THE WAY TO ENERGY EFFICIENCY A Path Forward on Energy and Sustainability to Confront a Changing Climate”, which is referenced and linked in the “Committee Procedures”(Page 2). The last principle in the list of principles (located on page 5 of “LEADING THE WAY TO ENERGY EFFICIENCY A Path Forward on Energy and Sustainability to Confront a Changing Climate”.) that govern the work of the committee it states:

The committee should develop **supplemental requirements** reflecting the diversity of energy efficiency goals made by adopting jurisdictions and the federal government. These shall include minimum requirements and **optional requirements aimed at achieving zero energy** buildings over multiple timeframes (e.g., through use of the current edition of the code, by 2030 and by 2050).

Furthermore, on page 7 of “LEADING THE WAY TO ENERGY EFFICIENCY A Path Forward on Energy and Sustainability to Confront a Changing

Climate" it states;

Building off the success of the IECC and IgCC, **the Code Council will develop a layered approach** that provides communities with **a menu of technical and policy resources**, which **integrate with the I-Codes**, to address their energy efficiency and GHG reduction goals, including those goals identified by the Energy and Carbon Advisory Council. The IECC will remain the minimum requirement.

The **resources are intended to be useable independently and adopted alongside the baseline code** to support the policies of a community in specific areas. For example, a community could adopt the 2021 IECC with provisions from the Code Council resources developed for electric vehicles or electrification.

It is clear that the ICC Board's instructions were that provisions for Electric Vehicles, electrification, electric ready, solar ready, mandatory onsite renewable energy and other Greenhouse Gas policy goals and zero energy building goals would be in supplemental, optional, non-mandatory appendices or resources and NOT in the baseline code.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This would decrease the cost of construction compared to leaving the provisions in the code.

Attached Files

- **Leading the Way to Energy Efficiency.pdf**
  https://energy.cdpaccess.com/proposal/1415/2618/files/download/476/
- **IECC Committee Procedures Directly from the Committee Website.pdf**
  https://energy.cdpaccess.com/proposal/1415/2618/files/download/475/
- **ICC Council Policy 7.pdf**
  https://energy.cdpaccess.com/proposal/1415/2618/files/download/474/

Workgroup Recommendation

Proposal # 1415

RED1-116-22

Proponents: Greg Johnson, representing National Multifamily Housing Council (gjohnsonconsulting@gmail.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R404.5 Electric readiness. Water heaters, household clothes dryers, conventional cooking tops and conventional ovens that use fossil fuel ~~Systems using fossil fuel: water heaters, household clothes dryers, conventional cooking tops or conventional ovens~~ shall comply with ~~the requirements~~ of Sections R404.5.1 through R404.5.4

Reason: Performed a colonectomy and otherwise edited for clarity.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
Editorial.

Workgroup Recommendation

Proposal # 1388

RED1-117-22

Proponents: Fredric Zwerg, representing Southwest Gas Corporation (fredric.zwerg@swgas.com)

2024 International Energy Conservation Code [RE Project]

Delete without substitution:

~~**R404.5 Electric readiness.** Systems using fossil fuel: water heaters, household clothes dryers, conventional cooking tops or conventional ovens shall comply with the requirements of Sections R404.5.1 through R404.5.4~~

Reason: Delete this proposed section entirely. The IECC is an energy code and not an electrification code. Electric readiness does not mean the building's energy usage will be less. This requirement adds costs to the home and puts an economic burden on the homeowner. According to the February 2021 Building Electrification study done by the Home Innovation Research Labs for the National Association of Home Builders (NAHB), home electrification is more expensive. Depending on the climate zone, it can range between $3,832 to $15,100 higher cost than a baseline mixed use (gas & electric) home. The proposed section assumes the homeowner will change over from gas appliances (cooking, space heating, water heating, clothes drying, decorative gas appliances and BBQ) to electric appliances. This proposal adds to the homeowner's mortgage with no cost savings. The current residential mortgage rates are very high (over a 6% for 15-year fixed to over 7% for a 30-year fixed). New homes are still in short supply with a shortage of qualified workers and delays in supplies (lumbar, steel, appliances and electrical supplies). The NAHB sent the President of the United States about shortages of electrical transformers and other electrical components. This proposed section is not justifiable and does not reasonable provide any energy savings. It is an electrification proposal only.

Cost Impact: The code change proposal will decrease the cost of construction.
This proposal will reduce the electrification cost.

Workgroup Recommendation

Proposal # 1118

RED1-118-22

Proponents: Ian Casey, representing NW Natural

2024 International Energy Conservation Code [RE Project]

Delete without substitution:

~~**R404.5 Electric readiness.** Systems using fossil fuel: water heaters, household clothes dryers, conventional cooking tops or conventional ovens shall comply with the requirements of Sections R404.5.1 through R404.5.4~~

~~**R404.5.1 Cooking products.** An individual branch circuit outlet with a rating not less than 250-volts, 40-amperes shall be installed, and terminate within three feet of conventional cooking tops, conventional ovens or cooking products combining both.~~

~~**Exception:** Cooking products not installed in an individual dwelling unit.~~

~~**R404.5.2 Household Clothes Dryers.** An individual branch circuit outlet with a rating not less than 240-volts, 30-amperes shall be installed, and terminate within three feet (304 mm) of each household clothes dryer.~~

~~**Exception:** Clothes dryers that serve more than one dwelling unit and are located outside of a dwelling unit.~~

Revise as follows:

~~**R404.5.3 Water heaters.** An individual branch circuit outlet with a rating not less than either 240-volts, 30-amperes or 120V, 20-amperes shall be installed, and terminate within three feet (304 mm) of each fossil fuel water heater.~~

~~**Exception:** Water heaters in a centralized water heating system serving multiple dwelling units in a R-2 occupancy.~~

Delete without substitution:

~~**R404.5.4 Electrification-ready circuits.** The unused conductors required by Sections R404.5.1 through R404.5.3 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 R404.5.1 through R404.5.3 shall be included in the load calculations of the original installation.~~

Reason: This proposal does not belong in the Energy Code. The provisions within this proposed code language will add construction costs for builders and do not guarantee energy savings for the homeowner. Additionally, it burdens homebuilders and homeowners with a duplicative energy system pathway that may never be used. The proposal has been presented as providing "flexibility" and "readiness" for the homeowner. In reality, it takes flexibility away from builders because it adds unnecessary building costs they cannot recover in sales price of their homes.

Cost Impact: The code change proposal will decrease the cost of construction.
By not requiring the originally proposed duplicative electrical infrastructure, this proposal will reduce cost of construction. This also will reduce complication and costs for plan review and enforcement by jurisdictions.

Workgroup Recommendation

Proposal # 1375

RED1-119-22

Proponents: Kevin Duell, representing NW Natural

2024 International Energy Conservation Code [RE Project]

Delete without substitution:

~~**R404.5 Electric readiness.** Systems using fossil fuel: water heaters, household clothes dryers, conventional cooking tops or conventional ovens shall comply with the requirements of Sections R404.5.1 through R404.5.4~~

~~**R404.5.1 Cooking products.** An individual branch circuit outlet with a rating not less than 250-volts, 40-amperes shall be installed, and terminate within three feet of conventional cooking tops, conventional ovens or cooking products combining both.~~

~~**Exception:** Cooking products not installed in an individual dwelling unit.~~

~~**R404.5.2 Household Clothes Dryers.** An individual branch circuit outlet with a rating not less than 240-volts, 30-amperes shall be installed, and terminate within three feet (304 mm) of each household clothes dryer.~~

~~**Exception:** Clothes dryers that serve more than one dwelling unit and are located outside of a dwelling unit.~~

~~**R404.5.3 Water heaters.** An individual branch circuit outlet with a rating not less than either 240-volts, 30-amperes or 120V, 20-amperes shall be installed, and terminate within three feet (304 mm) of each fossil fuel water heater.~~
~~**Exception:** Water heaters in a centralized water heating system serving multiple dwelling units in a R-2 occupancy.~~

~~**R404.5.4 Electrification-ready circuits.** The unused conductors required by Sections R404.5.1 through R404.5.3 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 R404.5.1 through R404.5.3 shall be included in the load calculations of the original installation.~~

Reason: This section as written is ideological, not based on the best available building science, and its illogical: It has nothing to do with energy efficiency – it only adds cost without saving energy. The proposal's requirements cannot pass a cost-effectiveness test or life cycle cost analysis. This proposed new section is misplaced: It is an electrical infrastructure measure, not an energy efficiency measure; therefore, it belongs in the Electrical Code (NFPA 72) - that is where designers, builders, plans examiners and inspectors look for guidance on electrical systems.

The proposed section is a ruse: It appears to provide options for occupants but is really just an economic embargo on gas infrastructure – effectuated by making the cost of gas systems prohibitive. That is its real purpose – to "get gas out of buildings" according to one proponent. Imagine the outcry if the language was inverted to require that gas piping be provided to all electric appliances: cooking products, clothes dryers, water heaters and furnaces. Sound absurd? It would be, just as requiring electrical wiring to all appliances is.

It is unfair: It will be used very rarely. What builder or owner will install two energy systems to serve cooking products, clothes dryers and water heaters - at twice the price? Very few, if any. This will probably only apply to custom homes and condos where the owner insists on gas appliances and has the wealth to cover it.

It is wasteful: Since it will only be used for owners committed to gas appliances, it will result in wasted assets: wiring, panel upgrades, larger transformers and inflated electrical utility infrastructure (that ratepayers will have to pay for).

The proposed section has numerous word choice and punctuation issues.

Cost Impact: The code change proposal will decrease the cost of construction.
This proposal reduces the cost of construction because does not require doubling up on energy infrastructure within the building. It will also reduce code enforcement costs - one less plan review and inspection item to check off.

Workgroup Recommendation

Proposal # 1377

RED1-120-22 Part I

Proponents: Ted Williams, representing ONE Gas (ngdllc@outlook.com)

2024 International Energy Conservation Code [RE Project]

Delete without substitution:

~~**R404.5 Electric readiness.** Systems using fossil fuel: water heaters, household clothes dryers, conventional cooking tops or conventional ovens shall comply with the requirements of Sections R404.5.1 through R404.5.4~~

~~**R404.5.1 Cooking products.** An individual branch circuit outlet with a rating not less than 250-volts, 40-amperes shall be installed, and terminate within three feet of conventional cooking tops, conventional ovens or cooking products combining both.~~

~~**Exception:** Cooking products not installed in an individual dwelling unit.~~

~~**R404.5.2 Household Clothes Dryers.** An individual branch circuit outlet with a rating not less than 240-volts, 30-amperes shall be installed, and terminate within three feet (304 mm) of each household clothes dryer.~~

~~**Exception:** Clothes dryers that serve more than one dwelling unit and are located outside of a dwelling unit.~~

~~**R404.5.3 Water heaters.** An individual branch circuit outlet with a rating not less than either 240-volts, 30-amperes or 120V, 20-amperes shall be installed, and terminate within three feet (304 mm) of each fossil fuel water heater.~~
~~**Exception:** Water heaters in a centralized water heating system serving multiple dwelling units in a R-2 occupancy.~~

~~**R404.5.4 Electrification-ready circuits.** The unused conductors required by Sections R404.5.1 through R404.5.3 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 R404.5.1 through R404.5.3 shall be included in the load calculations of the original installation.~~

Reason: **Presumption of Used Assets**

The proposal unjustifiably presumes that fuel fired end uses will be replaced by electric options. This presumption is unreasonable, given the longevity of domestic appliances, appliance replacement costs either over their useful lives or prematurely, uncertainty over motivation to switch fuels, and relative consumer energy costs favoring natural gas (the principal primary fuel of interest) over electricity in most jurisdictions. The proposal also disregards the consumer's ability to make justifiable energy choices based on their economic best interests.

Given the uncertainty of replacement of fuel fired appliances with electric appliances, costs versus benefits consideration cannot be evaluated since if gas appliances are not replaced with electric appliances, the benefit-to-cost of the proposal would be "zero" (or mathematically undefined if analyzed as a cost-to-benefit ratio). Costs and benefits discussed in subcommittee discussion of these requirements did not account for this uncertainty and the implication of comparing costs and benefits. Certainly, making a residential building "electric ready" incurs costs to the builder and eventual owner/occupant, but it in no way speaks to whether or not electric alternatives are installed and benefits might be presumed. Additionally, the actuality of conversion of appliances from gas fired to electric ignores the stranding of consumer assets in terms of gas supply systems and venting systems and utility natural gas supply infrastructure, the costs of which in the latter case will be allocated to other consumers.

Electric readiness requirements would conflict with important consumer energy choice alternatives that would include least-cost energy options for many consumers. This conflict over consumer options would most negatively impact economically-disadvantaged consumers who may have to pay for economically inefficient energy end use building infrastructure. In such instances, impacts upon consumers would be regressively burdensome.

Increased Emissions

The proposal unjustifiably presumes that full fuel cycle energy and emissions will decrease due to upstream primary energy changes. This presumption is not justified by the proponents of these changes and runs counter to current and the most likely electricity generation prospects based upon:

- Overall growth in generation capacity utilizing fossil fuels (specifically natural gas)
- Currently employed generation capacity
- Dispatched generation capacity and time-of-use electricity demand devoted to peak electricity demand
- Electricity generation infrastructure capacity to meet increased demand and time-of-use demand imposed by additional end use appliance demand

In fact, under current and foreseeable electricity generation growth, a switch from natural gas to electricity residential end uses would increase full fuel cycle energy consumption and carbon emissions on a national average basis by approximately 2.5 times compared to onsite energy consumption and carbon emissions from direct use of natural gas. Despite the growth of renewable electricity entering the national grid, the need to sustain time-dependent power demands and grid electrical frequency stability places limits on the foreseeable extent that renewable electricity will replace fossil fuel-fired generation, particularly with growing natural gas fired generation capacity and activity. Also, since the continued expansion of natural gas fired generation capacity is continuing (and recent judicial defeats of the federal Clean Power Plan), natural gas fired generation investment will continue to be used, displacing higher carbon generation fuels but nevertheless growing carbon emissions. The IECC should not incentivize this growth in carbon emissions and instead allow consumers to choose onsite use of natural gas to mitigate emissions increases (again precipitated by an approximate 2.5 to one advantage of onsite consumption of natural gas as opposed to powering electric generation).

Societal Costs

Similar national average considerations work against electric readiness requirements with respect to societal cost of compliance. The implicit expectation, supported by erroneous energy price forecasts published by the U. S. Energy Information Administration in its Annual Energy Outlook, is that electricity prices will decline as more renewable electricity comes to the national grid and that natural gas prices will increase over time in a "hockey stick" trend. Both of these energy price forecast series over time have not borne out across successive Annual Energy Outlook forecasts. Indeed, financial community forecasts of electricity prices show marked increases over the long term. The cumulative effect of the actual energy price trends would argue that all-electric residential building conversions would increase societal cost, perhaps to a significant degree.

The electric readiness requirements are not supported by cost effectiveness justification that would take into consideration both the full fuel cycle and emissions benefits (argued here as negative) and the costs to consumers and society in general (argued as positive). Adopting jurisdictions would be inclined to expect that IECC had evaluated the electric readiness requirements for cost effectiveness, but this expectation would be unfulfilled. ICC should not encourage such a lapse in justification in the IECC.

Electrical Service Industry Limitations

The proposal presumes that the additional labor burden of installing electric readiness infrastructure is manageable, which is subject to dispute in view of documented limitations on the labor force of qualified electricians and dim prospects for resolving the shortfall in that labor force. Evaluations by the National Electrical Contractors Association (NECA) documenting a shortfall amounting to 3,000 of qualified electricians annually (https://www.callaqm.com/blog/electrician-shortage/) , U. S. Bureau of Labor Statistics (BLS) predictions of 80,000 electricians growing at a rate of 7% annually (https://www.bls.gov/ooh/construction-and-extraction/electricians.htm) , Independent Electrical Contractors (IEC) analysis of electrician shortage and needs (https://insights.ieci.org/shortage-of-qualified-electrical-workers-in-2021-and-beyond/) present tangible limitations for implementation of electrification readiness measures in residential buildings, and these data and forecasts do not account for the additional labor burdens that electric ready construction would impose.

Transmission and Distribution Project Constraints and Delays

In addition to the projected scarcity of electricians, electric transmission project developers face permitting barriers and supply chain concerns for the foreseeable future. To realize federal GHG reduction goals, the US must build thousands of miles of upgraded or new transmission lines, however, the existing lengthy federal permitting process without an overhaul results in project delays of up to four years. In addition, utilities across the U.S. report wait times of 18 months to two years for transformer delivery. This delivery delay prevents the U.S. from not only building out clean energy infrastructure but also prevents local jurisdictions from issuing building permits because there is no means to provide power.

Cost Impact: The code change proposal will decrease the cost of construction.
Elimination of this section will decrease cost of construction by not requiring superfluous systems in the building structure.

Workgroup Recommendation

Proposal # 1398

RED1-120-22 Part II

Proponents: Ted Williams, representing ONE Gas (ngdllc@outlook.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R404.5 ~~Electric readiness.~~ ~~Systems using fossil fuel: water heaters, household clothes dryers, conventional cooking tops or conventional ovens shall comply with the requirements of Sections R404.5.1 through R404.5.4~~

~~R404.5.1 Cooking products.~~ ~~An individual branch circuit outlet with a rating not less than 250-volts, 40-amperes shall be installed, and terminate within three feet of conventional cooking tops, conventional ovens or cooking products combining both.~~

~~Exception:~~ ~~Cooking products not installed in an individual dwelling unit.~~

Delete without substitution:

~~R404.5.2 Household Clothes Dryers.~~ ~~An individual branch circuit outlet with a rating not less than 240-volts, 30-amperes shall be installed, and terminate within three feet (304 mm) of each household clothes dryer.~~

~~Exception:~~ ~~Clothes dryers that serve more than one dwelling unit and are located outside of a dwelling unit.~~

Revise as follows:

~~R404.5.3 Water heaters.~~ ~~An individual branch circuit outlet with a rating not less than either 240-volts, 30-amperes or 120V, 20-amperes shall be installed, and terminate within three feet (304 mm) of each fossil fuel water heater.~~

~~Exception:~~ ~~Water heaters in a centralized water heating system serving multiple dwelling units in a R-2 occupancy.~~

~~R404.5.4 Electrification-ready circuits.~~ ~~The unused conductors required by Sections R404.5.1 through R404.5.3 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 R404.5.1 through R404.5.3 shall be included in the load calculations of the original installation.~~

Reason: **Presumption of Used Assets**

The proposal unjustifiably presumes that fuel fired end uses will be replaced by electric options. This presumption is unreasonable, given the longevity of domestic appliances, appliance replacement costs either over their useful lives or prematurely, uncertainty over motivation to switch fuels, and relative consumer energy costs favoring natural gas (the principal primary fuel of interest) over electricity in most jurisdictions. The proposal also disregards the consumer's ability to make justifiable energy choices based on their economic best interests.

Given the uncertainty of replacement of fuel fired appliances with electric appliances, costs versus benefits consideration cannot be evaluated since if gas appliances are not replaced with electric appliances, the benefit-to-cost of the proposal would be "zero" (or mathematically undefined if analyzed as a cost-to-benefit ratio). Costs and benefits discussed in subcommittee discussion of these requirements did not account for this uncertainty and the implication of comparing costs and benefits. Certainly, making a residential building "electric ready" incurs costs to the builder and eventual owner/occupant, but it in no way speaks to whether or not electric alternatives are installed and benefits might be presumed. Additionally, the actuality of conversion of appliances from gas fired to electric ignores the stranding of consumer assets in terms of gas supply systems and venting systems and utility natural gas supply infrastructure, the costs of which in the latter case will be allocated to other consumers.

Electric readiness requirements would conflict with important consumer energy choice alternatives that would include least-cost energy options for many consumers. This conflict over consumer options would most negatively impact economically-disadvantaged consumers who may have to pay for economically inefficient energy end use building infrastructure. In such instances, impacts upon consumers would be regressively burdensome.

Increased Emissions

The proposal unjustifiably presumes that full fuel cycle energy and emissions will decrease due to upstream primary energy changes. This presumption is not justified by the proponents of these changes and runs counter to current and the most likely electricity generation prospects based upon:

- Overall growth in generation capacity utilizing fossil fuels (specifically natural gas)
- Currently employed generation capacity
- Dispatched generation capacity and time-of-use electricity demand devoted to peak electricity demand
- Electricity generation infrastructure capacity to meet increased demand and time-of-use demand imposed by additional end use appliance demand

In fact, under current and foreseeable electricity generation growth, a switch from natural gas to electricity residential end uses would increase full fuel cycle energy consumption and carbon emissions on a national average basis by approximately 2.5 times compared to onsite energy consumption and carbon emissions from direct use of natural gas. Despite the growth of renewable electricity entering the national grid, the need to sustain time-dependent power demands and grid electrical frequency stability places limits on the foreseeable extent that renewable electricity will replace fossil fuel-fired generation, particularly with growing natural gas fired generation capacity and activity. Also, since the continued expansion of natural gas fired generation capacity is continuing (and recent judicial defeats of the federal Clean Power Plan), natural gas fired generation investment will continue to be used, displacing higher carbon generation fuels but nevertheless growing carbon emissions. The IECC should not incentivize this growth in carbon emissions and instead allow consumers to choose onsite use of natural gas to mitigate emissions increases (again precipitated by an approximate 2.5 to one advantage of onsite consumption of natural gas as opposed to powering electric generation).

Societal Costs

Similar national average considerations work against electric readiness requirements with respect to societal cost of compliance. The implicit expectation, supported by erroneous energy price forecasts published by the U. S. Energy Information Administration in its Annual Energy Outlook, is that electricity prices will decline as more renewable electricity comes to the national grid and that natural gas prices will increase over time in a “hockey stick” trend. Both of these energy price forecast series over time have not borne out across successive Annual Energy Outlook forecasts. Indeed, financial community forecasts of electricity prices show marked increases over the long term. The cumulative effect of the actual energy price trends would argue that all-electric residential building conversions would increase societal cost, perhaps to a significant degree.

The electric readiness requirements are not supported by cost effectiveness justification that would take into consideration both the full fuel cycle and emissions benefits (argued here as negative) and the costs to consumers and society in general (argued as positive). Adopting jurisdictions would be inclined to expect that IECC had evaluated the electric readiness requirements for cost effectiveness, but this expectation would be unfulfilled. ICC should not encourage such a lapse in justification in the IECC.

Electrical Service Industry Limitations

The proposal presumes that the additional labor burden of installing electric readiness infrastructure is manageable, which is subject to dispute in view of documented limitations on the labor force of qualified electricians and dim prospects for resolving the shortfall in that labor force. Evaluations by the National Electrical Contractors Association (NECA) documenting a shortfall amounting to 3,000 of qualified electricians annually (https://www.callaqm.com/blog/electrician-shortage/) , U. S. Bureau of Labor Statistics (BLS) predictions of 80,000 electricians growing at a rate of 7% annually (https://www.bls.gov/ooh/construction-and-extraction/electricians.htm) , Independent Electrical Contractors (IEC) analysis of electrician shortage and needs (https://insights.ieci.org/shortage-of-qualified-electrical-workers-in-2021-and-beyond/) present tangible limitations for implementation of electrification readiness measures in residential buildings, and these data and forecasts do not account for the additional labor burdens that electric ready construction would impose.

Transmission and Distribution Project Constraints and Delays

In addition to the projected scarcity of electricians, electric transmission project developers face permitting barriers and supply chain concerns for the foreseeable future. To realize federal GHG reduction goals, the US must build thousands of miles of upgraded or new transmission lines, however, the existing lengthy federal permitting process without an overhaul results in project delays of up to four years. In addition, utilities across the U.S. report wait times of 18 months to two years for transformer delivery. This delivery delay prevents the U.S. from not only building out clean energy infrastructure but also prevents local jurisdictions from issuing building permits because there is no means to provide power.

Cost Impact: The code change proposal will decrease the cost of construction.
Elimination of requirements for electric readiness infrastructure will reduce construction costs to builders and home buyers and occupants.

Workgroup Recommendation

Proposal # 1399

RED1-121-22

Proponents: Shannon Corcoran, representing American Gas Association (corcoransm@att.net)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

~~**R404.5 Electric readiness.** Systems using fossil fuel: water heaters, household clothes dryers, conventional cooking tops or conventional ovens shall comply with the requirements of Sections R404.5.1 through R404.5.4~~

~~**R404.5.1 Cooking products.** An individual branch circuit outlet with a rating not less than 250-volts, 40-amperes shall be installed, and terminate within three feet of conventional cooking tops, conventional ovens or cooking products combining both.~~

~~**Exception:** Cooking products not installed in an individual dwelling unit.~~

R404.5.2 ~~**Household Clothes Dryers**~~. ~~An individual branch circuit outlet with a rating not less than 240-volts, 30-amperes shall be installed, and terminate within three feet (304 mm) of each household clothes dryer.~~

~~**Exception:** Clothes dryers that serve more than one dwelling unit and are located outside of a dwelling unit.~~

~~**R404.5.3 Water heaters.** An individual branch circuit outlet with a rating not less than either 240-volts, 30-amperes or 120V, 20-amperes shall be installed, and terminate within three feet (304 mm) of each fossil fuel water heater.~~

~~**Exception:** Water heaters in a centralized water heating system serving multiple dwelling units in a R-2 occupancy.~~

~~**R404.5.4 Electrification-ready circuits.** The unused conductors required by Sections R404.5.1 through R404.5.3 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 R404.5.1 through R404.5.3 shall be included in the load calculations of the original installation.~~

Reason: These proposals should be moved to an adoptable appendix or jurisdictional option in a new R409 section.
The International Energy Conservation Code should be fuel neutral and provide for energy savings regardless of the fuel source in the base code. The Code should not promote one energy source at the expense of other fuels, and should reflect the diversity of fuels used, home types, and consumer preferences across the US.

Electric-ready provisions are outside of the scope of the code as defined during the initial meetings of the consensus code.

These proposals presume that electrification is imminent and will be the only method to decarbonize homes. It ignores future advancements in technologies, like gas heat pumps and carbon capture, and dismisses developments in renewable gas and hydrogen

The proposals to include electric-ready provisions in the code add construction costs without adding energy savings for the consumer that opts to use natural gas, propane or fuel oil for space/water heating, cooking, clothes drying and decorative appliances. Additionally, there is no guarantee that a consumer will choose to convert from gas appliances to electric ones, leaving stranded assets and wasted costs if a homeowner never converts to an all-electric home.

The rationale statement for the original proposal stated that, "This proposal enhances customer choice by making it easy for homeowners to choose either electric or gas appliances." If customer choice were truly one of the main reasons for this proposal, it would require that both electric and gas connections be installed at these locations.

The proposals ignore the electric-grid's capacity to absorb the additional load that may be required for these proposals in addition to the proposed electric-vehicle charging station proposals.

Cost Impact: The code change proposal will increase the cost of construction.
As an adoptable appendix, the proposals will increase the cost of construction.

Workgroup Recommendation

Proposal # 1446

RED1-122-22

Proponents: Eric Tate, representing Atmos Energy (eric.tate@atmosenergy.com)

2024 International Energy Conservation Code [RE Project]

Delete without substitution:

~~**R404.5 Electric readiness.** Systems using fossil fuel: water heaters, household clothes dryers, conventional cooking tops or conventional ovens shall comply with the requirements of Sections R404.5.1 through R404.5.4~~

~~**R404.5.1 Cooking products.** An individual branch circuit outlet with a rating not less than 250-volts, 40-amperes shall be installed, and terminate within three feet of conventional cooking tops, conventional ovens or cooking products combining both.~~

~~**Exception:** Cooking products not installed in an individual dwelling unit.~~

~~**R404.5.2 Household Clothes Dryers.** An individual branch circuit outlet with a rating not less than 240-volts, 30-amperes shall be installed, and terminate within three feet (304 mm) of each household clothes dryer.~~

~~**Exception:** Clothes dryers that serve more than one dwelling unit and are located outside of a dwelling unit.~~

~~**R404.5.3 Water heaters.** An individual branch circuit outlet with a rating not less than either 240-volts, 30-amperes or 120V, 20-amperes shall be installed, and terminate within three feet (304 mm) of each fossil fuel water heater.~~
~~**Exception:** Water heaters in a centralized water heating system serving multiple dwelling units in a R-2 occupancy.~~

~~**R404.5.4 Electrification-ready circuits.** The unused conductors required by Sections R404.5.1 through R404.5.3 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 R404.5.1 through R404.5.3 shall be included in the load calculations of the original installation.~~

Reason: The proposal unjustifiably presumes that fuel fired end uses will be replaced by electric options. This presumption is unreasonable, given the longevity of domestic appliances, appliance replacement costs either over their useful lives or prematurely, uncertainty over motivation to switch fuels, and relative consumer energy costs favoring natural gas (the principal primary fuel of interest) over electricity in most jurisdictions.

Given the uncertainty of replacement of fuel fired appliances with electric appliances, costs versus benefits consideration cannot be evaluated since if gas appliances are not replaced with electric appliances, the benefit-to-cost of the proposal would be "zero" (or mathematically undefined if analyzed as a cost-to-benefit ratio). Costs and benefits discussed in subcommittee discussion of these requirements did not account for this uncertainty and the implication of comparing costs and benefits. Certainly, making a residential building "electric ready" incurs costs to the builder and eventual owner/occupant, but it in no way speaks to whether or not electric alternatives are installed and benefits might be presumed.

Electric readiness requirements would conflict with important consumer energy choice alternatives that would include least-cost energy options for many consumers. This conflict over consumer options would most negatively impact economically-disadvantaged consumers who could have to pay for economically inefficient energy end use building infrastructure. In such instances, impacts upon consumers would be regressively burdensome.

The proposal unjustifiably presumes that full fuel cycle energy and emissions will decrease due to upstream primary energy changes. This presumption is not justified by the proponents of these changes and runs counter to current and the most likely electricity generation prospects based upon:

- Overall growth in generation capacity utilizing fossil fuels (specifically natural gas),
- Currently employed generation capacity,
- Dispatched generation capacity and time-of-use electricity demand devoted to peak electricity demand.
- Electricity generation infrastructure capacity to meet increased demand and time-of-use demand imposed by additional end use appliance demand.

In fact, under current and foreseeable electricity generation growth, a switch from natural gas to electricity residential end uses would increase full fuel cycle energy consumption and carbon emissions on a national average basis by approximately 2.5 times compared onsite energy consumption and carbon emissions from direct use of natural gas. Despite the growth of renewable electricity entering the national grid, the need to sustain time-dependent power demands and grid electrical frequency stability places limits on the foreseeable extent that renewable electricity will replace fossil fuel-fired generation, particularly with growing natural gas fired generation capacity and activity. Also, since the continued expansion of natural gas fired generation capacity is continuing (and recent judicial decisions regarding the federal Clean Power Plan), natural gas fired generation investment will continue to be used, displacing higher carbon generation fuels. The IECC should not incorporate proposals that are purportedly aimed at reducing carbon emissions but that in reality increase those emissions. Instead, the IECC should not disincentivize consumers who choose onsite use of natural gas and actually help mitigate this growth in emissions (again precipitated by an approximate 2.5 to one advantage of onsite consumption of natural gas as opposed to powering electric generation). Proponents of the electric readiness requirements do not provide persuasive arguments countering these economic trends.

In addition, this proposal for electric readiness does not take into account accurate forecasts of the price of electricity versus the price of natural gas. Contrary to the energy price predictions of the U. S. Energy Information Administration in its Annual Energy Outlook (which have proven to be consistently inaccurate by underestimating the price of electricity and overestimating the price of natural gas in the out years), financial community forecasts of electricity prices show marked increases over the long term. The cumulative effect of the actual energy price trends demonstrate that all-electric residential building conversions would increase societal cost, perhaps to a significant degree.

The electric readiness requirements are not supported by cost effectiveness justification that would take into consideration both the full fuel cycle and emissions benefits (argued here as negative) and the costs to consumers and society in general (argued as positive). Jurisdictions adopting the 2024 IECC will expect that ICC has performed an analysis showing the cost effectiveness and societal benefits of this proposal. Without an accurate analysis reaching this conclusion, this proposal should be removed.

Cost Impact: The code change proposal will decrease the cost of construction.
Removal of these requirements will reduced cost of construction by not requiring installation of electrical circuitry and components that do not serve appliances installed at the building design stage and that may never get put into use.

Workgroup Recommendation

Proposal # 1448

RED1-123-22

Proponents: Steven Cowen, representing Black Hills Energy

2024 International Energy Conservation Code [RE Project]

Revise as follows:

~~**R404.5 Electric readiness.** Systems using fossil fuel: water heaters, household clothes dryers, conventional cooking tops or conventional ovens shall comply with the requirements of Sections R404.5.1 through R404.5.4~~

~~**R404.5.1 Cooking products.** An individual branch circuit outlet with a rating not less than 250-volts, 40-amperes shall be installed, and terminate within three feet of conventional cooking tops, conventional ovens or cooking products combining both.~~

~~**Exception:** Cooking products not installed in an individual dwelling unit.~~

~~**R404.5.2 Household Clothes Dryers**. An individual branch circuit outlet with a rating not less than 240-volts, 30-amperes shall be installed, and terminate within three feet (304 mm) of each household clothes dryer.~~

~~**Exception:** Clothes dryers that serve more than one dwelling unit and are located outside of a dwelling unit.~~

~~**R404.5.3 Water heaters.** An individual branch circuit outlet with a rating not less than either 240-volts, 30-amperes or 120V, 20-amperes shall be installed, and terminate within three feet (304 mm) of each fossil fuel water heater.~~

~~**Exception:** Water heaters in a centralized water heating system serving multiple dwelling units in a R-2 occupancy.~~

~~**R404.5.4 Electrification-ready circuits.** The unused conductors required by Sections R404.5.1 through R404.5.3 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 R404.5.1 through R404.5.3 shall be included in the load calculations of the original installation.~~

Reason: At Black Hills Energy, we provide safe, reliable and cost-effective natural gas and electric service to over 1.3 million customers in eight states. Our mission of improving life with energy means we must be ready to make tomorrow even better than today. That is why we are committed to creating a cleaner energy future which builds upon our responsibility to provide the safe, reliable and cost-effective energy that improves our customers' lives
Electric-ready provisions are not guaranteed to reduce energy consumption or greenhouse gas emissions. These provisions will add increased costs to consumers for features and service that may never be utilized. Currently, buyers considering these measures can do so in many instances in consultation with their builder. This additional cost should not be mandated upon consumers.

Black Hills Energy supports, and is a partner in, pursuing all sensible paths to reducing emissions and providing affordable, reliable energy for our customers today and tomorrow. Our natural gas systems are among the most advanced in the industry, and we continue to invest in clean and modern energy. This year we announced a new commitment to achieve Net Zero emissions by 2035 for our natural gas distribution system. This target replaces our previous commitment of a 50% reduction in GHG emissions intensity for mains and services by 2035, doubling our reduction target and expanding the boundary of the goal to all sources of emissions in our distribution system.

We have continued to achieve progress towards our goal to reduce electric utility emission intensity 40% by 2030 and 70% by 2040, already reducing emissions by more than a third since 2005.

Sustainably reducing greenhouse gas emissions will require continued efforts to reduce emissions from the natural gas sector; foster innovation of clean fuels, such as renewable natural gas and hydrogen; continued integration of clean energy sources like renewables and natural gas; utilization of our country's energy delivery infrastructure, and careful consideration of the impact to Americans.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
Proposal removes new provisions.

Workgroup Recommendation

Proposal # 1273

RED1-124-22

Proponents: Andrea Papageorge, representing Southern Company Gas (apapageo@southernco.com)

2024 International Energy Conservation Code [RE Project]

Delete without substitution:

~~**R404.5 Electric readiness.**~~ ~~Systems using fossil fuel: water heaters, household clothes dryers, conventional cooking tops or conventional ovens shall comply with the requirements of Sections R404.5.1 through R404.5.4~~

~~**R404.5.1 Cooking products.**~~ ~~An individual branch circuit outlet with a rating not less than 250-volts, 40-amperes shall be installed, and terminate within three feet of conventional cooking tops, conventional ovens or cooking products combining both.~~

~~**Exception:**~~ ~~Cooking products not installed in an individual dwelling unit.~~

~~**R404.5.2 Household Clothes Dryers**~~. ~~An individual branch circuit outlet with a rating not less than 240-volts, 30-amperes shall be installed, and terminate within three feet (304 mm) of each household clothes dryer.~~

~~**Exception:**~~ ~~Clothes dryers that serve more than one dwelling unit and are located outside of a dwelling unit.~~

~~**R404.5.3 Water heaters.**~~ ~~An individual branch circuit outlet with a rating not less than either 240-volts, 30-amperes or 120V, 20-amperes shall be installed, and terminate within three feet (304 mm) of each fossil fuel water heater.~~
~~**Exception:**~~ ~~Water heaters in a centralized water heating system serving multiple dwelling units in a R-2 occupancy.~~

~~**R404.5.4 Electrification-ready circuits.**~~ ~~The unused conductors required by Sections R404.5.1 through R404.5.3 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 R404.5.1 through R404.5.3 shall be included in the load calculations of the original installation.~~

Reason:

- The additional costs imposed on residential construction by requiring the buildings to be electric ready do not contribute to energy efficiency. Even in making the erroneous assumption that these provisions would contribute to energy efficiency, there is no way to assess any energy savings.
- These provisions would increase the cost of construction without any cost-effective justification.
- The requirement for electric readiness is not market driven. There is no evidence that consumers are asking for such features in homes.
- These provisions are in the prescriptive portion of the code, meaning that there would be no choice for residential contractors than to install these unneeded and unwanted assets.
- These provisions are based on the erroneous assumption that consumers will want to install electric appliances at some time in the future. In fact, in one meeting, it was stated that owners will be switching to electric appliances in the future and that by requiring electric outlets would same time and money in the future for consumers. There is no evidence that consumers of new home construction are desirous of making the switch to electric appliances in the future. Many home buyers will not consider the purchase of a home that does not have natural gas appliances.
- There is also the erroneous assumption that the future is all electric. This view is short sighted at best. No one can predict the future of energy and appliances. There will be future energy resources that have yet to be developed.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
By not requiring unneeded features in new construction, the cost of construction will not change as the construction design will not change. If these provisions remain in the code, the cost of construction will increase.

Workgroup Recommendation

Proposal # 1395

RED1-125-22

Proponents: Tom Ortiz, representing National Propane Gas Association (tortiz@npga.org); Bruce Swiecicki, representing National Propane Gas Association (bswiecicki@npga.org)

2024 ENERGY Chapter11

Delete without substitution:

~~**N1104.5 Electric readiness.** Systems using fossil fuel: water heaters, household clothes dryers, conventional cooking tops or conventional ovens shall comply with the requirements of Sections N1104.5.1 through N1104.5.4.~~

~~**N1104.5.1 Cooking products.** An individual branch circuit outlet with a rating not less than 250-volts, 40-amperes shall be installed, and terminate within three feet of conventional cooking tops, conventional ovens or cooking products combining both.~~

~~**Exception:** Cooking products not installed in an individual dwelling unit.~~

~~**N1104.5.2 Household Clothes Dryers.** An individual branch circuit outlet with a rating not less than 240-volts, 30-amperes shall be installed, and terminate within three feet (304 mm) of each household clothes dryer.~~

~~**Exception:** Clothes dryers that serve more than one dwelling unit and are located outside of a dwelling unit.~~

~~**N1104.5.3 Water heaters.** An individual branch circuit outlet with a rating not less than either 240-volts, 30-amperes or 120V, 20-amperes shall be installed, and terminate within three feet (304 mm) of each fossil fuel water heater.~~

~~**Exception:** Water heaters in a centralized water heating system serving multiple dwelling units in a R-2 occupancy.~~

~~**N1104.5.4 Electrification-ready circuits.** The unused conductors required by Sections N1104.5.1 through N1104.5.3 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 N1104.5.1 through N1104.5.3 shall be included in the load calculations of the original installation.~~

Reason: Buildings designed to use alternative fuel sources should not be required to incur the additional expense of mandatory, redundant electrification. Not only does this represent material and energy waste, but it also disadvantages renewable energy sources other than electricity. Furthermore, fuel gas can be more reliable in emergencies where a congested electric grid fails. We propose the following general principles as a pathway to achieving net zero carbon buildings:

1. It is highly doubtful that society, given the constraints of practicality and financial resources, would be able to fully upgrade the electric grid or provide enough on-site renewable energy to meet the demand that would be imposed with a "full-steam-ahead" electrification policy, which many are trying to achieve with the 2024 IECC.

2. The "real" issue we are addressing is not so much energy conservation, but carbon conservation in the form of limiting CO_2e emissions. No energy sources should be discounted if, on a source-basis, they can achieve a superior level of performance than other sources.

3. The code is revised and published every three years. A step-wise approach to be taken is the most prudent, as it allows the grid to be upgraded to handle the additional loads expected (much of it due to electrification of vehicles) and to allow implementation of two-way technology for returning electrons to the grid, which most locations to not currently permit.

It is very apparent that the huge ambitions held by some electrification advocates will outstrip the capacity of our infrastructure to deliver. The cost to build a "future-proof" grid will likely be somewhere between $1 trillion (Reuters[1]) and $7 trillion (Oilprice.com[2]). This is an expenditure on the order of what the US spent[3] on the wars in Iraq and Afghanistan between 2001 – 2021. The appetite for policymakers and ratepayers to absorb such costs is a question that is yet to be answered.

Meanwhile, the US EIA has documented that average electric transmission system outage times have roughly doubled between 2013 - 2021[4]. We therefore are facing the prospect of adding massive new load to a network that is already badly in need of maintenance, without knowing with any degree of certainty how much investment capital will be available to: a) enable safe and robust bi-directional power flow for distributed storage and generation; b) protect this new "smart" grid against cyberattack and other forms of sabotage; and c) procure enough domestic supplies of scarce critical minerals (e.g. lithium, cobalt, neodymium) to ensure a secure and affordable source for the—literally—billions of batteries that are intended to serve the electric vehicle, residential and commercial energy storage, utility-scale energy storage, and consumer electronics industries.

(And, not to be dismissed, when fusion energy becomes widespread, we will need yet more lithium from which to manufacture tritium—one necessary component of the most feasible fuel for any prospective fusion power plant.)

Therefore, we view inclusion of mandatory electrification in building codes as far more than an energy efficiency, or even a greenhouse gas, issue: it also has massive national security and health/safety implications that, in our opinions, are not being adequately analyzed. While building codes may not, per se, be tasked with solving all of those problems, they are nevertheless relied upon by decisionmakers as being rational, reliable, and conservative bases for managing the building stock of our nation's homes and businesses. Based on the foregoing, there should be consideration for more agnostically defining what is meant by a sustainable (rather than, strictly speaking, renewable) resource in the hope that we can use every feasible tool imaginable to optimize our energy system with respect to its myriad technical and environmental constraints.

[1]

McLaughlin, T. (2022), “Creaky U.S. power grid threatens progress on renewables, EVs”, Reuters, https://www.reuters.com/investigates/special-report/usa-renewables-electric-grid/

[2] Hyman, L. and Tilles, W. (2021), “The $7 Trillion Cost Of Upgrading The U.S. Power Grid”, Oilprice.com, https://oilprice.com/Energy/Energy-General/The-7-Trillion-Cost-Of-Upgrading-The-US-Power-Grid.html .

[3] https://www.brown.edu/news/2021-09-01/costsofwar

[4] US Energy Information Administration (2022), “Table 11.2. Reliability metrics using IEEE of U.S. distribution system by state”, https://www.eia.gov/electricity/annual/ .

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This code change will not affect the cost of construction.

Bibliography: [1] McLaughlin, T. (2022), “Creaky U.S. power grid threatens progress on renewables, EVs”, Reuters, https://www.reuters.com/investigates/special-report/usa-renewables-electric-grid/
[2] Hyman, L. and Tilles, W. (2021), “The $7 Trillion Cost Of Upgrading The U.S. Power Grid”, Oilprice.com, https://oilprice.com/Energy/Energy-General/The-7-Trillion-Cost-Of-Upgrading-The-US-Power-Grid.html .

[3] https://www.brown.edu/news/2021-09-01/costsofwar

[4] US Energy Information Administration (2022), “Table 11.2. Reliability metrics using IEEE of U.S. distribution system by state”, https://www.eia.gov/electricity/annual/ .

Workgroup Recommendation

Proposal # 1284

RED1-126-22 Part I

Proponents: Fredric Zwerg, representing Southwest Gas Corporation (fredric.zwerg@swgas.com)

2024 International Energy Conservation Code [RE Project]

Delete without substitution:

~~**R404.5.1 Cooking products.** An individual branch circuit outlet with a rating not less than 250-volts, 40-amperes shall be installed, and terminate within three feet of conventional cooking tops, conventional ovens or cooking products combining both.~~

~~**Exception:** Cooking products not installed in an individual dwelling unit.~~

~~**R404.5.2 Household Clothes Dryers.** An individual branch circuit outlet with a rating not less than 240-volts, 30-amperes shall be installed, and terminate within three feet (304 mm) of each household clothes dryer.~~

~~**Exception:** Clothes dryers that serve more than one dwelling unit and are located outside of a dwelling unit.~~

~~**R404.5.3 Water heaters.** An individual branch circuit outlet with a rating not less than either 240-volts, 30-amperes or 120V, 20-amperes shall be installed, and terminate within three feet (304 mm) of each fossil fuel water heater.~~
~~**Exception:** Water heaters in a centralized water heating system serving multiple dwelling units in a R-2 occupancy.~~

~~**R404.5.4 Electrification-ready circuits.** The unused conductors required by Sections R404.5.1 through R404.5.3 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 R404.5.1 through R404.5.3 shall be included in the load calculations of the original installation.~~

Reason: Delete this Section R404.5 Electric Readiness entirely. This adds cost with no guaranteed energy savings. This is an economic burden to the home buyer. See my reasons for deleting Section R404.5 Electric Readiness.

Cost Impact: The code change proposal will decrease the cost of construction.
This proposal will reduce construction costs.

Workgroup Recommendation

Proposal # 1123

RED1-126-22 Part II

Proponents: Fredric Zwerg, representing Southwest Gas Corporation (fredric.zwerg@swgas.com)

2024 ENERGY Chapter11

Delete without substitution:

~~**N1104.5 Electric readiness.** Systems using fossil fuel: water heaters, household clothes dryers, conventional cooking tops or conventional ovens shall comply with the requirements of Sections N1104.5.1 through N1104.5.4.~~

Reason: Delete this proposed section entirely. The IECC is an energy code and not an electrification code. Electric readiness does not mean the building's energy usage will be less. This requirement adds costs to the home and puts an economic burden on the homeowner. According to the February 2021 Building Electrification study done by the Home Innovation Research Labs for the National Association of Home Builders (NAHB), home electrification is more expensive. Depending on the climate zone, it can range between $3,832 to $15,100 higher cost than a baseline mixed use (gas & electric) home. The proposed section assumes the homeowner will change over from gas appliances (cooking, space heating, water heating, clothes drying, decorative gas appliances and BBQ) to electric appliances. This proposal adds to the homeowner's mortgage with no cost savings. The current residential mortgage rates are very high (over a 6% for 15-year fixed to over 7% for a 30-year fixed). New homes are still in short supply with a shortage of qualified workers and delays in supplies (lumbar, steel, appliances and electrical supplies). The NAHB sent the President of the United States about shortages of electrical transformers and other electrical components. This proposed section is not justifiable and does not reasonable provide any energy savings. It is an electrification proposal only.

Cost Impact: The code change proposal will decrease the cost of construction.
The deletion of this section will decrease the cost of construction.

I did try to attached the NAHB report but got a 32 bit error code. I was able to upload it for the IECC R404.5 proposal.

Workgroup Recommendation

Proposal # 1171

RED1-127-22

Proponents: Renee Lani, representing American Public Gas Association (rlani@apga.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R404.5 Electric readiness. Systems using ~~fossil~~ fuel gas or fuel oil: water heaters, household clothes dryers, conventional cooking tops or conventional ovens shall comply with the requirements of Sections R404.5.1 through R404.5.4

R404.5.3 Water heaters. An individual branch circuit outlet with a rating not less than either 240-volts, 30-amperes or 120V, 20-amperes shall be installed, and terminate within three feet (304 mm) of each ~~fossil~~ fuel gas or fuel oil water heater.

Exception: Water heaters in a centralized water heating system serving multiple dwelling units in a R-2 occupancy.

Reason: The term "fossil fuel" is inappropriate to describe combustion appliances that may be powered by a number of different of fuel gases or fuel oils, including renewable natural gas (RNG). While the term fossil fuel may be more recognizable than "fuel gas or fuel oil" to the general public, the I-Codes are specifically intended for building and code professionals, many of who are familiar with the technical terms such as "fuel gas," which is defined in other I-Codes such as the International Fuel Gas Code. For these reasons, any instances of "fossil fuel" should be replaced with the words "fuel gas or fuel oil," whether in this proposed added section, which APGA opposes (addressed in another comment), or elsewhere in the IECC-R.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
The code change proposal is just a change in term used and does not impact cost of construction.

Workgroup Recommendation

Proposal # 1027

RED1-128-22

Proponents: Shane Hoeper, representing myself (shoeper@cityofdubuque.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R404.5.1 Cooking products. A~~n individual~~ dedicated branch circuit~~ outlet~~ with a rating not less than 2~~5~~40-volts, 40-amperes shall be installed~~,~~ and terminate within three feet of conventional cooking tops, conventional ovens or cooking ~~products~~ appliances combining both.

Exception: Cooking ~~products~~ appliances not installed in an individual dwelling unit.

Reason: This edit is intended to clean-up the language used and does not change the intent of the section.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This editorial change does not change the cost impact of the code section.

Workgroup Recommendation

Proposal # 1141

RED1-129-22

Proponents: Adam Berry, representing Colorado Energy Office (adam.berry@state.co.us)

2024 International Energy Conservation Code [RE Project]

Add new text as follows:

R404.5.1 Space heating and cooling. An individual branch circuit outlet with a rating not less than 240-volts, 30-amperes shall be installed, and terminate within three feet of each fossil fuel space heating or cooling system. The electrical panel shall have sufficient capacity and reserved space to support an electric heat pump system.

Revise as follows:

R404.5 Electric readiness. Systems using fossil fuel: space heating or cooling systems, water heaters, household clothes dryers, conventional cooking tops or conventional ovens shall comply with the requirements of Sections R404.5.1 through R404.5. 5~~4~~

R404.5.2~~1~~ Cooking products. An individual branch circuit outlet with a rating not less than 250-volts, 40-amperes shall be installed, and terminate within three feet of conventional cooking tops, conventional ovens or cooking products combining both.
Exception: Cooking products not installed in an individual dwelling unit.

R404.5.3~~2~~ Household Clothes Dryers. An individual branch circuit outlet with a rating not less than 240-volts, 30-amperes shall be installed, and terminate within three feet (304 mm) of each household clothes dryer.
Exception: Clothes dryers that serve more than one dwelling unit and are located outside of a dwelling unit.

R404.5.4~~3~~ Water heaters. An individual branch circuit outlet with a rating not less than either 240-volts, 30-amperes or 120V, 20-amperes shall be installed, and terminate within three feet (304 mm) of each fossil fuel water heater. **Exception:** Water heaters in a centralized water heating system serving multiple dwelling units in a R-2 occupancy.

R404.5.5~~4~~ Electrification-ready circuits. The unused conductors required by Sections R404.5.1 through R404.5.3 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 R404.5.1 through R404.5.3 shall be included in the load calculations of the original installation.

2024 ENERGY Chapter11

Revise as follows:

N1104.5 Electric readiness. Systems using fossil fuel: space heating or cooling systems, water heaters, household clothes dryers, conventional cooking tops or conventional ovens shall comply with the requirements of Sections N1104.5.1 through N1104.5. 5~~4~~.

N1104.5.2~~1~~ Cooking products. An individual branch circuit outlet with a rating not less than 250-volts, 40-amperes shall be installed, and terminate within three feet of conventional cooking tops, conventional ovens or cooking products combining both.
Exception: Cooking products not installed in an individual dwelling unit.

N1104.5.3~~2~~ Household Clothes Dryers. An individual branch circuit outlet with a rating not less than 240-volts, 30-amperes shall be installed, and terminate within three feet (304 mm) of each household clothes dryer.
Exception: Clothes dryers that serve more than one dwelling unit and are located outside of a dwelling unit.

N1104.5.4~~3~~ Water heaters. An individual branch circuit outlet with a rating not less than either 240-volts, 30-amperes or 120V, 20-amperes shall be installed, and terminate within three feet (304 mm) of each fossil fuel water heater.
Exception: Water heaters in a centralized water heating system serving multiple dwelling units in a R-2 occupancy.

N1104.5.5~~4~~ Electrification-ready circuits. The unused conductors required by Sections N1104.5.1 through N1104.5.3 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 N1104.5.1 through N1104.5.3 shall be included in the load calculations of the original installation.

Add new text as follows:

N1104.5.1 Space heating and cooling. An individual branch circuit outlet with a rating not less than 240-volts, 30-amperes shall be installed, and terminate within three feet of each fossil fuel space heating or cooling system. The electrical panel shall have sufficient capacity and reserved space to support an electric heat pump system.

Reason: Space heating and cooling is most often the largest consumer of energy in residential buildings. Failing to require electric readiness for space heating and cooling systems along with cooking, water heating, and clothes drying will likely lead to very costly renovations of homes and upgrades of electrical panels to accommodate electric space heating, which will increase the challenge of installation of these systems for homeowners. Installing electric readiness infrastructure for space heating and cooling at the time of construction will be more cost effective and will enable simpler and less costly future retrofits for all-electric heating systems.

Cost Impact: The code change proposal will increase the cost of construction.
While this proposal may increase the upfront cost of construction, it will prove much more cost effective than future retrofits for electric heating systems and will take advantage of incremental cost increases for electrical panels with greater capacity and labor that is already engaged in construction of the home.

Workgroup Recommendation

Proposal # 1327

RED1-131-22

Proponents: Shane Hoeper, representing myself (shoeper@cityofdubuque.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R404.5.2 Household Clothes Dryers. A~~n individual~~ dedicated branch circuit~~ outlet~~ with a rating not less than 240-volts, 30-amperes shall be installed~~,~~ and terminate within three feet (304 mm) of each household clothes dryer.

> **Exception:** Clothes dryers ~~that serve more than one dwelling unit and are located outside of a dwelling unit~~ not installed in an individual dwelling unit.

Reason: Editorial changes to be consistent with R404.5.1. Not intended to change the intent of the section.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This change is only editorial.

Workgroup Recommendation

Proposal # 1186

RED1-132-22

Proponents: Douglas Presley, representing Dandelion Energy (dpresley@dandelionenergy.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R404.5 Electric readiness. Systems using fossil fuel: water heaters, space heating equipment, household clothes dryers, conventional cooking tops or conventional ovens shall comply with the requirements of Sections R404.5.1 through ~~R404.5.4~~ R404.5.5

Add new text as follows:

R404.5.4 Space heating . An individual branch circuit outlet in compliance with IRC Section E3702.11 based on heat pump space heating equipment sized in accordance with R403.7 and terminating within 3 feet (914 mm) of the location of each fossil fuel space heating system.

Revise as follows:

~~R404.5.4~~ R404.5.5 Electrification-ready circuits. The unused conductors required by Sections R404.5.1 through ~~R404.5.3~~ R404.5.4 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 R404.5.1 through ~~R404.5.3~~ R404.5.4 shall be included in the load calculations of the original installation.

Reason: Electrification of space heating is a key tool for improving the energy efficiency of buildings using heat pump technologies. Homeowner demand for heat pumps has been increasing dramatically over the past year, and many homeowners are seeking to upgrade their existing heating systems with heat pumps to avoid rising fossil fuel prices. Additionally, over 90 jurisdictions across 12 states have established some form of all-electric building policy, and these numbers will continue to grow as states take further steps to achieve their climate goals. Requiring electric-ready construction for space heating is a low-cost way to ensure residences are ready to implement future policy decisions and avoid costly retrofits in the future. Including electric-ready requirements in the 2024 Residential IECC would ensure that new homes are appropriately configured to receive heat pumps in the future when consumers or local policy demands it.

Cost Impact: The code change proposal will increase the cost of construction.
Minor increase in cost of construction.

Workgroup Recommendation

Proposal # 1058

RED1-133-22

Proponents: Steven Rosenstock, representing Edison Electric Institute (srosenstock@eei.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R404.6 Renewable energy infrastructure. The building shall comply with the requirements of R404.6.1 or R404.6.2.

Exceptions:

1. Buildings located in a jurisdiction with a Renewable Portfolio Standard of not less than 70 percent.
2. Buildings located in a jurisdiction where the amount of renewable or zero carbon electricity provided to the jurisdiction was not less than 70 percent of the total amount of electricity provided to the jurisdiction in the most recent previous calendar year.

Reason: Many jurisdictions in the US have renewable portfolio standards that have recently increased or will increase significantly over the next several years. For example, in California under SB 1020 that was signed into law in September 2022, the state electricity providers are required to achieve 90% renewable energy and zero-carbon electricity by the end of 2035. In Washington DC, the RPS requirement is 100% by 2032. In Oregon, the requirement is 100% by 2040. Several other states have similar requirements by 2045 or 2050, well within the lifetime of new buildings being built today or in the near future.
Other areas, like Seattle, already receive nearly all of their power from renewable and/or zero carbon resources. In 2020, Seattle received 86% of their power from hydroelectric facilities, 5% from wind farms, 5% from nuclear, 1% from biogas, and the other 3% from other sources. (source: https://www.seattle.gov/city-light/energy-and-environment).

In these areas, it does not make economic sense to force buildings to produce renewable energy when there are legal mandates for electricity (or other energy) providers to supply mostly or all renewable energy to buildings. Central station renewable energy has a much lower cost than rooftop residential and commercial (see Chapter 3 of the NREL report on the cost of solar installations at https://www.nrel.gov/docs/fy23osti/84515.pdf).

These proposed exceptions account for current scenarios as well as mandated future scenarios for energy supply.

Cost Impact: The code change proposal will decrease the cost of construction.
In those jurisdictions that meet the stringent exceptions.

Bibliography: *Fall 2022 Solar Industry Update*, National Renewable Energy Laboratory, October 27, 2022, accessed at https://www.nrel.gov/docs/fy23osti/84515.pdf

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Workgroup Recommendation

Proposal # 1056

RED1-134-22 Part I

Proponents: Tom Ortiz, representing National Propane Gas Association (tortiz@npga.org); Bruce Swiecicki, representing National Propane Gas Association (bswiecicki@npga.org)

2024 International Energy Conservation Code [RE Project]

Delete without substitution:

~~**R404.6 Renewable energy infrastructure.** The building shall comply with the requirements of R404.6.1 or R404.6.2.~~

~~**R404.6.1 One- and two- family dwellings and townhouses .** One- and two-family dwellings and townhouses shall comply with Sections R404.6.1.1 through R404.6.1.4.~~

~~**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^2) of roof area oriented between 110 degrees and 270 degrees of true north.~~
3. ~~A dwelling unit with less than 500 square feet (46m^2) of roof area oriented between 110 degrees and 270 degrees of true north.~~
4. ~~Dwelling units where 50 percent of the solar-ready area is shaded from direct-beam sunlight by natural objects or by structures that are not part of the building for more than 2500 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 whole-building electric use on an annual basis.~~
7. ~~A dwelling unit less than or equal to 1,500 square feet (139 m^2) of living space floor area located above grade plane.~~

~~**R404.6.1.1 Solar-ready zone area.** The total area of the solar-ready zone shall not be less than 250 square feet (23.2 m^2) 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^2) 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^2) per dwelling shall be permitted to have a solar-ready zone area of not less than 150 square feet (14 m^2).~~

~~**R404.6.1.2 Obstructions**. Solar-ready zones shall be free from obstructions, including but not limited to vents, chimneys, and roof-mounted equipment.~~

~~**R404.6.1.3 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 Solar Electric." The reserved space shall be at the opposite (load) end of the busbar from the primary energy source.~~

~~**R404.6.1.4 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 minimum 1 inch (25 mm) nonflexible metallic conduit or permanently installed wire as approved by the code official. Where the interconnection terminates in the attic, location shall be no less than 12 inches (35 mm) above ceiling insulation. Both ends of the interconnection shall be labeled "For Future Solar Electric".~~

~~**R404.6.2 Group R occupancies.** Buildings in Group R-2, R-3 and R-4 shall comply with Appendix CB.~~

Reason: This section appears to presume that all renewable energy is solar electric, which is not necessarily true. Renewable hydrocarbons, renewable biomass, and other systems can be designed. As such, buildings which do not include particular optional design features should not be economically penalized by having to install support for them.We propose the following general principles as a pathway to achieving net zero carbon buildings:

1. It is highly doubtful that society, given the constraints of practicality and financial resources, would be able to fully upgrade the electric grid or provide enough on-site renewable energy to meet the demand that would be imposed with a "full-steam-ahead" electrification policy, which many are trying to achieve with the 2024 IECC.

2. The "real" issue we are addressing is not so much energy conservation, but carbon conservation in the form of limiting CO_2e emissions. No energy sources should be discounted if, on a source-basis, they can achieve a superior level of performance than other sources.

3. The code is revised and published every three years. A step-wise approach to be taken is the most prudent, as it allows the grid to be upgraded to handle the additional loads expected (much of it due to electrification of vehicles) and to allow implementation of two-way technology for returning electrons to the grid, which most locations to not currently permit.

It is very apparent that the huge ambitions held by some electrification advocates will outstrip the capacity of our infrastructure to deliver. The cost to build a “future-proof” grid will likely be somewhere between $1 trillion (Reuters[1]) and $7 trillion (Oilprice.com[2]). This is an expenditure on the order of what the US spent[3] on the wars in Iraq and Afghanistan between 2001 – 2021. The appetite for policymakers and ratepayers to absorb such costs is a question that is yet to be answered.

Meanwhile, the US EIA has documented that average electric transmission system outage times have roughly doubled between 2013 - 2021[4]. We therefore are facing the prospect of adding massive new load to a network that is already badly in need of maintenance, without knowing with any degree of certainty how much investment capital will be available to: a) enable safe and robust bi-directional power flow for distributed storage and generation; b) protect this new “smart” grid against cyberattack and other forms of sabotage; and c) procure enough domestic supplies of scarce critical minerals (e.g. lithium, cobalt, neodymium) to ensure a secure and affordable source for the—literally—billions of batteries that are intended to serve the electric vehicle, residential and commercial energy storage, utility-scale energy storage, and consumer electronics industries.

(And, not to be dismissed, when fusion energy becomes widespread, we will need yet more lithium from which to manufacture tritium—one necessary component of the most feasible fuel for any prospective fusion power plant.)

Therefore, we view inclusion of mandatory electrification in building codes as far more than an energy efficiency, or even a greenhouse gas, issue: it also has massive national security and health/safety implications that, in our opinions, are not being adequately analyzed. While building codes may not, per se, be tasked with solving all of those problems, they are nevertheless relied upon by decisionmakers as being rational, reliable, and conservative bases for managing the building stock of our nation’s homes and businesses. Based on the foregoing, there should be consideration for more agnostically defining what is meant by a sustainable (rather than, strictly speaking, renewable) resource in the hope that we can use every feasible tool imaginable to optimize our energy system with respect to its myriad technical and environmental constraints.

[1]

McLaughlin, T. (2022), “Creaky U.S. power grid threatens progress on renewables, EVs”, Reuters, https://www.reuters.com/investigates/special-report/usa-renewables-electric-grid/

[2] Hyman, L. and Tilles, W. (2021), “The $7 Trillion Cost Of Upgrading The U.S. Power Grid”, Oilprice.com, https://oilprice.com/Energy/Energy-General/The-7-Trillion-Cost-Of-Upgrading-The-US-Power-Grid.html .

[3] https://www.brown.edu/news/2021-09-01/costsofwar

[4] US Energy Information Administration (2022), “Table 11.2. Reliability metrics using IEEE of U.S. distribution system by state”, https://www.eia.gov/electricity/annual/ .

Cost Impact: The code change proposal will decrease the cost of construction.
Buildings that utilize renewable energy sources other than electricity will avoid having to install unneeded equipment.

Bibliography: [1] McLaughlin, T. (2022), “Creaky U.S. power grid threatens progress on renewables, EVs”, Reuters, https://www.reuters.com/investigates/special-report/usa-renewables-electric-grid/
[2] Hyman, L. and Tilles, W. (2021), “The $7 Trillion Cost Of Upgrading The U.S. Power Grid”, Oilprice.com, https://oilprice.com/Energy/Energy-General/The-7-Trillion-Cost-Of-Upgrading-The-US-Power-Grid.html .

[3] https://www.brown.edu/news/2021-09-01/costsofwar

[4] US Energy Information Administration (2022), “Table 11.2. Reliability metrics using IEEE of U.S. distribution system by state”, https://www.eia.gov/electricity/annual/ .

Workgroup Recommendation

Proposal # 1253

RED1-134-22 Part II

Proponents: Tom Ortiz, representing National Propane Gas Association (tortiz@npga.org); Bruce Swiecicki, representing National Propane Gas Association (bswiecicki@npga.org)

2024 ENERGY Chapter11

Delete without substitution:

~~**N1104.6 Renewable energy infrastructure.** The building shall comply with the requirements of N1104.6.1 or N1104.6.2.~~

~~**N1104.6.1 One- and two- family dwellings and townhouses .** One- and two-family dwellings and townhouses shall comply with Sections N1104.6.1.1 through N1104.6.1.4.~~

~~**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^2) of roof area oriented between 110 degrees and 270 degrees of true north.~~
3. ~~A dwelling unit with less than 500 square feet (46m^2) of roof area oriented between 110 degrees and 270 degrees of true north.~~
4. ~~Dwelling units where 50 percent of the solar-ready area is shaded from direct-beam sunlight by natural objects or by structures that are not part of the building for more than 2500 annual hours between 8:00 a.m. and 4:00 p.m.~~
5. ~~A dwelling unit that complies with Appendix AX.~~
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 whole-building electric use on an annual basis.~~
7. ~~A dwelling unit less than or equal to 1,500 square feet of living space floor area located above grade plane.~~

~~**N1104.6.1.1 Solar-ready zone area.** The total area of the solar-ready zone shall not be less than 250 square feet (23.2 m^2) 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^2) 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^2) per dwelling shall be permitted to have a solar-ready zone area of not less than 150 square feet (14 m^2).~~

~~**N1104.6.1.2 Obstructions.** Solar-ready zones shall be free from obstructions, including but not limited to vents, chimneys, and roof-mounted equipment.~~

~~**N1104.6.1.3 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 Solar Electric." The reserved space shall be at the opposite (load) end of the busbar from the primary energy source.~~

~~**N1104.6.1.4 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 minimum 1 inch (25 mm) nonflexible metallic conduit or permanently installed wire as approved by the code official. Where the interconnection terminates in the attic, location shall be no less than 12 inches (35 mm) above ceiling insulation. Both ends of the interconnection shall be labeled "For Future Solar Electric".~~

~~**N1104.6.2 Group R occupancies.** Buildings in Group R-2, R-3 and R-4 shall comply with *International Energy Conservation Code* Commercial Appendix CB.~~

Reason: This section appears to presume that all renewable energy is solar electric, which is not necessarily true. Renewable hydrocarbons, renewable biomass, and other systems can be designed. As such, buildings which do not include particular optional design features should not be economically penalized by having to install support for them.
We propose the following general principles as a pathway to achieving net zero carbon buildings:
1. It is highly doubtful that society, given the constraints of practicality and financial resources, would be able to fully upgrade the electric grid or provide enough on-site renewable energy to meet the demand that would be imposed with a "full-steam-ahead" electrification policy, which many are trying to achieve with the 2024 IECC.

2. The "real" issue we are addressing is not so much energy conservation, but carbon conservation in the form of limiting CO_2e emissions. No energy sources should be discounted if, on a source-basis, they can achieve a superior level of performance than other sources.

3. The code is revised and published every three years. A step-wise approach to be taken is the most prudent, as it allows the grid to be upgraded to handle the additional loads expected (much of it due to electrification of vehicles) and to allow implementation of two-way technology for returning electrons to the grid, which most locations to not currently permit.

It is very apparent that the huge ambitions held by some electrification advocates will outstrip the capacity of our infrastructure to deliver. The cost to build a "future-proof" grid will likely be somewhere between $1 trillion (Reuters[1]) and $7 trillion (Oilprice.com[2]). This is an expenditure on the order of what the US spent[3] on the wars in Iraq and Afghanistan between 2001 – 2021. The appetite for policymakers and ratepayers to absorb such costs is a question that is yet to be answered.

Meanwhile, the US EIA has documented that average electric transmission system outage times have roughly doubled between 2013 - 2021[4]. We therefore are facing the prospect of adding massive new load to a network that is already badly in need of maintenance, without knowing with any degree of certainty how much investment capital will be available to: a) enable safe and robust bi-directional power flow for distributed storage and generation; b) protect this new "smart" grid against cyberattack and other forms of sabotage; and c) procure enough domestic supplies of scarce critical minerals (e.g. lithium, cobalt, neodymium) to ensure a secure and affordable source for the—literally—billions of batteries that are intended to serve the electric vehicle, residential and commercial energy storage, utility-scale energy storage, and consumer electronics industries.

(And, not to be dismissed, when fusion energy becomes widespread, we will need yet more lithium from which to manufacture tritium—one necessary component of the most feasible fuel for any prospective fusion power plant.)

Therefore, we view inclusion of mandatory electrification in building codes as far more than an energy efficiency, or even a greenhouse gas, issue: it also has massive national security and health/safety implications that, in our opinions, are not being adequately analyzed. While building codes may not, per se, be tasked with solving all of those problems, they are nevertheless relied upon by decisionmakers as being rational, reliable, and conservative bases for managing the building stock of our nation's homes and businesses. Based on the foregoing, there should be consideration for more agnostically defining what is meant by a sustainable (rather than, strictly speaking, renewable) resource in the hope that we can use every feasible tool imaginable to optimize our energy system with respect to its myriad technical and environmental constraints.

[1]

McLaughlin, T. (2022), "Creaky U.S. power grid threatens progress on renewables, EVs", Reuters, https://www.reuters.com/investigates/special-report/usa-renewables-electric-grid/

[2] Hyman, L. and Tilles, W. (2021), "The $7 Trillion Cost Of Upgrading The U.S. Power Grid", Oilprice.com, https://oilprice.com/Energy/Energy-General/The-7-Trillion-Cost-Of-Upgrading-The-US-Power-Grid.html .

[3] https://www.brown.edu/news/2021-09-01/costsofwar

[4] US Energy Information Administration (2022), "Table 11.2. Reliability metrics using IEEE of U.S. distribution system by state", https://www.eia.gov/electricity/annual/ .

Cost Impact: The code change proposal will decrease the cost of construction.
Buildings that provide renewable energy through other means than electricity will see a decrease in cost of construction.

Bibliography: [1] McLaughlin, T. (2022), "Creaky U.S. power grid threatens progress on renewables, EVs", Reuters, https://www.reuters.com/investigates/special-report/usa-renewables-electric-grid/
[2] Hyman, L. and Tilles, W. (2021), "The $7 Trillion Cost Of Upgrading The U.S. Power Grid", Oilprice.com, https://oilprice.com/Energy/Energy-General/The-7-Trillion-Cost-Of-Upgrading-The-US-Power-Grid.html .

[3] https://www.brown.edu/news/2021-09-01/costsofwar

[4] US Energy Information Administration (2022), "Table 11.2. Reliability metrics using IEEE of U.S. distribution system by state", https://www.eia.gov/electricity/annual/ .

Workgroup Recommendation

Proposal # 1290

RED1-135-22 Part I

Proponents: Fredric Zwerg, representing Southwest Gas Corporation (fredric.zwerg@swgas.com)

2024 International Energy Conservation Code [RE Project]

Delete without substitution:

~~**R404.6 Renewable energy infrastructure.** The building shall comply with the requirements of R404.6.1 or R404.6.2.~~

~~**R404.6.1 One- and two- family dwellings and townhouses .** One- and two-family dwellings and townhouses shall comply with Sections R404.6.1.1 through R404.6.1.4.~~

~~**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^2) of roof area oriented between 110 degrees and 270 degrees of true north.~~
3. ~~A dwelling unit with less than 500 square feet (46m^2) of roof area oriented between 110 degrees and 270 degrees of true north.~~
4. ~~Dwelling units where 50 percent of the solar-ready area is shaded from direct-beam sunlight by natural objects or by structures that are not part of the building for more than 2500 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 whole-building electric use on an annual basis.~~
7. ~~A dwelling unit less than or equal to 1,500 square feet (139 m^2) of living space floor area located above grade plane.~~

~~**R404.6.1.1 Solar-ready zone area.** The total area of the solar-ready zone shall not be less than 250 square feet (23.2 m^2) 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^2) 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^2) per dwelling shall be permitted to have a solar-ready zone area of not less than 150 square feet (14 m^2).~~

~~**R404.6.1.2 Obstructions.** Solar-ready zones shall be free from obstructions, including but not limited to vents, chimneys, and roof-mounted equipment.~~

~~**R404.6.1.3 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 Solar Electric." The reserved space shall be at the opposite (load) end of the busbar from the primary energy source.~~

~~**R404.6.1.4 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 minimum 1 inch (25 mm) nonflexible metallic conduit or permanently installed wire as approved by the code official. Where the interconnection terminates in the attic, location shall be no less than 12 inches (35 mm) above ceiling insulation. Both ends of the interconnection shall be labeled "For Future Solar Electric".~~

~~**R404.6.2 Group R occupancies.** Buildings in Group R-2, R-3 and R-4 shall comply with Appendix CB.~~

Reason: Delete this Section R404.6 entirely. This section requires additional costs that the homeowner must pay for, even if no renewable energy systems are to be installed. This proposal has no guaranteed energy savings. The choice should be left up to the builder and/or the home buyer if they want to install any portion of a renewable energy infrastructure. This section is an electrification proposal and should not be included in an energy code.

Cost Impact: The code change proposal will decrease the cost of construction.
Deleting this section will reduce construction costs.

Workgroup Recommendation

Proposal # 1121

RED1-135-22 Part II

Proponents: Fredric Zwerg, representing Southwest Gas Corporation (fredric.zwerg@swgas.com)

2024 ENERGY Chapter11

Delete without substitution:

~~**N1104.6 Renewable energy infrastructure.** The building shall comply with the requirements of N1104.6.1 or N1104.6.2.~~

~~**N1104.6.1 One- and two- family dwellings and townhouses .** One- and two-family dwellings and townhouses shall comply with Sections N1104.6.1.1 through N1104.6.1.4.~~

~~**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^2) of roof area oriented between 110 degrees and 270 degrees of true north.~~
3. ~~A dwelling unit with less than 500 square feet (46m^2) of roof area oriented between 110 degrees and 270 degrees of true north.~~
4. ~~Dwelling units where 50 percent of the solar-ready area is shaded from direct-beam sunlight by natural objects or by structures that are not part of the building for more than 2500 annual hours between 8:00 a.m. and 4:00 p.m.~~
5. ~~A dwelling unit that complies with Appendix AX.~~
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 whole-building electric use on an annual basis.~~
7. ~~A dwelling unit less than or equal to 1,500 square feet of living space floor area located above grade plane.~~

~~**N1104.6.1.1 Solar-ready zone area.** The total area of the solar-ready zone shall not be less than 250 square feet (23.2 m^2) 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^2) 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^2) per dwelling shall be permitted to have a solar-ready zone area of not less than 150 square feet (14 m^2).~~

~~**N1104.6.1.2 Obstructions.** Solar-ready zones shall be free from obstructions, including but not limited to vents, chimneys, and roof-mounted equipment.~~

~~**N1104.6.1.3 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 Solar Electric.” The reserved space shall be at the opposite (load) end of the busbar from the primary energy source.~~

~~**N1104.6.1.4 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 minimum 1 inch (25 mm) nonflexible metallic conduit or permanently installed wire as approved by the code official. Where the interconnection terminates in the attic, location shall be no less than 12 inches (35 mm) above ceiling insulation. Both ends of the interconnection shall be labeled “For Future Solar Electric”.~~

~~**N1104.6.2 Group R occupancies.** Buildings in Group R-2, R-3 and R-4 shall comply with *International Energy Conservation Code* Commercial Appendix CB.~~

Reason: Delete this section entirely. This section requires additional costs that the homeowner must pay, even if no renewable energy system is installed. The choice should be left up to the builder and buyer if they want to install any renewable energy infrastructure. This provision does not provide any energy savings to the home. This requirement is an electrification proposal and should not be included in an energy code.

Cost Impact: The code change proposal will decrease the cost of construction.
This proposal will reduce construction costs.

Workgroup Recommendation

RED1-136-22

Proponents: Adam Berry, representing Colorado Energy Office (adam.berry@state.co.us)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R404.6.1 One- and two- family dwellings and townhouses . One- and two-family dwellings and townhouses shall comply with Sections R404.6.1.1 through R404.6.1.4.
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 300~~500~~ square feet (46 m^2) of roof area oriented between 110 degrees and 270 degrees of true north.
3. A dwelling unit with less than 500 square feet (46m^2) of roof area oriented between 110 degrees and 270 degrees of true north.
4. Dwelling units where 50 percent or more of the solar-ready area is shaded from direct-beam sunlight by natural objects or by structures that are not part of the building for more than 2500 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 whole-building electric use on an annual basis.
7. ~~A dwelling unit less than or equal to 1,500 square feet (139 m²) of living space floor area located above grade plane.~~

R404.6.1.1 Solar-ready zone area. The total area of the solar-ready zone shall not be less than 300~~250~~ square feet (23.2 m^2) 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^2) 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^2) per dwelling shall be permitted to have a solar-ready zone area of not less than 150 square feet (14 m^2).

2024 ENERGY Chapter11

Revise as follows:

N1104.6.1 One- and two- family dwellings and townhouses . One- and two-family dwellings and townhouses shall comply with Sections N1104.6.1.1 through N1104.6.1.4.
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 300~~500~~ square feet (46 m^2) of roof area oriented between 110 degrees and 270 degrees of true north.
3. A dwelling unit with less than 500 square feet (46m^2) of roof area oriented between 110 degrees and 270 degrees of true north.
4. Dwelling units where 50 percent or more of the solar-ready area is shaded from direct-beam sunlight by natural objects or by structures that are not part of the building for more than 2500 annual hours between 8:00 a.m. and 4:00 p.m.
5. A dwelling unit that complies with Appendix AX.
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 whole-building electric use on an annual basis.
7. ~~A dwelling unit less than or equal to 1,500 square feet of living space floor area located above grade plane.~~

N1104.6.1.1 Solar-ready zone area. The total area of the solar-ready zone shall not be less than 300~~250~~ square feet (23.2 m^2) 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^2) 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^2) per dwelling shall be permitted to have a solar-ready zone area of not less than 150 square feet (14 m^2).

Reason: Increasing minimum solar ready zone under R404.6.1 and N1104.6.1 to 300 square feet - This proposal aligns the minimum solar ready zone size with the size required under Appendix RB. This has been the required size under Appendix RB for several code cycles, and many states and jurisdictions have adopted Appendix RB.
Reducing exception #2 under R404.6 and N1104.6 to 300 square feet - R404.6.1 and N1104.6.1 establish that the minimum solar ready zone

requirement is less than 500 square feet, so there should not be an exception for homes that have a solar ready zone that could be greater than that minimum. Reducing the minimum solar ready zone exception under #2 to 300 square feet would align it with the minimum requirement proposal I have made under sections R404.6.1 and N1104.6.1.

Addition of "or more" to exception #4 under R404.6 and N1104.6 - This provides more flexibility to allow for 50% of the solar ready zone area being shaded to be the minimum rather than an exact requirement.

Striking exception #7 under R404.6 and N1104.6 - The primary factor in determining the available roof area for a solar ready zone is dependent on roof size and inclination, not on the size of conditioned square footage within the home. A significant percentage of homes are less than 1,500 square feet of conditioned space above grade plane, and arbitrarily exempting these homes just because of their conditioned square footage as opposed to their actual roof size would exempt a significant number of new single family homes and townhomes from solar ready requirements that may result in costly future retrofits.

Cost Impact: The code change proposal will increase the cost of construction.
This proposal would only increase the cost of construction for homes that would have been exempted from solar ready requirements under the language of Public Comment Draft #1. All homes above 1,500 square feet that have at least 300 square feet of roof space suitable for a solar ready zone will not be affected.

Workgroup Recommendation

Proposal # 1331

RED1-137-22

Proponents: Greg Johnson, representing National Multifamily Housing Council (gjohnsonconsulting@gmail.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R404.6.1.3 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 ~~Solar~~ Renewable Electric.” The reserved space shall be at the opposite (load) end of the busbar from the primary energy source.

Reason: There are other renewable energy systems than solar, even on rooftops.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
Editorial.

Workgroup Recommendation

Proposal # 1097

RED1-138-22

Proponents: Greg Johnson, representing National Multifamily Housing Council (gjohnsonconsulting@gmail.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R404.6.1.4 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 ~~minimum~~ not less than 1 inch (25 mm) nonflexible metallic conduit or permanently installed wire as *approved* ~~by the code official~~. Where the interconnection terminates in the attic, the location shall be no t less than 12 inches (35 mm) above ceiling insulation. Both ends of the interconnection shall be labeled “For Future ~~Solar~~ Renewable Electric”.

Reason: There are other renewable energy systems than solar and some fit on roofs. Edited for preferable code language.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
Editorial.

Workgroup Recommendation

Proposal # 1098

RED1-139-22

Proponents: Greg Johnson, representing National Multifamily Housing Council (gjohnsonconsulting@gmail.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R404.6.1.4 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 minimum 1 inch (25 mm) nonflexible metallic conduit or permanently installed wire as *approved* ~~by the code official~~. Where the interconnection terminates in the attic, location shall be no less than 12 inches (35 mm) above ceiling insulation. Both ends of the interconnection shall be labeled “For Future ~~Solar~~ Renewable Electric”.

Reason: Approved is defined to mean 'acceptable to the code official.' It's unnecessary to re-state "code official" in the text. There are other renewable energy systems suitable for rooftop mounting. The code avoid requirements that are not technology neutral or proprietary.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
Editorial.

Workgroup Recommendation

Proposal # 1387

RED1-140-22

Proponents: Greg Johnson, representing National Multifamily Housing Council (gjohnsonconsulting@gmail.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R404.6.2 Group R occupancies. ~~Buildings in Group R-2, R-3 and R-4 shall comply with Appendix CB.~~

Reason: Section R101.5 clearly requires that residential buildings comply with the IECC-R rather than the IECC- commercial provisions. The original proponent of this section should do the work of incorporating the actual requirements for the benefit of the code user instead of referencing a code that may not be adopted, such as in an ASHRAE 90.1 adopting jurisdiction..

Additionally, the reference itself is flaky - it doesn't even specify what document's appendix is the subject of the reference.

Finally, IECC-C Appendix CB (if that's the intended reference) is only applicable where specifically adopted. The IECC-R cannot change that.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
If original proponent fixes the referencing violation and puts the requirements in the right place there will be no cost impact.

Workgroup Recommendation

Proposal # 1099

RED1-141-22

Proponents: Michael Tillou, representing Pacific Northwest National Lab (michael.tillou@pnnl.gov)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R404.7 Electric Vehicle Power Transfer Infrastructure. ~~New automobile parking spaces for one- and two-family dwellings and townhouses shall be provided in accordance with Sections R404.7.1 through R404.7.5.~~ New residential automobile parking spaces for one and two family dwellings and townhouses and R-2 occupancies shall be provided with electric vehicle power transfer infrastructure in accordance with Sections R404.7.1 through R404.7.5.

R404.7.1 Quantity. New one- and two-family dwellings and townhouses with a designated attached or detached garage or other onsite private parking provided adjacent to the dwelling unit shall be provided with one EV-capable, EV-ready, or EVSE installed space 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 EVSE space for 40 percent of each dwelling units or automobile parking spaces, whichever is less.

R404.7.2 EV Capable Spaces. Each EV capable space used to meet the requirements of Section R404.7.1 shall comply with all of the following:

1. A continuous raceway or cable assembly shall be installed between an enclosure or outlet located within 3 feet (914 mm) of the EV capable space and a suitable panelboard or other onsite electrical distribution equipment.
2. Installed raceway or cable assembly shall be sized and rated to supply a minimum circuit capacity in accordance with R404.7.4
3. The electrical distribution equipment to which the raceway or cable assembly connects shall have sufficient dedicated space and spare electrical capacity for a 2-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)."

R404.7.3 EV Ready Spaces. Each branch circuit serving EV ready spaces shall comply with all of the following:

1. Terminate at an outlet or enclosure, located within 3 feet (914 mm) of each EV ready space it serves.
2. Have a minimum circuit capacity in accordance with R404.7.4.
3. The panelboard or other electrical distribution equipment directory shall designate the branch circuit as "For electric vehicle supply equipment (EVSE)" and the outlet or enclosure shall be marked "For electric vehicle supply equipment (EVSE)."

Revise as follows:

R404.7.4 Circuit Capacity. For one- and two-family dwellings and townhouses, the capacity of electrical infrastructure serving each required EV capable space, EV ready space and EVSE space shall be sized for *EV* charging at a rate not less than 6.2 kVA (or 30A at 208/240V) per space. ~~have a rated capacity not less than 8.3 kVA (or 40A at 208/240V) for each EV capable space, EV ready space or EVSE space it serves.~~ Where a circuit is shared or managed it shall be in accordance with NFPA 70. For R-2 occupancies, the capacity of electrical infrastructure serving each EV capable space, EV ready space and EVSE space shall comply with one of the following:

1. A branch circuit shall have a rated capacity sized for *EV* charging at a rate not less than 6.2kVA (30A at 208/240V) per space. ~~not less than 8.3kVA (or 40A at 208/240V) for each EV capable space, EV ready space or EVSE space it serves.~~ Where a circuit is shared or managed it shall be in accordance with NFPA 70.
2. The requirements of R404.7.4.1.

Exceptions:

1. Where the local electric distribution entity has certified in writing that it is not able to provide 100 percent of the necessary distribution capacity within 2 years after the estimated date of the certificate of occupancy. The required EV charging infrastructure shall be reduced based on the available existing electric distribution capacity.
2. Where substantiation has been approved that meeting the requirements of Section R404.7.4.1 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 $400.00 per dwelling unit.

R404.7.4.1 Circuit capacity management. The capacity of each branch circuit serving multiple EVSE spaces, EV ready space or EV capable spaces designed to be controlled by an energy management system providing load management in accordance with NFPA 70, shall be sized for *EV* charging at a rate of not less than 2.1 kVA per space. ~~have a capacity of not less than 2.7 kVA per space.~~

R404.7.5 EVSE installation. ~~For one- and two-family dwellings and townhouses,~~ EVSE shall be installed in accordance with NFPA 70 and shall be listed and labeled in accordance with UL 2202 or UL 2594. ~~For R-2 occupancies, EVSE shall be installed in accordance with NFPA 70 and Section~~

~~R404.7.5.1 and shall be listed and labeled in accordance with UL 2202 and UL 2594.~~

Delete without substitution:

~~**R404.7.5.1 EVSE minimum charging rate.**~~ ~~Each installed EVSE shall comply with one of the following:~~

1. ~~Be capable of charging at a rate of not less than 6.2 kVA (or 30A at 208/240V).~~
2. ~~Where serving EVSE spaces allowed to have a circuit capacity of not less than 2.7 kVA in accordance with R404.7.4.1 and controlled by an energy management system providing load management, be capable of simultaneously charging each EVSE space at a rate of not less than 2.1 kVA.~~

Reason: The proposed public comment is editorial and suggests changes to clarify the proposed language. The original language created confusion because it described both a minimum charging rate and a required circuit capacity necessary to provide that charging rate. The recommendation is to only provide the required charging rate that a EV space must be sized for. This is consistent with the proposed Federal Rulemaking by the US Department of Transportation with regard to the installation of EV charging infrastructure. https://www.federalregister.gov/documents/2022/06/22/2022-12704/national-electric-vehicle-infrastructure-formula-program Additional suggestions have been provided to clean up redundant language.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This proposal does not change the currently proposed requirements for EV charging infrastructure.

Workgroup Recommendation

Proposal # 1361

RED1-142-22

Proponents: Shane Hoeper, representing myself (shoeper@cityofdubuque.org)

2024 International Energy Conservation Code [RE Project]

Delete without substitution:

~~**R404.7 Electric Vehicle Power Transfer Infrastructure.** New automobile parking spaces for one- and two-family dwellings and townhouses shall be provided in accordance with Sections R404.7.1 through R404.7.5. New residential automobile parking spaces for R-2 occupancies shall be provided with electric vehicle power transfer infrastructure in accordance with Sections R404.7.1 through R404.7.5.~~

~~**R404.7.1 Quantity.** New one- and two-family dwellings and townhouses with a designated attached or detached garage or other onsite private parking provided adjacent to the dwelling unit shall be provided with one EV capable, EV ready, or EVSE installed space 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 EVSE space for 40 percent of each dwelling units or automobile parking spaces, whichever is less.~~

~~**R404.7.2 EV Capable Spaces.** Each EV capable space used to meet the requirements of Section R404.7.1 shall comply with all of the following:~~

1. ~~A continuous raceway or cable assembly shall be installed between an enclosure or outlet located within 3 feet (914 mm) of the EV capable space and a suitable panelboard or other onsite electrical distribution equipment.~~
2. ~~Installed raceway or cable assembly shall be sized and rated to supply a minimum circuit capacity in accordance with R404.7.4~~
3. ~~The electrical distribution equipment to which the raceway or cable assembly connects shall have sufficient dedicated space and spare electrical capacity for a 2-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)."~~

~~**R404.7.3 EV Ready Spaces.** Each branch circuit serving EV ready spaces shall comply with all of the following:~~

1. ~~Terminate at an outlet or enclosure, located within 3 feet (914 mm) of each EV ready space it serves.~~
2. ~~Have a minimum circuit capacity in accordance with R404.7.4.~~
3. ~~The panelboard or other electrical distribution equipment directory shall designate the branch circuit as "For electric vehicle supply equipment (EVSE)" and the outlet or enclosure shall be marked "For electric vehicle supply equipment (EVSE)."~~

~~**R404.7.4 Circuit Capacity.** For one- and two-family dwellings and townhouses, the capacity of electrical infrastructure serving each EV capable space, EV ready space and EVSE space shall have a rated capacity not less than 8.3 kVA (or 40A at 208/240V) for each EV capable space, EV ready space or EVSE space it serves. Where a circuit is shared or managed it shall be in accordance with NFPA 70. For R-2 occupancies, the capacity of electrical infrastructure serving each EV capable space, EV ready space and EVSE space shall comply with one of the following:~~

1. ~~A branch circuit shall have a rated capacity not less than 8.3kVA (or 40A at 208/240V) for each EV capable space, EV ready space or EVSE space it serves. Where a circuit is shared or managed it shall be in accordance with NFPA 70.~~
2. ~~The requirements of R404.7.4.1.~~

~~**Exceptions:**~~

1. ~~Where the local electric distribution entity has certified in writing that it is not able to provide 100 percent of the necessary distribution capacity within 2 years after the estimated date of the certificate of occupancy. The required EV charging infrastructure shall be reduced based on the available existing electric distribution capacity.~~
2. ~~Where substantiation has been approved that meeting the requirements of Section R404.7.4.1 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 $400.00 per dwelling unit.~~

~~**R404.7.4.1 Circuit capacity management.** The capacity of each branch circuit serving multiple EVSE spaces, EV ready space or EV capable spaces designed to be controlled by an energy management system providing load management in accordance with NFPA 70, shall have a capacity of not less than 2.7 kVA per space.~~

~~**R404.7.5 EVSE installation.** For one- and two-family dwellings and townhouses, EVSE shall be installed in accordance with NFPA 70 and shall be listed and labeled in accordance with UL 2202 or UL 2594. For R-2 occupancies, EVSE shall be installed in accordance with NFPA 70 and Section R404.7.5.1 and shall be listed and labeled in accordance with UL 2202 and UL 2594.~~

~~**R404.7.5.1 EVSE minimum charging rate.** Each installed EVSE shall comply with one of the following:~~

1. ~~Be capable of charging at a rate of not less than 6.2 kVA (or 30A at 208/240V).~~

2. ~~Where serving EVSE spaces allowed to have a circuit capacity of not less than 2.7 kVA in accordance with R404.7.4.1 and controlled by an energy management system providing load management, be capable of simultaneously charging each EVSE space at a rate of not less than 2.1 kVA.~~

Add new text as follows:

R404.7 Electric Vehicle Power Transfer Infrastructure. R404.4 Electric Vehicle Power Transfer Infrastructure. Automobile parking spaces shall be supplied with Electric Vehicle Power Transfer Infrastructure as described in 404.4.1-404.4.4
R404.4.1 Quantity. The number of allocated, on-site parking spaces requiring EVSE Installed or EVSE Capable shall be as follows:

Total Parking Spaces Provided in Parking Facilities

EVSE Installed Spaces – 10% - minimum 2

EV Capable Spaces – 15% - minimum 2 R404.4.1.1

Accessible Parking Spaces. If accessible parking spaces are provided, they shall be EVSE Installed or EVSE Capable in the same proportion as the parking facility as a whole – minimum 1.

These requirements shall not increase the total number of parking spaces. Where more than one parking facility is provided on a site, the number of spaces required shall be calculated separately for each parking facility.

Exception: One- and two-family dwellings and townhouses with onsite parking shall be provided with one EVSE Installed or EVSE Capable space per dwelling unit.

R404.4.2 EV Capable Spaces. Each EV Capable Space shall comply with the following:

1. A continuous raceway or cable assembly shall be installed between the electrical distribution equipment and a location within 3 feet of the designated EV capable space.

2. The raceway or cable assembly shall be capable of supplying the loads specified in R404.4.4 and marked “Reserved for Future Electric Vehicle Supply Equipment (EVSE)”.

R404.4.3 EVSE Installed Spaces. Each EVSE Installed Space shall comply with one of the following:

1. The EVSE shall be installed within 3 feet of the designated EVSE Installed Space.

R404.4.4 Minimum Charging Rate

1. The EVSE shall be capable of charging at a rate not less than 6.6kVA per parking space.

2. When served by an approved automatic load management system, the EVSE shall be capable of charging at a rate not less than 3.3kVA per parking space.

Reason: The EV charging language is overly complicated and overly burdensome in terms of infrastructure. It also doesn't account for charging for accessible parking spaces.

Cost Impact: The code change proposal will increase the cost of construction.
This proposal will increase the cost of construction over the 2021 code but will be less expensive than the proposed language it replaces in the 2024 code.

Workgroup Recommendation

Proposal # 1355

RED1-143-22

Proponents: Sean Denniston, representing New Buildings Institute (sean@newbuildings.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R404.7 Electric Vehicle Power Transfer Infrastructure. New automobile parking spaces for one- and two-family dwellings and townhouses shall be provided in accordance with Sections R404.7.1 through R404.7.5. New residential automobile parking spaces for R-2 occupancies shall ~~be provided with electric vehicle power transfer infrastructure in accordance with Sections R404.7.1 through R404.7.5.~~ comply with Section C405.14 of the International Energy Conservation Code.

R404.7.1 Quantity. New one- and two-family dwellings and townhouses with a designated attached or detached garage or other onsite private parking provided adjacent to the dwelling unit shall be provided with one ~~EV capable,~~ EV-ready~~, or EVSE installed~~ space 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 EVSE space for 40 percent of each dwelling units or automobile parking spaces, whichever is less.~~
Exceptions:

1. Where the local electric distribution entity has certified in writing that it is not able to provide 100 percent of the necessary distribution capacity within 2 years after the estimated date of the certificate of occupancy. The required EV charging infrastructure shall be reduced based on the available existing electric distribution capacity.
2. Where substantiation has been approved that meeting the requirements of Section R404.7.4.1 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 $400.00 per dwelling unit.

Delete without substitution:

~~**R404.7.2 EV Capable Spaces.** Each EV capable space used to meet the requirements of Section R404.7.1 shall comply with all of the following:~~

1. ~~A continuous raceway or cable assembly shall be installed between an enclosure or outlet located within 3 feet (914 mm) of the EV capable space and a suitable panelboard or other onsite electrical distribution equipment.~~
2. ~~Installed raceway or cable assembly shall be sized and rated to supply a minimum circuit capacity in accordance with R404.7.4~~
3. ~~The electrical distribution equipment to which the raceway or cable assembly connects shall have sufficient dedicated space and spare electrical capacity for a 2-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)."~~

Revise as follows:

R404.7.3 EV Ready Spaces. Each branch circuit serving EV ready spaces shall comply with all of the following:

1. Terminate at an outlet or enclosure, located within 3 feet (914 mm) of each EV ready space it serves.
2. ~~Have a minimum circuit capacity in accordance with R404.7.4.~~ The branch circuit shall have a rated capacity not less than 8.3kVA (or 40A at 208/240V) for each EV ready space it serves. Where a circuit is shared or managed it shall be in accordance with NFPA 70.
3. The panelboard or other electrical distribution equipment directory shall designate the branch circuit as "For electric vehicle supply equipment (EVSE)" and the outlet or enclosure shall be marked "For electric vehicle supply equipment (EVSE)."

Delete without substitution:

~~**R404.7.4 Circuit Capacity.** For one- and two-family dwellings and townhouses, the capacity of electrical infrastructure serving each EV capable space, EV ready space and EVSE space shall have a rated capacity not less than 8.3 kVA (or 40A at 208/240V) for each EV capable space, EV ready space or EVSE space it serves. Where a circuit is shared or managed it shall be in accordance with NFPA 70. For R-2 occupancies, the capacity of electrical infrastructure serving each EV capable space, EV ready space and EVSE space shall comply with one of the following:~~

1. ~~A branch circuit shall have a rated capacity not less than 8.3kVA (or 40A at 208/240V) for each EV capable space, EV ready space or EVSE space it serves. Where a circuit is shared or managed it shall be in accordance with NFPA 70.~~
2. ~~The requirements of R404.7.4.1.~~

~~**Exceptions:**~~

1. ~~Where the local electric distribution entity has certified in writing that it is not able to provide 100 percent of the necessary distribution capacity within 2 years after the estimated date of the certificate of occupancy. The required EV charging infrastructure shall be reduced based on the available existing electric distribution capacity.~~
2. ~~Where substantiation has been approved that meeting the requirements of Section R404.7.4.1 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 $400.00 per dwelling unit.~~

~~**R404.7.4.1 Circuit capacity management.** The capacity of each branch circuit serving multiple EVSE spaces, EV ready space or EV capable spaces designed to be controlled by an energy management system providing load management in accordance with NFPA 70, shall have a capacity of not less than 2.7 kVA per space.~~

~~**R404.7.5 EVSE installation.** For one- and two-family dwellings and townhouses, EVSE shall be installed in accordance with NFPA 70 and shall be listed and labeled in accordance with UL 2202 or UL 2594. For R-2 occupancies, EVSE shall be installed in accordance with NFPA 70 and Section R404.7.5.1 and shall be listed and labeled in accordance with UL 2202 and UL 2594.~~

~~**R404.7.5.1 EVSE minimum charging rate.** Each installed EVSE shall comply with one of the following:~~

1. ~~Be capable of charging at a rate of not less than 6.2 kVA (or 30A at 208/240V).~~
2. ~~Where serving EVSE spaces allowed to have a circuit capacity of not less than 2.7 kVA in accordance with R404.7.4.1 and controlled by an energy management system providing load management, be capable of simultaneously charging each EVSE space at a rate of not less than 2.1 kVA.~~

Reason: This public comment substantially simplifies the requirements for EV charging in the code and aligns the EV charging requirements better with the approach to central systems already in the code. It removes all of the requirements for residential buildings other than single-family, duplexes and townhouses and replaces them with a reference to the commercial requirements for EV charging. It also removes all of the language that is really only necessary for larger projects, leaving only the simple requirement for one EV Ready space per dwelling unit. This results in a more understandable and more usable code for a few reasons:

- Throughout the IECC, when a system serves multiple dwelling units in Group R occupancies, those systems are subject to the commercial section of the code. For example, R403.8 which directs all HVAC and hot water systems that serve multiple dwelling units to the commercial provisions and R404.1.1 that directs exterior lighting for buildings other than one- and two-family dwellings and townhouses to the commercial provisions. The parking lot is effectively a system that serves multiple dwelling units, so it is more consistent with the structure of the energy code to refer EV charging to the commercial provisions.
- Most of the language in the public comment draft is relevant only to multifamily projects, which makes using the code much more confusing for single-family users.
- The needs for low-rise and high-rise Group R projects are not substantially different. Having the requirements split between the residential and commercial sections creates the potential for the current situation in the developmental draft where the low-rise and high-rise language and requirements are out of sync.

Since the commercial section of the code is ahead of the residential section, there is ample opportunity to address any language, technical or stringency problems with the commercial language.

Cost Impact: The code change proposal will increase the cost of construction.
The commercial requirements for Group R occupancies is more stringent than the residential requirements. However, these are likely to be changed and may become more in line with the residential requirements.

Workgroup Recommendation

Proposal # 1274

RED1-144-22

Proponents: Greg Johnson, representing National Multifamily Housing Council (gjohnsonconsulting@gmail.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R404.7 Electric Vehicle Power Transfer Infrastructure. New automobile parking spaces for one- and two-family dwellings and townhouses shall be provided in accordance with Sections R404.7.1 through R404.7.5. ~~New residential automobile parking spaces for R-2 occupancies shall be provided with electric vehicle power transfer infrastructure in accordance with Sections R404.7.1 through R404.7.5.~~

R404.7.1 Quantity. New one- and two-family dwellings and townhouses with a designated attached or detached garage or other onsite private parking provided adjacent to the dwelling unit shall be provided with one EV-capable, EV-ready, or EVSE installed space 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 EVSE space for 40 percent of each dwelling units or automobile parking spaces, whichever is less.~~

Add new text as follows:

RG
Electric Vehicle Power Transfer Infrastructure for R-2 Occupancies

RF101.1 Applicability. Where adopted, this appendix provides requirements for electric vehicle power transfer infrastructure for multifamily buildings classified as R-2 occupancies.

RG102 Quantity. 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 EVSE space for each dwelling unit or automobile parking space, whichever is less.

RG103 Compliance.. Electric vehicle power transfer infrastructure shall comply with Sections R404.7.2 through R404.7.5.1.

Reason: According to the National Low Income Housing Coalition the USA has a shortage of 7 million affordable rental homes.
The IECC's Consensus Committees' response to this critical shortage is to inflate the cost (in both money and spent carbon) of housing by requiring mandatory installations of equipment that does not save building energy and that will likely never be used, such as EV charging infrastructure at R-2 multifamily buildings, while ignoring[1]:

- New battery technologies are being regularly announced that bring charging times down to less than ten and in some cases less than five minutes range
- Advancing charging technologies (robot chargers, beamed charging, roadbed charging, mobile solar charging)
- Increased battery density and storage significantly extending the range of EVs and reducing needed charging times
- EV manufacturer business models where the EV owner does not own the battery – a huge cost savings - but leases it for a minimal subscription fee. In this case the battery is swapped out whole when needed in five minutes or less
- Commercial (business, mercantile, restaurant), market driven opportunities to invest in EV charging stations and networks
- Government funded EV charging infrastructure
- EV charging infrastructure provided by EV vehicle manufacturers
- The relative ease of adding EV charging in structured parking in the future at R-2 occupancies

By the time the 2024 IECC-C is ready to be adopted – 2027 in many state jurisdictions - the EV charging infrastructure currently required is likely to be stranded technology. The money and carbon that was spent to provide EV charging infrastructure in R-2 occupancies will be wasted.

Finally, researchers at Stanford University make a compelling case that overnight EV charging will have deleterious effects on the grid. According to Eurasia Review:

"*In March, the Stanford research team published a paper on a model they created for charging demand that can be applied to an array of populations and other factors. In the new study, published in Nature Energy, they applied their model to the whole of the western United States and examined the stress the region's electric grid will come under by 2035 from growing EV ownership. In a little over a decade, they found, rapid EV growth alone could increase peak electricity demand by up to 25 percent, assuming a continued dominance of residential, nighttime charging.*

To limit the high costs of all that new capacity for generating and storing electricity, the researchers say, drivers should move to daytime charging at work or public charging stations, which would also reduce greenhouse gas emissions."

EV charging infrastructure for R-2 occupancies belongs in an optional adoption appendix. In this way, if the relevant advances in technology do not occur, jurisdictions can readily adopt the appendix to meet local policy objectives.

If the predicted advances in technology do occur, and the EV charging infrastructure is in an optional adoption appendix, it will be ignored by the jurisdiction and a reason for building developers to oppose adoption of the code will go away.

An obstacle to creating more affordable housing will also go away.

[1] References to bulleted statements are provided in the bibliography

Cost Impact: The code change proposal will decrease the cost of construction.
This code change will significantly reduce the cost of construction of R-2 occupancies and better support affordable housing.

Bibliography: 1. https://www.eurasiareview.com/23092022-charging-cars-at-home-at-night-is-not-the-way-to-go 2. https://electrek.co/2022/10/11/storedot-extreme-fast-charging-cycles/ 3. https://electrek.co/2022/10/06/how-you-can-invest-in-ev-charging-stations-and-take-advantage-of-the-auto-transition/ 4. https://electrek.co/2022/10/18/taco-bell-innovates-the-fast-food-experience-with-fast-ev-charging/ 5. https://newatlas.com/energy/novel-electrode-ev-batteries-25-density-boost/ 6. https://ca.news.yahoo.com/nasa-invents-incredible-battery-electric-112230038.html 7. https://therealdeal.com/2022/05/24/more-multifamily-landlords-are-making-less-than-their-lenders/ 8. https://www.newsweek.com/quantum-charging-electric-cars-could-fast-pumping-gas-1690630 9. https://newatlas.com/energy/natron-sodium-ion-battery-production/ 10. https://www.vice.com/en/article/k7w5ma/phoenix-tent-city-homeless-encampment 11. https://www.cnn.com/videos/business/2022/06/17/ziggy-ev-charging-robot-orig-ht.cnn-business 12. https://science.nasa.gov/technology/technology-highlights/cooling-technique-developed-for-space-use-makes-charging-electric-cars-on-earth-quicker-and-easier 13. https://www.anthropocenemagazine.org/2022/10/could-this-fast-charging-energetic-battery-spark-the-ev-era/?utm_source=rss&utm_medium=rss&utm_campaign=could-this-fast-charging-energetic-battery-spark-the-ev-era&utm_source=rss&utm_medium=rss&utm_campaign=could-this-fast-charging-energetic-battery-spark-the-ev-era

Workgroup Recommendation

Proposal # 1078

RED1-145-22

Proponents: Alex Smith, representing NAHB (asmith@nahb.org); Patricia Chawla, representing Austin Energy (patricia.chawla@austinenergy.com); Michael Stone, representing NEMA (mike.stone@nema.org); Gayathri Vijayakumar, representing Steven Winter Associates, Inc. (gvijayakumar@swinter.com); Robert Raymer, representing Leading Builders of America (rraymer@cbia.org); Emily Kelly, representing ChargePoint (emily.kelly@chargepoint.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R404.7 Electric Vehicle Power Transfer Infrastructure. ~~New automobile parking spaces for one- and two-family dwellings and townhouses shall be provided in accordance with Sections R404.7.1 through R404.7.5.~~ New residential automobile parking spaces for ~~R-2 occupancies~~ residential buildings shall be provided with electric vehicle power transfer infrastructure in accordance with Sections R404.7.1 through R404.7.5.

R404.7.1 Quantity. New one- and two-family dwellings and townhouses with a designated attached or detached garage or other onsite private parking provided adjacent to the dwelling unit shall be provided with one EV-capable, EV-ready, or EVSE ~~installed~~ space 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 EVSE space for 40 percent of each dwelling units or automobile parking spaces, whichever is less.

R404.7.2 EV Capable Spaces. Each EV capable space used to meet the requirements of Section R404.7.1 shall comply with all of the following:

1. A continuous raceway or cable assembly shall be installed between an enclosure or outlet located within ~~3~~ 6 feet (~~914~~ 1828 mm) of the EV capable space and a suitable panelboard or other onsite electrical distribution equipment.
2. Installed raceway or cable assembly shall be sized and rated to supply a minimum circuit capacity in accordance with R404.7.~~4~~ 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 2-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)."

R404.7.3 EV Ready Spaces. Each branch circuit serving EV ready spaces shall comply with all of the following:

1. Terminate at an outlet or enclosure, located within ~~3~~ 6 feet (~~914~~ 1828 mm) of each EV ready space it serves and marked "For electric vehicle supply equipment (EVSE)".
2. ~~Have~~ Be served by an ~~a minimum~~ electrical distribution system and circuit capacity in accordance with ~~R404.7.4~~ Section R404.7.5.
3. Be designated on ~~T~~ the panelboard or other electrical distribution equipment directory ~~shall designate the branch circuit~~ as "For electric vehicle supply equipment (EVSE)." ~~and the outlet or enclosure shall be marked "For electric vehicle supply equipment (EVSE)."~~

~~R404.7.4.1~~ R404.7.4 ~~Circuit capacity management~~ EVSE Spaces. ~~The capacity of each branch circuit serving multiple EVSE spaces, EV ready space or EV capable spaces designed to be controlled by an energy management system providing load management in accordance with NFPA 70, shall have a capacity of not less than 2.7 kVA per space.~~
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 R404.7.5
2. Have a nameplate charging capacity of not less than 6.2 kVA (or 30A at 208/240V) per EVSE space served. Where an EVSE serves three or more EVSE spaces and is controlled by an energy management system in accordance with Section R404.7.5, the nameplate charging capacity shall be not less than 2.1 kVA per EVSE space served.
3. Be located within ~~3~~ 6 feet (914 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.

~~R404.7.4~~ R404.7.5 ~~Circuit Capacity~~ Electrical distribution system capacity. ~~For one- and two-family dwellings and townhouses, the capacity of electrical infrastructure~~ The branch circuits and electrical distribution system serving each EV capable space, EV ready space and EVSE space used to comply with Section R404.7.1 shall ~~have a rated capacity not less than 8.3 kVA (or 40A at 208/240V) for each EV capable space, EV ready space or EVSE space it serves. Where a circuit is shared or managed it shall be in accordance with NFPA 70. For R-2 occupancies, the capacity of electrical infrastructure serving each EV capable space, EV ready space and EVSE space shall~~ comply with one of the following:

1. ~~A branch circuit shall have a rated capacity not less than 8.3kVA (or 40A at 208/240V) for each EV capable space, EV ready space or EVSE space it serves.~~ 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 requirements of R404.7.4.1.~~ 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 R404.7.1.

Exceptions:

1. Where the local electric distribution entity has certified in writing that it is not able to provide 100 percent of the necessary distribution capacity within 2 years after the estimated date of the certificate of occupancy. The required EV charging infrastructure shall be reduced based on the available existing electric distribution capacity.
2. Where substantiation has been approved that meeting the requirements of Section R404.7.5~~4.1~~ 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 $400.00 per dwelling unit.

~~**R404.7.5.1 EVSE minimum charging rate.** Each installed EVSE shall comply with one of the following:~~

1. ~~Be capable of charging at a rate of not less than 6.2 kVA (or 30A at 208/240V).~~
2. ~~Where serving EVSE spaces allowed to have a circuit capacity of not less than 2.7 kVA in accordance with R404.7.4.1 and controlled by an energy management system providing load management, be capable of simultaneously charging each EVSE space at a rate of not less than 2.1 kVA.~~

Reason: The intent of this public comment is not to make substantive changes to the essential requirements for EV charging, but is intended to improve the clarity, usability and enforceability of the EV charging section of the code. The only change to the requirements loosens the location requirement. This public comment was developed as a consensus proposal with input from several stakeholders as part of discussions by a working group. The edits do several things:

- Since the section was created by two separate proposals for single-family and multifamily, the code ended up with redundant language. The proposal removes and consolidates the redundant langue for better clarity.
- There are several editorial changes to make the language more internally consistent and more understandable.
- The language has been clarified that capacity requirements are not just for branch circuits, but for the whole electrical distribution system. This is particularly important for clarity and enforceability of the load managed capacity section.
- Section R404.7.4 Circuit Capacity. has been renamed and renumbered R404.7.5 Electrical distribution system capacity. The new location is more logical. The new name reflects the reality that capacity requirements apply to the whole electrical distribution system and not just individual branch circuits. This section has been modified for greater clarity and technical soundness. The existing language creates confusion because it sets requirements for the capacity of the distribution system that take into account the safety factors in the electrical code. This creates confusion because it is not always clear that those safety factors have already been applied and users might think that they need to still apply those factors. It is also problematic because the electrical code could change the safety and sizing requirements for distribution systems serving EV loads, introducing inconsistencies. The edit changes the focus to the minimum functional requirements of the EV charging infrastructure: the amount of power available. It changes to the requirement to the minimum EV charging load that the distribution system needs to be sized for. It leaves all of the sizing calculations and safety factors up to the electrical designer and electrical code. This has the additional benefit of aligning the numbers in the capacity section with the functional requirements for EVSE.
- The existing Section R404.7.4.1 has been simplified and incorporated into R404.7.5.
- The content of R404.7.5.1 EVSE minimum charging rate has been moved to a more logical location (section R404.7.4) it has also been modified for greater clarity. The "capable of charging at a minimum rate" (in kW), consistently caused confusion. The PC replaces that with a requirement for minimum nameplate charging capacity. This is better aligned with the way that electric equipment capacities are denoted. It also allows the unit to be kVA, which is the appropriate unit for capacity (as opposed to kW) and aligns better with modifications made to how capacity requirements have been modified below. The section is also clear about what the minimum nameplate rating needs to be for load managed EVSE with multiple connections.
- The working group considered 3 feet to be overly restrictive and inconsistent with the requirements used by some jurisdictions. Therefore, the location requirement for all EV space types has been changed to 6 feet.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This change will not change the cost of construction.

Workgroup Recommendation

Proposal # 997

RED1-146-22 Part I

Proponents: Fredric Zwerg, representing Southwest Gas Corporation (fredric.zwerg@swgas.com)

2024 International Energy Conservation Code [RE Project]

Delete without substitution:

~~**R404.7 Electric Vehicle Power Transfer Infrastructure.** New automobile parking spaces for one- and two-family dwellings and townhouses shall be provided in accordance with Sections R404.7.1 through R404.7.5. New residential automobile parking spaces for R-2 occupancies shall be provided with electric vehicle power transfer infrastructure in accordance with Sections R404.7.1 through R404.7.5.~~

~~**R404.7.1 Quantity.** New one- and two-family dwellings and townhouses with a designated attached or detached garage or other onsite private parking provided adjacent to the dwelling unit shall be provided with one EV capable, EV ready, or EVSE installed space 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 EVSE space for 40 percent of each dwelling units or automobile parking spaces, whichever is less.~~

~~**R404.7.2 EV Capable Spaces.** Each EV capable space used to meet the requirements of Section R404.7.1 shall comply with all of the following:~~

1. ~~A continuous raceway or cable assembly shall be installed between an enclosure or outlet located within 3 feet (914 mm) of the EV capable space and a suitable panelboard or other onsite electrical distribution equipment.~~
2. ~~Installed raceway or cable assembly shall be sized and rated to supply a minimum circuit capacity in accordance with R404.7.4~~
3. ~~The electrical distribution equipment to which the raceway or cable assembly connects shall have sufficient dedicated space and spare electrical capacity for a 2-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)."~~

~~**R404.7.3 EV Ready Spaces.** Each branch circuit serving EV ready spaces shall comply with all of the following:~~

1. ~~Terminate at an outlet or enclosure, located within 3 feet (914 mm) of each EV ready space it serves.~~
2. ~~Have a minimum circuit capacity in accordance with R404.7.4.~~
3. ~~The panelboard or other electrical distribution equipment directory shall designate the branch circuit as "For electric vehicle supply equipment (EVSE)" and the outlet or enclosure shall be marked "For electric vehicle supply equipment (EVSE)."~~

~~**R404.7.4 Circuit Capacity.** For one- and two-family dwellings and townhouses, the capacity of electrical infrastructure serving each EV capable space, EV ready space and EVSE space shall have a rated capacity not less than 8.3 kVA (or 40A at 208/240V) for each EV capable space, EV ready space or EVSE space it serves. Where a circuit is shared or managed it shall be in accordance with NFPA 70. For R-2 occupancies, the capacity of electrical infrastructure serving each EV capable space, EV ready space and EVSE space shall comply with one of the following:~~

1. ~~A branch circuit shall have a rated capacity not less than 8.3kVA (or 40A at 208/240V) for each EV capable space, EV ready space or EVSE space it serves. Where a circuit is shared or managed it shall be in accordance with NFPA 70.~~
2. ~~The requirements of R404.7.4.1.~~

~~**Exceptions:**~~

1. ~~Where the local electric distribution entity has certified in writing that it is not able to provide 100 percent of the necessary distribution capacity within 2 years after the estimated date of the certificate of occupancy. The required EV charging infrastructure shall be reduced based on the available existing electric distribution capacity.~~
2. ~~Where substantiation has been approved that meeting the requirements of Section R404.7.4.1 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 $400.00 per dwelling unit.~~

~~**R404.7.4.1 Circuit capacity management.** The capacity of each branch circuit serving multiple EVSE spaces, EV ready space or EV capable spaces designed to be controlled by an energy management system providing load management in accordance with NFPA 70, shall have a capacity of not less than 2.7 kVA per space.~~

~~**R404.7.5 EVSE installation.** For one- and two-family dwellings and townhouses, EVSE shall be installed in accordance with NFPA 70 and shall be listed and labeled in accordance with UL 2202 or UL 2594. For R-2 occupancies, EVSE shall be installed in accordance with NFPA 70 and Section R404.7.5.1 and shall be listed and labeled in accordance with UL 2202 and UL 2594.~~

~~**R404.7.5.1 EVSE minimum charging rate.** Each installed EVSE shall comply with one of the following:~~

1. ~~Be capable of charging at a rate of not less than 6.2 kVA (or 30A at 208/240V).~~

2. ~~Where serving EVSE spaces allowed to have a circuit capacity of not less than 2.7 kVA in accordance with R404.7.4.1 and controlled by an energy management system providing load management, be capable of simultaneously charging each EVSE space at a rate of not less than 2.1 kVA.~~

Reason: Delete the Electric Vehicle Power Transfer Infrastructure section entirely. The IECC is an energy code, not an electrification code. Requiring electrification infrastructure for electric vehicles will not reduce the building's energy consumption, but will actually increase it. This section adds an unnecessary cost to the home on the hope that sometime in the future the homeowner or renter will want an electric vehicle. Most EV purchases come with a Level 1 standard EV charger to plug into the homes 120V outlet. A Level 1 charge does not need an upgraded EV infrastructure. This proposal assumes a Level 2 or higher EV charging system will be needed. The choice should be left up to the buyer if they plan to purchase an EV and need an infrastructure upgrade. This provision does not save energy and adds cost. This is an electrification proposal and should not be included in the energy code. If necessary, this should be moved into an optional appendix for consumer choice.

Cost Impact: The code change proposal will decrease the cost of construction.
Deleting this entire section will reduce the construction cost for the home.

Workgroup Recommendation

Proposal # 1124

RED1-146-22 Part II

Proponents: Fredric Zwerg, representing Southwest Gas Corporation (fredric.zwerg@swgas.com)

2024 ENERGY Chapter11

Delete without substitution:

~~**N1104.7 Electric Vehicle Power Transfer Infrastructure.** New automobile parking spaces for one- and two-family dwellings and townhouses shall be provided in accordance with Sections N1104.7.1 through N1104.7.5.~~

~~**N1104.7.1 Quantity.** New one- and two-family dwellings and townhouses with a designated attached or detached garage or other onsite private parking provided adjacent to the dwelling unit shall be provided with one EV capable, EV ready, or EVSE installed space per dwelling unit.~~

~~**N1104.7.2 EV Capable Spaces.** Each EV capable space used to meet the requirements of Section N1104.7.1 shall comply with all of the following:~~

1. ~~A continuous raceway or cable assembly shall be installed between an enclosure or outlet located within 3 feet (914 mm) of the EV capable space and a suitable panelboard or other onsite electrical distribution equipment.~~
2. ~~Installed raceway or cable assembly shall be sized and rated to supply a minimum circuit capacity in accordance with N1104.7.4.~~
3. ~~The electrical distribution equipment to which the raceway or cable assembly connects shall have sufficient dedicated space and spare electrical capacity for a 2-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)."~~

~~**N1104.7.3 EV Ready Spaces.** Each branch circuit serving EV ready spaces shall comply with all of the following:~~

1. ~~Terminate at an outlet or enclosure, located within 3 feet (914 mm) of each EV ready space it serves.~~
2. ~~Have a minimum circuit capacity in accordance with N1104.7.4.~~
3. ~~The panelboard or other electrical distribution equipment directory shall designate the branch circuit as "For electric vehicle supply equipment (EVSE)" and the outlet or enclosure shall be marked "For electric vehicle supply equipment (EVSE)."~~

~~**N1104.7.4 Circuit Capacity.** For one- and two-family dwellings and townhouses, the capacity of electrical infrastructure serving each EV capable space, EV ready space and EVSE space shall have a rated capacity not less than 8.3 kVA (or 40A at 208/240V) for each EV capable space, EV ready space or EVSE space it serves. Where a circuit is shared or managed it shall be in accordance with NFPA 70.~~

~~**Exceptions:**~~

1. ~~Where the local electric distribution entity has certified in writing that it is not able to provide 100% of the necessary distribution capacity within 2 years after the estimated date of the certificate of occupancy. The required EV charging infrastructure shall be reduced based on the available existing electric distribution capacity.~~
2. ~~Where substantiation has been approved that meeting the requirements of Section N1104.7.4.1 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 $400.00 per dwelling unit.~~

~~**N1104.7.4.1 Circuit capacity management.** The capacity of each branch circuit serving multiple EVSE spaces, EV ready space or EV capable spaces designed to be controlled by an energy management system providing load management in accordance with NFPA 70, shall have a capacity of not less than 2.7 kVA per space.~~

~~**N1104.7.5 EVSE installation.** For one- and two-family dwellings and townhouses, EVSE shall be installed in accordance with NFPA 70 and shall be listed and labeled in accordance with UL 2202 or UL 2594. For R-2 occupancies, EVSE shall be installed in accordance with NFPA 70 and Section N1104.7.5.1 and shall be listed and labeled in accordance with UL 2202 and UL 2594.~~

~~**N1104.7.5.1 EVSE minimum charging rate.** Each installed EVSE shall comply with one of the following:~~

1. ~~Be capable of charging at a rate of not less than 6.2 kVA (or 30A at 208/240V).~~
2. ~~Where serving EVSE spaces allowed to have a circuit capacity of not less than 2.7 kVA in accordance with N1104.7.4.1 and controlled by an energy management system providing load management, be capable of simultaneously charging each EVSE space at a rate of not less than 2.1 kVA.~~

Reason: Delete the Electric Vehicle Power Transfer Infrastructure section entirely. The IECC is an energy code, not an electrification code. Requiring electrification infrastructure for electric vehicles will not reduce the building's energy consumption, but will actually increase it. This section adds an unnecessary cost to the home on the hope that sometime in the future the homeowner or renter will want an electric vehicle. Most EV purchases come with a Level 1 standard EV charger to plug into the homes 120V outlet. A Level 1 charge does not need an upgraded EV infrastructure. This proposal assumes a Level 2 or higher EV charging system will be needed. The choice should be left up to the buyer if they plan to purchase an EV and need an infrastructure upgrade. This provision does not save energy and adds cost. This is an electrification proposal and should not be included in the energy code. If necessary, this should be moved into an optional appendix for consumer choice.

Cost Impact: The code change proposal will decrease the cost of construction.
The proposed code change will reduce construction costs.

Workgroup Recommendation

Proposal # 1173

RED1-147-22

Proponents: Ted Williams, representing ONE Gas (ngdllc@outlook.com)

2024 International Energy Conservation Code [RE Project]

Delete without substitution:

~~**R404.7 Electric Vehicle Power Transfer Infrastructure.** New automobile parking spaces for one- and two-family dwellings and townhouses shall be provided in accordance with Sections R404.7.1 through R404.7.5. New residential automobile parking spaces for R-2 occupancies shall be provided with electric vehicle power transfer infrastructure in accordance with Sections R404.7.1 through R404.7.5.~~

~~**R404.7.1 Quantity.** New one- and two-family dwellings and townhouses with a designated attached or detached garage or other onsite private parking provided adjacent to the dwelling unit shall be provided with one EV capable, EV ready, or EVSE installed space 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 EVSE space for 40 percent of each dwelling units or automobile parking spaces, whichever is less.~~

~~**R404.7.2 EV Capable Spaces.** Each EV capable space used to meet the requirements of Section R404.7.1 shall comply with all of the following:~~

1. ~~A continuous raceway or cable assembly shall be installed between an enclosure or outlet located within 3 feet (914 mm) of the EV capable space and a suitable panelboard or other onsite electrical distribution equipment.~~
2. ~~Installed raceway or cable assembly shall be sized and rated to supply a minimum circuit capacity in accordance with R404.7.4~~
3. ~~The electrical distribution equipment to which the raceway or cable assembly connects shall have sufficient dedicated space and spare electrical capacity for a 2-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)."~~

~~**R404.7.3 EV Ready Spaces.** Each branch circuit serving EV ready spaces shall comply with all of the following:~~

1. ~~Terminate at an outlet or enclosure, located within 3 feet (914 mm) of each EV ready space it serves.~~
2. ~~Have a minimum circuit capacity in accordance with R404.7.4.~~
3. ~~The panelboard or other electrical distribution equipment directory shall designate the branch circuit as "For electric vehicle supply equipment (EVSE)" and the outlet or enclosure shall be marked "For electric vehicle supply equipment (EVSE)."~~

~~**R404.7.4 Circuit Capacity.** For one- and two-family dwellings and townhouses, the capacity of electrical infrastructure serving each EV capable space, EV ready space and EVSE space shall have a rated capacity not less than 8.3 kVA (or 40A at 208/240V) for each EV capable space, EV ready space or EVSE space it serves. Where a circuit is shared or managed it shall be in accordance with NFPA 70. For R-2 occupancies, the capacity of electrical infrastructure serving each EV capable space, EV ready space and EVSE space shall comply with one of the following:~~

1. ~~A branch circuit shall have a rated capacity not less than 8.3kVA (or 40A at 208/240V) for each EV capable space, EV ready space or EVSE space it serves. Where a circuit is shared or managed it shall be in accordance with NFPA 70.~~
2. ~~The requirements of R404.7.4.1.~~

~~**Exceptions:**~~

1. ~~Where the local electric distribution entity has certified in writing that it is not able to provide 100 percent of the necessary distribution capacity within 2 years after the estimated date of the certificate of occupancy. The required EV charging infrastructure shall be reduced based on the available existing electric distribution capacity.~~
2. ~~Where substantiation has been approved that meeting the requirements of Section R404.7.4.1 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 $400.00 per dwelling unit.~~

~~**R404.7.4.1 Circuit capacity management.** The capacity of each branch circuit serving multiple EVSE spaces, EV ready space or EV capable spaces designed to be controlled by an energy management system providing load management in accordance with NFPA 70, shall have a capacity of not less than 2.7 kVA per space.~~

~~**R404.7.5 EVSE installation.** For one- and two-family dwellings and townhouses, EVSE shall be installed in accordance with NFPA 70 and shall be listed and labeled in accordance with UL 2202 or UL 2594. For R-2 occupancies, EVSE shall be installed in accordance with NFPA 70 and Section R404.7.5.1 and shall be listed and labeled in accordance with UL 2202 and UL 2594.~~

~~**R404.7.5.1 EVSE minimum charging rate.** Each installed EVSE shall comply with one of the following:~~

1. ~~Be capable of charging at a rate of not less than 6.2 kVA (or 30A at 208/240V).~~

2. ~~Where serving EVSE spaces allowed to have a circuit capacity of not less than 2.7 kVA in accordance with R404.7.4.1 and controlled by an energy management system providing load management, be capable of simultaneously charging each EVSE space at a rate of not less than 2.1 kVA.~~

Reason: The proposal would increase building energy consumption if EV charging is implemented under the proposed requirements. While an interpretation of the revised IECC scope may permit the IECC Consensus Committee to consider EVs as a means for reducing full transportation fuel cycle energy consumption and climate emissions reductions, implementation of the EV charging under the provisions of these minimum code requirements would unquestionably increase metered building electricity consumption should EV charging be implemented.

The proposal unjustifiably presumes that full transportation fuel cycle energy and emissions will decrease due to upstream primary energy changes. This presumption is not justified by the proponents of these changes and runs counter to current and the most likely electricity generation prospects based upon:

- o Overall growth in generation capacity utilizing fossil fuels (specifically natural gas),
- o Currently employed generation capacity,
- o Dispatched generation capacity and time-of-use electricity demand devoted to EV charging,
- o Electricity generation infrastructure capacity to meet increased demand and time-of-use demand imposed by vehicle recharging.

The proposal "picks winners" among renewable fuel sources by requiring building infrastructure to move toward EVs at the expense of alternative fuels directly employable as vehicle fuels, including renewable natural gas, responsibly sourced gas, hydrogen fuel cells, and renewable propane. The proposals take no account of these alternatives or their relative energy efficiency and climate performance.

The proposal discriminates among building owners and occupants by effectively subsidizing EV owners and operators. Economically disadvantaged building owners and occupants, who are unlikely to either afford or economically justify EV purchases, will be burdened with the costs associated with recharging infrastructure and potentially associated energy costs.

The requirements of the proposal, for these reasons, reaches beyond prudent promulgation of minimum energy code requirements and, if ultimately justified by energy and transportation market transformation, would be better justified for voluntary implementation by building owners and occupants. These requirements do not belong in a minimum energy code and instead should be brought forward for consideration in "overlay" and "green codes."

Costs versus benefits discussed by the Consensus Committee omitted the point that if no EVs are purchased or operated by the building owner or occupants, the benefit-to-cost of the proposal would be "zero" (or mathematically undefined if analyzed as a cost-to-benefit ratio). This discussion presumed that EV owners and operators would be occupants of the covered buildings and would recharge EVs at the buildings, which is likely to be an outdated assumption by the time of code adoption and when, at best, a broad recharging infrastructure is implemented.

Cost Impact: The code change proposal will decrease the cost of construction.
The proposal would reduce cost of construction by eliminating electrical infrastructure costs superfluous to energy efficiency of the building.

Workgroup Recommendation

Proposal # 1404

RED1-148-22

Proponents: Shannon Corcoran, representing American Gas Association (corcoransm@att.net)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

~~**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, EVSE, a rechargeable storage battery, a fuel cell, a photovoltaic array, or another source of electric current. Plug-in hybrid electric vehicles are electric vehicles having a second source of motive power. Off-road, self-propelled electric mobile equipment, such as industrial trucks, hoists, lifts, transports, golf carts, airline ground support equipment, tractors, boats and the like, are not considered electric vehicles.~~

~~**ELECTRIC VEHICLE CAPABLE SPACE (EV CAPABLE SPACE).** A designated automobile parking space that is provid-ed with electrical infrastructure, such as, but not limited to, raceways, cables, electrical capacity, and panelboard or other elec-trical 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 either an outlet, junction box or receptacle, that will support an installed EVSE.~~

~~**ELECTRIC VEHICLE SUPPLY EQUIPMENT (EVSE).** Equipment for plug-in power transfer including the ungrounded, grounded and equipment grounding conductors, and the electric vehicle connectors, attachment plugs, 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.~~

~~**R404.7 Electric Vehicle Power Transfer Infrastructure.** New automobile parking spaces for one- and two-family dwellings and townhouses shall be provided in accordance with Sections R404.7.1 through R404.7.5. New residential automobile parking spaces for R-2 occupancies shall be provided with electric vehicle power transfer infrastructure in accordance with Sections R404.7.1 through R404.7.5.~~

~~**R404.7.1 Quantity.** New one- and two-family dwellings and townhouses with a designated attached or detached garage or other onsite private parking provided adjacent to the dwelling unit shall be provided with one EV-capable, EV-ready, or EVSE installed space 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 EVSE space for 40 percent of each dwelling units or automobile parking spaces, whichever is less.~~

~~**R404.7.2 EV Capable Spaces.** Each EV capable space used to meet the requirements of Section R404.7.1 shall comply with all of the following:~~

1. ~~A continuous raceway or cable assembly shall be installed between an enclosure or outlet located within 3 feet (914 mm) of the EV capable space and a suitable panelboard or other onsite electrical distribution equipment.~~
2. ~~Installed raceway or cable assembly shall be sized and rated to supply a minimum circuit capacity in accordance with R404.7.4~~
3. ~~The electrical distribution equipment to which the raceway or cable assembly connects shall have sufficient dedicated space and spare electrical capacity for a 2-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)."~~

~~**R404.7.3 EV Ready Spaces.** Each branch circuit serving EV ready spaces shall comply with all of the following:~~

1. ~~Terminate at an outlet or enclosure, located within 3 feet (914 mm) of each EV ready space it serves.~~
2. ~~Have a minimum circuit capacity in accordance with R404.7.4.~~
3. ~~The panelboard or other electrical distribution equipment directory shall designate the branch circuit as "For electric vehicle supply equipment (EVSE)" and the outlet or enclosure shall be marked "For electric vehicle supply equipment (EVSE)."~~

~~**R404.7.4 Circuit Capacity.** For one- and two-family dwellings and townhouses, the capacity of electrical infrastructure serving each EV capable space, EV ready space and EVSE space shall have a rated capacity not less than 8.3 kVA (or 40A at 208/240V) for each EV capable space, EV ready space or EVSE space it serves. Where a circuit is shared or managed it shall be in accordance with NFPA 70. For R-2 occupancies, the capacity of electrical infrastructure serving each EV capable space, EV ready space and EVSE space shall comply with one of the following:~~

1. ~~A branch circuit shall have a rated capacity not less than 8.3kVA (or 40A at 208/240V) for each EV capable space, EV ready space or EVSE space it serves. Where a circuit is shared or managed it shall be in accordance with NFPA 70.~~
2. ~~The requirements of R404.7.4.1.~~

Exceptions:

1. ~~Where the local electric distribution entity has certified in writing that it is not able to provide 100 percent of the necessary distribution capacity within 2 years after the estimated date of the certificate of occupancy. The required EV charging infrastructure shall be reduced based on the available existing electric distribution capacity.~~
2. ~~Where substantiation has been approved that meeting the requirements of Section R404.7.4.1 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 $400.00 per dwelling unit.~~

~~**R404.7.4.1 Circuit capacity management.**~~ ~~The capacity of each branch circuit serving multiple EVSE spaces, EV ready space or EV capable spaces designed to be controlled by an energy management system providing load management in accordance with NFPA 70, shall have a capacity of not less than 2.7 kVA per space.~~

~~**R404.7.5 EVSE installation.**~~ ~~For one- and two-family dwellings and townhouses, EVSE shall be installed in accordance with NFPA 70 and shall be listed and labeled in accordance with UL 2202 or UL 2594. For R-2 occupancies, EVSE shall be installed in accordance with NFPA 70 and Section R404.7.5.1 and shall be listed and labeled in accordance with UL 2202 and UL 2594.~~

~~**R404.7.5.1 EVSE minimum charging rate.**~~ ~~Each installed EVSE shall comply with one of the following:~~

1. ~~Be capable of charging at a rate of not less than 6.2 kVA (or 30A at 208/240V).~~
2. ~~Where serving EVSE spaces allowed to have a circuit capacity of not less than 2.7 kVA in accordance with R404.7.4.1 and controlled by an energy management system providing load management, be capable of simultaneously charging each EVSE space at a rate of not less than 2.1 kVA.~~

Reason: These provisions should be located in an adoptable appendix or jurisdictional option in a new R409 section, The proposals do not contain exceptions for grid capacity and cost of infrastructure upgrade. By being in an adoptable appendix, this would allow jurisdictions that need and want electric vehicle charging capabilities to adopt the provisions while not mandating that all jurisdictions mandate electric vehicle charging stations in new construction
There is the potential for stranded assets for homes that never install EV charging stations, which would add construction costs without the potential for energy reductions for the consumer or lower emissions.

Cost Impact: The code change proposal will increase the cost of construction.
The proposed appendix when adopted will increase the cost of construction

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Workgroup Recommendation

Proposal # 1437

RED1-150-22

Proponents: Eric Tate, representing Atmos Energy (eric.tate@atmosenergy.com)

2024 International Energy Conservation Code [RE Project]

Delete without substitution:

~~**R404.7 Electric Vehicle Power Transfer Infrastructure.** New automobile parking spaces for one- and two-family dwellings and townhouses shall be provided in accordance with Sections R404.7.1 through R404.7.5. New residential automobile parking spaces for R-2 occupancies shall be provided with electric vehicle power transfer infrastructure in accordance with Sections R404.7.1 through R404.7.5.~~

~~**R404.7.1 Quantity.** New one- and two-family dwellings and townhouses with a designated attached or detached garage or other onsite private parking provided adjacent to the dwelling unit shall be provided with one EV capable, EV ready, or EVSE installed space 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 EVSE space for 40 percent of each dwelling units or automobile parking spaces, whichever is less.~~

~~**R404.7.2 EV Capable Spaces.** Each EV capable space used to meet the requirements of Section R404.7.1 shall comply with all of the following:~~

1. ~~A continuous raceway or cable assembly shall be installed between an enclosure or outlet located within 3 feet (914 mm) of the EV capable space and a suitable panelboard or other onsite electrical distribution equipment.~~
2. ~~Installed raceway or cable assembly shall be sized and rated to supply a minimum circuit capacity in accordance with R404.7.4~~
3. ~~The electrical distribution equipment to which the raceway or cable assembly connects shall have sufficient dedicated space and spare electrical capacity for a 2-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)."~~

~~**R404.7.3 EV Ready Spaces.** Each branch circuit serving EV ready spaces shall comply with all of the following:~~

1. ~~Terminate at an outlet or enclosure, located within 3 feet (914 mm) of each EV ready space it serves.~~
2. ~~Have a minimum circuit capacity in accordance with R404.7.4.~~
3. ~~The panelboard or other electrical distribution equipment directory shall designate the branch circuit as "For electric vehicle supply equipment (EVSE)" and the outlet or enclosure shall be marked "For electric vehicle supply equipment (EVSE)."~~

~~**R404.7.4 Circuit Capacity.** For one- and two-family dwellings and townhouses, the capacity of electrical infrastructure serving each EV capable space, EV ready space and EVSE space shall have a rated capacity not less than 8.3 kVA (or 40A at 208/240V) for each EV capable space, EV ready space or EVSE space it serves. Where a circuit is shared or managed it shall be in accordance with NFPA 70. For R-2 occupancies, the capacity of electrical infrastructure serving each EV capable space, EV ready space and EVSE space shall comply with one of the following:~~

1. ~~A branch circuit shall have a rated capacity not less than 8.3kVA (or 40A at 208/240V) for each EV capable space, EV ready space or EVSE space it serves. Where a circuit is shared or managed it shall be in accordance with NFPA 70.~~
2. ~~The requirements of R404.7.4.1.~~

~~**Exceptions:**~~

1. ~~Where the local electric distribution entity has certified in writing that it is not able to provide 100 percent of the necessary distribution capacity within 2 years after the estimated date of the certificate of occupancy. The required EV charging infrastructure shall be reduced based on the available existing electric distribution capacity.~~
2. ~~Where substantiation has been approved that meeting the requirements of Section R404.7.4.1 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 $400.00 per dwelling unit.~~

~~**R404.7.4.1 Circuit capacity management.** The capacity of each branch circuit serving multiple EVSE spaces, EV ready space or EV capable spaces designed to be controlled by an energy management system providing load management in accordance with NFPA 70, shall have a capacity of not less than 2.7 kVA per space.~~

~~**R404.7.5 EVSE installation.** For one- and two-family dwellings and townhouses, EVSE shall be installed in accordance with NFPA 70 and shall be listed and labeled in accordance with UL 2202 or UL 2594. For R-2 occupancies, EVSE shall be installed in accordance with NFPA 70 and Section R404.7.5.1 and shall be listed and labeled in accordance with UL 2202 and UL 2594.~~

~~**R404.7.5.1 EVSE minimum charging rate.** Each installed EVSE shall comply with one of the following:~~

1. ~~Be capable of charging at a rate of not less than 6.2 kVA (or 30A at 208/240V).~~

2. ~~Where serving EVSE spaces allowed to have a circuit capacity of not less than 2.7 kVA in accordance with R404.7.4.1 and controlled by an energy management system providing load management, be capable of simultaneously charging each EVSE space at a rate of not less than 2.1 kVA.~~

Reason: The proposal would increase building energy consumption if EV charging is implemented under the proposed requirements. While an interpretation of the revised IECC scope may permit the IECC Consensus Committee to consider EVs as a means for reducing full transportation fuel cycle energy consumption and climate emissions reductions, implementation of the EV charging under the provisions of these minimum code requirements would unquestionably increase metered building electricity consumption should EV charging be implemented.

The proposal unjustifiably presumes that full transportation fuel cycle energy and emissions will decrease due to upstream primary energy changes. This presumption is not justified by the proponents of these changes and runs counter to current and the most likely electricity generation prospects based upon:

- o Overall growth in generation capacity utilizing fossil fuels (specifically natural gas),
- o Currently employed generation capacity,
- o Dispatched generation capacity and time-of-use electricity demand devoted to EV charging,
- o Electricity generation infrastructure capacity to meet increased demand and time-of-use demand imposed by vehicle recharging.

The proposal "picks winners" among renewable fuel sources by requiring building infrastructure to move toward EVs at the expense of alternative fuels directly employable as vehicle fuels, including renewable natural gas, responsibly sourced gas, hydrogen fuel cells, and renewable propane. The proposals take no account of these alternatives or their relative energy efficiency and climate performance.

The proposal discriminates among building owners and occupants by effectively subsidizing EV owners and operators. Economically disadvantaged building owners and occupants, who are unlikely to either afford or economically justify EV purchases, will be burdened with the costs associated with recharging infrastructure and potentially associated energy costs.

The requirements of the proposal, for these reasons, reaches beyond prudent promulgation of minimum energy code requirements and, if ultimately justified by energy and transportation market transformation, would be better justified for voluntary implementation by building owners and occupants. These requirements do not belong in a minimum energy code and instead should be brought forward for consideration in "overlay" and "green codes."

Costs versus benefits discussed by the Consensus Committee omitted the point that if no EVs are purchased or operated by the building owner or occupants, the benefit-to-cost of the proposal would be "zero" (or mathematically undefined if analyzed as a cost-to-benefit ratio). This discussion presumed that EV owners and operators would be occupants of the covered buildings and would recharge EVs at the buildings, which is likely to be an outdated assumption by the time of code adoption and when, at best, a broad recharging infrastructure is implemented.

Cost Impact: The code change proposal will decrease the cost of construction.
Elimination of these requirements will reduce construction costs by not requiring electrical supply for vehicles, which would increase building energy consumption if vehicle charging is implemented.

Workgroup Recommendation

Proposal # 1451

RED1-151-22

Proponents: Andrea Papageorge, representing Southern Company Gas (apapageo@southernco.com)

2024 International Energy Conservation Code [RE Project]

Delete without substitution:

~~**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, EVSE, a rechargeable storage battery, a fuel cell, a photovoltaic array, or another source of electric current. Plug-in hybrid electric vehicles are electric vehicles having a second source of motive power. Off-road, self-propelled electric mobile equipment, such as industrial trucks, hoists, lifts, transports, golf carts, airline ground support equipment, tractors, boats and the like, are not considered electric vehicles.~~

~~**ELECTRIC VEHICLE CAPABLE SPACE (EV CAPABLE SPACE).** A designated automobile parking space that is provid-ed with electrical infrastructure, such as, but not limited to, raceways, cables, electrical capacity, and panelboard or other elec-trical 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 either an outlet, junction box or receptacle, that will support an installed EVSE.~~

~~**ELECTRIC VEHICLE SUPPLY EQUIPMENT (EVSE).** Equipment for plug-in power transfer including the ungrounded, grounded and equipment grounding conductors, and the electric vehicle connectors, attachment plugs, 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.~~

~~**R404.7 Electric Vehicle Power Transfer Infrastructure.** New automobile parking spaces for one- and two-family dwellings and townhouses shall be provided in accordance with Sections R404.7.1 through R404.7.5. New residential automobile parking spaces for R-2 occupancies shall be provided with electric vehicle power transfer infrastructure in accordance with Sections R404.7.1 through R404.7.5.~~

~~**R404.7.1 Quantity.** New one- and two-family dwellings and townhouses with a designated attached or detached garage or other onsite private parking provided adjacent to the dwelling unit shall be provided with one EV-capable, EV-ready, or EVSE installed space 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 EVSE space for 40 percent of each dwelling units or automobile parking spaces, whichever is less.~~

~~**R404.7.2 EV Capable Spaces.** Each EV capable space used to meet the requirements of Section R404.7.1 shall comply with all of the following:~~

1. ~~A continuous raceway or cable assembly shall be installed between an enclosure or outlet located within 3 feet (914 mm) of the EV capable space and a suitable panelboard or other onsite electrical distribution equipment.~~
2. ~~Installed raceway or cable assembly shall be sized and rated to supply a minimum circuit capacity in accordance with R404.7.4~~
3. ~~The electrical distribution equipment to which the raceway or cable assembly connects shall have sufficient dedicated space and spare electrical capacity for a 2-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)."~~

~~**R404.7.3 EV Ready Spaces.** Each branch circuit serving EV ready spaces shall comply with all of the following:~~

1. ~~Terminate at an outlet or enclosure, located within 3 feet (914 mm) of each EV ready space it serves.~~
2. ~~Have a minimum circuit capacity in accordance with R404.7.4.~~
3. ~~The panelboard or other electrical distribution equipment directory shall designate the branch circuit as "For electric vehicle supply equipment (EVSE)" and the outlet or enclosure shall be marked "For electric vehicle supply equipment (EVSE)."~~

~~**R404.7.4 Circuit Capacity.** For one- and two-family dwellings and townhouses, the capacity of electrical infrastructure serving each EV capable space, EV ready space and EVSE space shall have a rated capacity not less than 8.3 kVA (or 40A at 208/240V) for each EV capable space, EV ready space or EVSE space it serves. Where a circuit is shared or managed it shall be in accordance with NFPA 70. For R-2 occupancies, the capacity of electrical infrastructure serving each EV capable space, EV ready space and EVSE space shall comply with one of the following:~~

1. ~~A branch circuit shall have a rated capacity not less than 8.3kVA (or 40A at 208/240V) for each EV capable space, EV ready space or EVSE space it serves. Where a circuit is shared or managed it shall be in accordance with NFPA 70.~~
2. ~~The requirements of R404.7.4.1.~~

~~**Exceptions:**~~

1. ~~Where the local electric distribution entity has certified in writing that it is not able to provide 100 percent of the necessary distribution capacity within 2 years after the estimated date of the certificate of occupancy. The required EV charging infrastructure shall be reduced based on the available existing electric distribution capacity.~~
2. ~~Where substantiation has been approved that meeting the requirements of Section R404.7.4.1 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 $400.00 per dwelling unit.~~

~~**R404.7.4.1 Circuit capacity management.** The capacity of each branch circuit serving multiple EVSE spaces, EV ready space or EV capable spaces designed to be controlled by an energy management system providing load management in accordance with NFPA 70, shall have a capacity of not less than 2.7 kVA per space.~~

~~**R404.7.5 EVSE installation.** For one- and two-family dwellings and townhouses, EVSE shall be installed in accordance with NFPA 70 and shall be listed and labeled in accordance with UL 2202 or UL 2594. For R-2 occupancies, EVSE shall be installed in accordance with NFPA 70 and Section R404.7.5.1 and shall be listed and labeled in accordance with UL 2202 and UL 2594.~~

~~**R404.7.5.1 EVSE minimum charging rate.** Each installed EVSE shall comply with one of the following:~~

1. ~~Be capable of charging at a rate of not less than 6.2 kVA (or 30A at 208/240V).~~
2. ~~Where serving EVSE spaces allowed to have a circuit capacity of not less than 2.7 kVA in accordance with R404.7.4.1 and controlled by an energy management system providing load management, be capable of simultaneously charging each EVSE space at a rate of not less than 2.1 kVA.~~

Reason: EV ready requirements do not belong in the mandatory provisions of the IECC Residential Code. Such requirements will increase the overall cost of construction by requiring assets that may not be wanted nor desired by the builder or the consumer. EV ready capability does not have any impact on the energy efficiency of the building. In addition, there is no way to show that these assets by themselves will decrease overall energy consumption or greenhouse gas emissions.
EVs are not the only options for transportation. The marketplace has many options including EVs, gasoline vehicles, diesel vehicles, hybrid vehicles, and compressed natural gas vehicles.

At the most, EV provisions should be located in an adoptable appendix that would allow for guidance to the builder or consumer who desires to install this infrastructure.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
The removal of EV requirements would not increase nor decrease the cost of construction.

Workgroup Recommendation

Proposal # 1474

RED1-152-22

Proponents: Noelani Derrickson, representing Tesla (nderrickson@tesla.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R404.7.1 Quantity. New one- and two-family dwellings and townhouses with a designated attached or detached garage or other onsite private parking provided adjacent to the dwelling unit shall be provided with one EV-capable, EV-ready, or EVSE installed space 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 EVSE space for ~~40 percent of~~ each dwelling unit~~s or automobile parking spaces, whichever is less~~.

Reason: R404.7.1 requires that new one- and two-family dwellings and townhouses with parking is provided with either one EV-capable, EV-ready, or EVSE installed space per dwelling unit. Additionally, it requires that R-2 occupancies, or multi-family units are provided with either an EV-capable, EV-ready, or EVSE installed space for 40 percent of the dwelling units or of total automobile spaces, whichever is less. We recommend aligning the requirement for R-2 occupancies with the requirement for new one- and two-family dwellings in that each dwelling unit is provided with one EV-capable, EV-ready, or EVSE installed space. This modification would provide greater equity in EV charging access to residents, regardless of if they live in one-, two-, or multi-family dwellings. Additionally, we provide the below reasons in support of R404.7.
Electric Vehicle Transition

The transition to electric vehicles (EV) is accelerating and inevitable. President Biden's Executive Order 14037 set a target that 50% of all new vehicle sales will be EVs by 2030 [1], and California adopted legally binding requirements that 68% of all new vehicle sales are EVs by 2030 [2]. Achieving these targets and requirements would result in 50 to 80 million EVs on the road by 2035. Conservative forecasts suggest that by 2030 10% of passenger vehicles on the road will be electric [3], with others projecting closer to 50% by 2050 [4], well within the lifetime of buildings constructed to the IECC. Unlike combustion engine vehicles, most electric vehicle refueling (i.e., "charging") will occur where the vehicle is parked for many hours at a time. Most commonly EV charging will occur at home. Residential buildings that have not been properly future proofed with adequate EV charging infrastructure will face much greater renovation costs than new construction featuring such future proofing.

Code Standardization

Several states and numerous local jurisdictions have already adopted codes to require make ready infrastructure in new buildings to prepare for electric vehicle charging (CA, OR, WA, CO, NJ, MD, Chicago, Atlanta, Miami, Salt Lake City). The definitions and requirements can vary, often lacking specificity for each occupancy type or alignment with National Electrical Code (NEC). This inconsistency can result in varied code requirements even within the same county, making it challenging for builders and building code officials. R404.7 provides standardized code language, robustly developed by code specialists, with definitions consistent with the NEC and technical requirements which align with vehicle charging needs.

Locating Requirements in the Main Body of the Code

It is paramount that R404.7 be adopted in the main body of the IECC and not in the appendix. Many local governments are restricted from adopting an appendix if a state has elected not to adopt it. To ensure that the greatest number of state and local jurisdictions benefit from the structure, definitions, and requirements of R404.7, it must be included in the body of the IECC code.

Multi-family Retrofits

This code proposal is essential for R-2 occupancies, or multi-family housing, where vehicles are parked overnight for many hours at a time and retrofitting existing parking spots to provide EV charging is complex and costly. Unlike residents of single-family homes, multi-family tenants are commonly renters without the authority to retrofit parking spaces to install charging equipment. When retrofitting to provide EV charging is possible, tenants and owners can face costs of 4-6 times higher than if done during new construction [5]. The ability to charge an EV overnight is additionally important for multi-family tenants who are rural, low-income, or in disadvantaged communities, who typically have longer commutes and drive older EVs with shorter ranges. Additionally, it is critical to ensure equity in access to EV charging regardless of if a resident lives in a one-, two-, or multi-family dwelling.We support proposal R404.7 and strongly recommend inclusion in the 2024 IECC.

Cost Impact: The code change proposal will increase the cost of construction.
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3. https://www.eei.org/-/media/Project/EEI/Documents/Issues-and-Policy/Electric-Transportation/EV-Forecast--Infrastructure-Report.pdf

4. https://graphics.reuters.com/AUTOS-ELECTRIC/USA/mopanyqxwva/

5. https://caletc.aodesignsolutions.com/assets/files/CALGreen-2019-Supplement-Cost-Analysis-Final-1.pdf

Workgroup Recommendation

Proposal # 1386

RED1-153-22

Proponents: Emily Kelly, representing ChargePoint (emily.kelly@chargepoint.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R404.7.1 Quantity. New one- and two-family dwellings and townhouses with a designated attached or detached garage or other onsite private parking provided adjacent to the dwelling unit shall be provided with one EV-capable, EV-ready, or EVSE installed space per dwelling unit. R-2 occupancies or allocated parking for R-2 occupancies in mixed-use buildings shall be~~ provided with~~ 100% ~~an EV capable space~~, EV ready. ~~or EVSE space for 40 percent of each dwelling units or automobile parking spaces, whichever is less.~~

Reason: *Importance of Charging Infrastructure in Multi-Family buildings*
To facilitate adoption of EVs, it is critical that drivers have access to convenient, cost-effective EV charging. More than 80% of EV charging in the USA currently occurs at home, and it is projected that into the future, the most convenient, cost-effective means of providing charging will be household's home assigned parking space (if households have access to onsite parking at their residence), or at work. Additionally, some drivers will make use of publicly accessible EV charging infrastructure located at amenities they regularly visit (e.g. retail, assembly uses, etc.) – see e.g. (International Council on Clean Transportation, 2021). It is very costly and complicated to renovate EV charging infrastructure into existing multifamily buildings. Therefore, new construction should be future-proofed for the near-universal EV adoption necessary in the coming decades. If parking is provided as part of new residential developments, the greatest societal value can be realized by ensuring each households' onsite parking space is "EV Ready" (I.e. parking that features an adjacent electrical outlet at which "AC Level 2" electric vehicle supply equipment [EVSE] can be easily installed in the future). Likewise, significant portions of workplace parking and publicly accessible parking in commercial developments should be made EV Ready.100% EV Ready residential parking new construction requirements are the best practice in North America. The City of Vancouver and 16 other communities in British Columbia, Canada, have adopted 100% EV Ready requirements for multifamily buildings, as has the City of Toronto, Canada, in "Tier 2" of its Toronto Green Standard Version 4. Similar requirements are being considered by multiple other cities across North America. In 2019, Natural Resources Canada submitted 100% residential EV Ready requirements for inclusion in the model Canadian National Energy Code for Buildings (NECB); changes to appropriate objectives statement in the NECB are currently being pursued to enable these requirements.

High levels of EV Ready parking can be realized cost-effectively in new developments by allowing designs to use of EV energy management systems (EVEMS, i.e. automatic load management systems, systems to monitor and control of EV charging). EVEMS can facilitate load sharing across branch circuits, sharing at the electrical panel level, electrical service monitoring and associated control of EVSE, and other forms of controlling EVSE loads. The Canadian jurisdictions that have adopted 100% EV Ready requirements allow for reasonable levels of load sharing across branch circuits, as well as other EVEMS strategies (e.g. panel sharing, service monitoring, etc.). Allowing for appropriate use of load sharing between EV Ready parking spaces significantly reduces the electrical capacity required to provide for 100% EV Ready parking, and associated costs for new developments.

Code Standardization

Several states and numerous local jurisdictions have already adopted codes to require make ready infrastructure in new buildings to prepare for electric vehicle charging (CA, OR, WA, CO, NJ, MD, Chicago, Atlanta, Miami, Salt Lake City). The definitions and requirements can vary, often lacking specificity for each occupancy type or alignment with National Electrical Code (NEC). This inconsistency can result in varied code requirements even within the same county, making it challenging for builders and building code officials. R404.7 provides standardized code language, robustly developed by code specialists, with definitions consistent with the NEC and technical requirements which align with vehicle charging needs.

Locating Requirements in the Main Body of the Code

It is vital that R404.7 be adopted in the main body of the IECC and not in the appendix. Many local governments are restricted from adopting an appendix if a state has elected not to adopt it. To ensure that the greatest number of state and local jurisdictions benefit from the structure, definitions, and requirements of R404.7, it must be included in the body of the IECC code.

Cost Impact: The code change proposal will increase the cost of construction.
Although initial construction costs will increase to prepare a space for the eventual installation of a charger, codifying EV Ready parking will eventually save money in the long run, as the retrofitting of spaces is much more expensive.

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Workgroup Recommendation

Proposal # 1439

RED1-154-22

Proponents: Greg Johnson, representing National Multifamily Housing Council (gjohnsonconsulting@gmail.com)

2024 International Energy Conservation Code [RE Project]

CHAPTER 4 [RE]
RESIDENTIAL ENERGY EFFICIENCY

Revise as follows:

R404.7.1 Quantity. New one- and two-family dwellings and townhouses with a designated attached or detached garage or other onsite private parking provided adjacent to the dwelling unit shall be provided with one EV-capable, EV-ready, or EVSE installed space 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 EVSE space for 40 percent of each dwelling units or automobile parking spaces, whichever is less.
Exceptions:

1. Where the local electric distribution entity has certified in writing that it is not able to provide 100 percent of the necessary distribution capacity within 2 years after the estimated date of the certificate of occupancy. The required EV charging infrastructure shall be reduced based on the available existing electric distribution capacity.
2. Where substantiation has been approved that meeting the requirements of Section R404.7.4.1 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 $400.00 per dwelling unit.

R404.7.4 Circuit Capacity. For one- and two-family dwellings and townhouses, the capacity of electrical infrastructure serving each EV capable space, EV ready space and EVSE space shall have a rated capacity not less than 8.3 kVA (or 40A at 208/240V) for each EV capable space, EV ready space or EVSE space it serves. Where a circuit is shared or managed it shall be in accordance with NFPA 70. For R-2 occupancies, the capacity of electrical infrastructure serving each EV capable space, EV ready space and EVSE space shall comply with one of the following:

1. A branch circuit shall have a rated capacity not less than 8.3kVA (or 40A at 208/240V) for each EV capable space, EV ready space or EVSE space it serves. Where a circuit is shared or managed it shall be in accordance with NFPA 70.
2. The requirements of R404.7.4.1.

~~**Exceptions:**~~

1. ~~Where the local electric distribution entity has certified in writing that it is not able to provide 100 percent of the necessary distribution capacity within 2 years after the estimated date of the certificate of occupancy. The required EV charging infrastructure shall be reduced based on the available existing electric distribution capacity.~~
2. ~~Where substantiation has been approved that meeting the requirements of Section R404.7.4.1 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 $400.00 per dwelling unit.~~

Reason: The exceptions for the local electrical utility's lack of capacity are misplaced in the circuit capacity section. They instead should be located in the quantity section.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This change simply relocates provisions.

Workgroup Recommendation

Proposal # 1080

RED1-155-22

Proponents: Amy Martino, representing Building Site Synergy (amartino@buildingsitesynergy.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R404.7.2 EV Capable Spaces. Each EV capable space used to meet the requirements of Section R404.7.1 shall comply with all of the following:

1. A continuous raceway or cable assembly shall be installed between an enclosure or outlet located within ~~3 feet (914 mm)~~ close proximity of the EV capable space and a suitable panelboard or other onsite electrical distribution equipment.
2. Installed raceway or cable assembly shall be sized and rated to supply a minimum circuit capacity in accordance with R404.7.4
3. The electrical distribution equipment to which the raceway or cable assembly connects shall have sufficient dedicated space and spare electrical capacity for a 2-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)."

R404.7.3 EV Ready Spaces. Each branch circuit serving EV ready spaces shall comply with all of the following:

1. Terminate at an outlet or enclosure, located within ~~3 feet (914 mm)~~ close proximity of each EV ready space it serves.
2. Have a minimum circuit capacity in accordance with R404.7.4.
3. The panelboard or other electrical distribution equipment directory shall designate the branch circuit as "For electric vehicle supply equipment (EVSE)" and the outlet or enclosure shall be marked "For electric vehicle supply equipment (EVSE)."

Add new text as follows:

<u>**R404.7.4** **EVSE Spaces**</u>**.** <u>***(omitted in PC#1 draft- correction with edit in #3)***</u>
<u>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:</u>
<u>1. Be served by an electrical distribution system in accordance with Section R404.7.5</u>
<u>2, Have a nameplate charging capacity of not less than 6.2 kVA (or 30A at 208/240V) per EVSE space served.</u>
<u>3. Be located within close proximity of each EVSE space it serves.</u>
<u>4. Be installed in accordance with NFPA 70 and be listed and labeled in accordance with UL</u>

Reason: Section R404.7.4 EVSE spaces was omitted in the public comment draft #1 although approved by the consensus committee. I have reinserted and made an edit to the exception.
In addition, the same corresponding sections of Chapter 11 of the IRC should be coordinated and included in the public comment.

I have proposed an edit to eliminate an exact distance to an EV capable, EV ready and EVSE parking space which is consistent with California's requirement. It is not necessary to mandate the distance from a charging station to an EV parking space which will potentially require more charging stations and increase costs.

With advances in the technology of wireless charging, EV management systems. Load management and load sharing serving multiple car charging from one station, new future EV technology will only make advances beyond. Mandating the location with 3 feet of the EV parking space even currently is antiquated.

Here are some examples of wireless charging and current technology.

https://www.pluglesspower.com/install/

https://witricity.com/products/automotive-solutions/

https://hevo.com/rezonant-e8.html

https://arstechnica.com/cars/2022/09/whats-the-state-of-wireless-ev-charging/

Article regarding EV technology trends

https://tridenstechnology.com/electric-vehicle-ev-charging-future-trends/#h-how-does-this-work-in-real-life-scenarios

According to a report by AES Engineering Ltd. Dated April 4, 2017 “Electric Vehicle Charging Infrastructure in New Multifamily Developments - Requirement Options and Costing Analysis “ …”Load management and load sharing are EVSE control technologies that reduce peak power demand and improve utilization of EV charging systems, thereby reducing electrical infrastructure costs. The technologies also provide the capability to control the time of use, which may be utilized in reducing the impact on the Utility’s system.”

Cost Impact: The code change proposal will decrease the cost of construction.
By utilizing current and future technology, the potential of locating the charging source further away and in a safer and more secure location in addition to eliminating a plug and cord to charge an EV will not rely on a specific distance to the EV parking space. "Close proximity" allows for flexibility and potentially fewer charging stations which may reduce the installation costs.

Workgroup Recommendation

Proposal # 1409

RED1-156-22

Proponents: Adam Berry, representing Colorado Energy Office (adam.berry@state.co.us)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R404.7.4 Circuit Capacity. For one- and two-family dwellings and townhouses, the capacity of electrical infrastructure serving each EV capable space, EV ready space and EVSE space shall have a rated capacity not less than 8.3 kVA (or 40A at 208/240V) for each EV capable space, EV ready space or EVSE space it serves. Where a circuit is shared or managed it shall be in accordance with NFPA 70. For R-2 occupancies, the capacity of electrical infrastructure serving each EV capable space, EV ready space and EVSE space shall comply with one of the following:

1. A branch circuit shall have a rated capacity not less than 8.3kVA (or 40A at 208/240V) for each EV capable space, EV ready space or EVSE space it serves. Where a circuit is shared or managed it shall be in accordance with NFPA 70.
2. The requirements of R404.7.4.1.

Exceptions:

1. Where the local electric distribution entity has certified in writing that it is not able to provide 100 percent of the necessary distribution capacity within 2 years after the estimated date of the certificate of occupancy. EV capable spaces and EV ready spaces may be substituted for EVSE installed spaces ~~The required EV charging infrastructure shall be reduced~~ based on the available existing electric distribution capacity.
2. Where substantiation has been approved that meeting the requirements of Section R404.7.4.1 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 $400.00 per dwelling unit. EV capable spaces and EV ready spaces may be substituted for EVSE installed spaces that contribute to increased utility side costs over $400.00 per dwelling unit.

2024 ENERGY Chapter11

Revise as follows:

N1104.7.4 Circuit Capacity. For one- and two-family dwellings and townhouses, the capacity of electrical infrastructure serving each EV capable space, EV ready space and EVSE space shall have a rated capacity not less than 8.3 kVA (or 40A at 208/240V) for each EV capable space, EV ready space or EVSE space it serves. Where a circuit is shared or managed it shall be in accordance with NFPA 70.
Exceptions:

1. Where the local electric distribution entity has certified in writing that it is not able to provide 100% of the necessary distribution capacity within 2 years after the estimated date of the certificate of occupancy. ~~The required EV charging infrastructure shall be reduced~~ EV capable spaces and EV ready spaces may be substituted for EVSE installed spaces based on the available existing electric distribution capacity.
2. Where substantiation has been approved that meeting the requirements of Section N1104.7.4.1 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 $400.00 per dwelling unit. EV capable spaces and EV ready spaces may be substituted for EVSE installed spaces that contribute to increased utility side costs over $400.00 per dwelling unit.

Reason: While a distribution utility's inability to provide the necessary electricity distribution to support installed EV charging infrastructure, requiring EV capable and EV ready infrastructure in new residential construction will not directly impact the electricity distribution demand on the utility. So, in situations where a utility can legitimately document that they are unable to meet the additional distribution demand, or doing so would provide an excessive cost burden relating to increased utility side costs, new residential buildings should be required to install, at a minimum, EV capable or EV ready infrastructure to support the future installation of EV charging equipment when the utility is capable of providing the necessary electricity distribution to support such equipment. Failure to require, at a minimum, the installation of EV capable or EV ready infrastructure during construction would result in far more costly retrofits when the utility situation improves and a homeowner is seeking to install EV charging equipment.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This change should not increase the cost of construction, as these requirements are already in place outside of the utility exception.

Workgroup Recommendation

RED1-157-22

Proponents: Steven Rosenstock, representing Edison Electric Institute (srosenstock@eei.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R404.7.4 Circuit Capacity. For one- and two-family dwellings and townhouses, the capacity of electrical infrastructure serving each EV capable space, EV ready space and EVSE space shall have a rated capacity not less than 8.3 kVA (or 40A at 208/240V) for each EV capable space, EV ready space or EVSE space it serves. Where a circuit is shared or managed it shall be in accordance with NFPA 70. For R-2 occupancies, the capacity of electrical infrastructure serving each EV capable space, EV ready space and EVSE space shall comply with one of the following:

1. A branch circuit shall have a rated capacity not less than 8.3kVA (or 40A at 208/240V) for each EV capable space, EV ready space or EVSE space it serves. Where a circuit is shared or managed it shall be in accordance with NFPA 70.
2. The requirements of R404.7.4.1.

Exceptions:

1. Where the local electric distribution entity has certified in writing that it is not able to provide 100 percent of the necessary distribution capacity within 2 years after the estimated date of the certificate of occupancy. The required EV charging infrastructure shall be reduced based on the available existing electric distribution capacity.
2. Where substantiation has been approved that meeting the requirements of Section R404.7.4.1 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 ~~$400.00~~ <u>$450.00</u> per dwelling unit.

Reason: This proposed change is suggested to adjust the nominal value in Exception 2 to account for current (2022) inflation and to account for projected inflation in 2023 and 2024. Using data and projections from the following web sites:

https://www.usinflationcalculator.com/inflation/current-inflation-rates/
https://www.federalreserve.gov/monetarypolicy/fomcprojtabl20221214.htm
https://www.bls.gov/cpi/

Inflation in the US (as of November 2022) was 7.1% over the 12 month period from November 2021 to November 2022. The December Federal Reserve projection for personal consumption expenditures (PCE) inflation is 3.1% for 2023 and 2.5% in 2024.

Using these values for inflation and projected inflation yields the following results:

$400.00 * 1.071 (7.1% inflation in 2022) = $428.40

$428.40 * 1.031 (3.1% inflation in 2023) = $441.68

$441.68 * 1.025 (2.5% inflation in 2024) = $452.72

This proposal rounds down the value to $450 for ease of use in the code.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This proposed change only adjusts a value in an exception to account for inflation.

Workgroup Recommendation

RED1-158-22

Proponents: Daniel Carroll, representing Division of Building Standards & Codes (daniel.carroll@dos.ny.gov); Hendrik Shank, representing New York State, Department of State (hendrikus.shank@dos.ny.gov)

2024 International Energy Conservation Code [RE Project]

Add new text as follows:

R404.8 **Dwelling electrical meter.** Each *dwelling unit* located in a *Group R-2* building shall have a separate electrical meter.

Revise as follows:

TABLE R405.2 REQUIREMENTS FOR SIMULATED BUILDING PERFORMANCE

Portions of table not shown remain unchanged.

SECTION[a]	TITLE
Electrical Power and Lighting Systems	
R404.8	Dwelling electrical meter

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

TABLE R406.2 REQUIREMENTS FOR ENERGY RATING INDEX

Portions of table not shown remain unchanged.

SECTION[a]	TITLE
Electrical Power and Lighting Systems	
R404.8	Dwelling electrical meter

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

Reason: The purpose of this code change proposal is to keep the separate electrical meter requirements consistent for all Group R-2 residential buildings, regardless of the number of stories above grade plane. The U.S. Green Building Council's LEED BD+C v4 Reference Guide states that the intent of their Building Level Energy Metering credit requirement for LEED certified buildings is *"to support energy management and identify opportunities for additional energy savings by tracking building-level energy use."* The Guide further states that *"whole-building metering lets building operators track energy consumption over time, illustrating variations in usage patterns that can be used to develop energy conservation measures over the lifetime of the building. Once such conservation measures are in place, metering then allows staff to track energy savings and used to justify additional investments with calculable payback periods. Building operators gain detailed feedback, enabling them to precisely calibrate operational parameters, depending on the needs of changing occupancy groups, while continuing to operate building systems efficiently."* According to the commentary to Section C405.5 of the 2018 IECC, *"people are more likely to conserve energy when provided with the means to track how much they are using. This requirement does not mandate that the units be billed separately for the electrical service; it simply helps people to understand how their use of the service and selection of equipment can affect energy consumption."*

Without separate metering requirements in the Residential Provisions of the IECC, the opportunity to track energy use, adjust malfunctioning systems, and identify energy conservation strategies is not afforded to building managers or occupants of R-2 buildings that are less than 3 stories above grade. This proposal seeks to offer parity to all dwelling units in Group R-2 occupancies regardless of the number of stories.

Cost Impact: The code change proposal will increase the cost of construction.
This code change proposal would increase the cost of construction for buildings defined as "residential buildings" per Chapter 2 of the 2024 IECC. However, this change would align the IECC Residential Provisions for all Group R-2 buildings with the IECC Commercial Provisions and the Provisions of ASHRAE 90.1.

Workgroup Recommendation

Proposal # 1200

RED1-159-22

Proponents: Greg Johnson, representing National Multifamily Housing Council (gjohnsonconsulting@gmail.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

TABLE R405.2 REQUIREMENTS FOR SIMULATED BUILDING PERFORMANCE

Portions of table not shown remain unchanged.

SECTION[a]	TITLE
R404.5	Electric readiness
R404.6 except R404.6.2	Renewable energy infrastructure
~~R404.7~~	~~Electric Vehicle power transfer infrastructure~~

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

TABLE R406.2 REQUIREMENTS FOR ENERGY RATING INDEX

Portions of table not shown remain unchanged.

SECTION[a]	TITLE
General	
R404.6 except R404.6.2	Renewable energy infrastructure
~~R404.7~~	~~Electric Vehicle power transfer infrastructure~~

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

Reason: Reference to R404.7 is deleted to correlate with proposals to put EV charging in an appendix.
R404.6.2 is an inappropriate reference.

It attempts to violate the principle that appendices are only applicable where specifically adopted (see the introductory text of Appendix CB) and further makes reference to an appendix in the IECC-Commercial, violating Section R101.5, which requires that residential buildings meet the requirements of the IECC-Residential.

The proponents who keep trying to mandate compliance with voluntary appendices and those who try to use commercial provisions in the residential code, without actually providing the text of the requirements for inclusion in the residential code, are making the code less useable for the people who have to design, build, and regulate with it.

Knock it off.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This should not affect any cost of installations.

Workgroup Recommendation

Proposal # 1405

RED1-160-22 Part I

Proponents: Fredric Zwerg, representing Southwest Gas Corporation (fredric.zwerg@swgas.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

TABLE R405.2 REQUIREMENTS FOR SIMULATED BUILDING PERFORMANCE

SECTION[a]	TITLE
General	
R401.2.5	Additional energy efficiency
R401.3	Certificate
Building Thermal Envelope	
R402.1.1	Vapor retarder
R402.2.3	Attic knee or pony wall
R402.2.4	Eave baffle
R402.2.5.1	Access hatches and doors
R402.2.9	Basement walls
R402.2.9.1	Basement wall insulation installation
R402.2.10.1	Slab-on-grade floor insulation installation
R402.2.11.1	Crawl space wall insulation installations
R402.5.1.1	Installation
R402.5.1.2	Testing
R402.5.2	Fireplaces
R402.5.3	Fenestration air leakage
R402.5.4	Room containing fuel burning applicances
R402.5.5	Recessed lighting
R402.5.6	Air-sealed electrical and communication outlet boxes
R402.6	Maximum fenestration *U*-factor and SHGC
Mechanical	
R403.1	Controls
R403.2	Hot water boiler temperature reset
R403.3	Duct systems
R403.4	Mechanical system piping insulation
R403.5 except Section R403.5.2 (staff note: this needs to be fixed with hot water pipe insulation)	Service hot water system
R403.5.2	Hot water pipe insulation
R403.6	Mechanical ventilation
R403.7, except Section R403.7.1	Equipment sizing and efficiency rating
R403.8	Systems serving multiple dwelling units
R403.9	Snow melt and ice system controls
R403.11	Energy consumption of pools and spas
R403.12	Portable spas
R403.13	Residential pools and permanent residential spas
Electrical Power and Lighting Systems	
R404.1	Lighting equipment
R404.2	Interior lighting controls
~~R404.5~~	~~Electric readiness~~
~~R404.6~~	~~Renewable energy infrastructure~~
~~R404.7~~	~~Electric Vehicle power transfer infrastructure~~

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

Reason: Delete the three electrification references. These are electrification policy proposals and are not energy related.

Cost Impact: The code change proposal will decrease the cost of construction.
Removal of selected references will reduce construction costs.

Workgroup Recommendation

Proposal # 1130

RED1-160-22 Part II

Proponents: Fredric Zwerg, representing Southwest Gas Corporation (fredric.zwerg@swgas.com)

2024 ENERGY Chapter11

Revise as follows:

TABLE N1105.2 REQUIREMENTS FOR SIMULATED BUILDING PERFORMANCE

SECTION[a]	TITLE
General	
N1101.14	Certificate
Building Thermal Envelope	
N1102.1.1	Vapor retarder
N1102.2.3	Attic knee or pony wall
N1102.2.4	Eave baffle
N1102.2.5.1	Access hatches and doors
N1102.2.9	Basement walls
N1102.2.9.1	Basement wall insulation installation
N1102.2.10.1	Slab-on-grade floor insulation installation
N1102.2.11.1	Crawl space wall insulation installation
N1102.5.1.1	Installation
N1102.5.1.2	Testing
N1102.5.2	Fireplaces
N1102.5.3	Fenestration air leakage
N1102.5.4	Rooms containing fuel burning appliances
N1102.5.5	Recessed lighting
N1102.5.6	Air Sealed electrical and communication outlet boxes
N1102.6	Maximum fenestration *U*-factor and SHGC
Mechanical	
N1103.1	Controls
N1103.2	Hot Water boiler temperature reset
N1103.3,	Duct systems
N1103.4	Mechanical system piping insulation
N1103.5 except Section N1103.5.2	Service hot water systems
N1103.5.2	Hot water pipe insulation
N1103.6	Mechanical ventilation
N1103.7, except Section N1103.7.1	Equipment sizing and efficiency rating
N1103.8	Systems serving multiple dwelling units
N1103.9	Snow melt and ice system controls
N1103.11	Energy consumption of pools and spas
N1103.12	Portable spas
N1103.13	Residential pools and permanent residential spas
Electrical Power and Lighting Systems	
N1104.1	Lighting equipment
N1104.2	Interior lighting controls
~~N1104.5~~	~~Electric readiness~~
~~N1104.6~~	~~Renewable energy infrastructure~~
~~N1104.7~~	~~Electric vehicle power transfer infrastructure~~

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

Reason: Delete the three electrification policy references. These are electrification policy proposals which are not energy related and do not apply in the energy code requirements.

Cost Impact: The code change proposal will decrease the cost of construction.

Deleting these three electrification proposals in the references will reduce the cost of construction. There are no energy savings associated with these proposals.

Workgroup Recommendation

Proposal # 1175

RED1-161-22

Proponents: Eric Tate, representing Atmos Energy (eric.tate@atmosenergy.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

TABLE R405.2 REQUIREMENTS FOR SIMULATED BUILDING PERFORMANCE

SECTION[a]	TITLE
General	
R401.2.5	Additional energy efficiency
R401.3	Certificate
Building Thermal Envelope	
R402.1.1	Vapor retarder
R402.2.3	Attic knee or pony wall
R402.2.4	Eave baffle
R402.2.5.1	Access hatches and doors
R402.2.9	Basement walls
R402.2.9.1	Basement wall insulation installation
R402.2.10.1	Slab-on-grade floor insulation installation
R402.2.11.1	Crawl space wall insulation installations
R402.5.1.1	Installation
R402.5.1.2	Testing
R402.5.2	Fireplaces
R402.5.3	Fenestration air leakage
R402.5.4	Room containing fuel burning applicances
R402.5.5	Recessed lighting
R402.5.6	Air-sealed electrical and communication outlet boxes
R402.6	Maximum fenestration *U*-factor and SHGC
Mechanical	
R403.1	Controls
<u>R403.2</u>	Hot water boiler temperature reset
<u>R403.3</u>	<u>Duct systems</u>
R403.4	Mechanical system piping insulation
R403.5 except Section R403.5.2 (staff note: this needs to be fixed with hot water pipe insulation)	Service hot water system
R403.5.2	Hot water pipe insulation
R403.6	Mechanical ventilation
R403.7, except Section R403.7.1	Equipment sizing and efficiency rating
R403.8	Systems serving multiple dwelling units
R403.9	Snow melt and ice system controls
R403.11	Energy consumption of pools and spas
R403.12	Portable spas
R403.13	Residential pools and permanent residential spas
Electrical Power and Lighting Systems	
R404.1	Lighting equipment
R404.2	Interior lighting controls
~~R404.5~~	~~Electric readiness~~
~~R404.6~~	~~Renewable energy infrastructure~~
~~R404.7~~	~~Electric Vehicle power transfer infrastructure~~

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

Reason: These measures do not implement specific energy efficiency measures but instead only prepare the building for uncertain future efficiency measures. As a consequence, their contribution to building energy efficiency, as designed, cannot be modeled with validity. Such measures would be more appropriately considered in existing building code coverage.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
These deletions would not affect the cost of construction in of themselves.

Workgroup Recommendation

Proposal # 1460

RED1-162-22

Proponents: Eric Tate, representing Atmos Energy (eric.tate@atmosenergy.com)

2024 International Energy Conservation Code [RE Project]

CHAPTER 4 [RE]
RESIDENTIAL ENERGY EFFICIENCY

Revise as follows:

TABLE R406.2 REQUIREMENTS FOR ENERGY RATING INDEX

SECTION[a]	TITLE
General	
R401.3	Certificate
Building Thermal Envelope	
R402.1.1	Vapor retarder
R402.2.4	Eave baffle
R402.2.5.1	Access hatches and doors
R402.2.9	Basement walls
R402.2.9.1	Basement wall insulation installation
R402.2.10.1	Slab-on-grade floor insulation installation
R402.2.11.1	Crawl space wall insulation installation
R402.5.1.1	Installation
R402.5.1.2	Testing
R402.5.2	Fireplaces
R402.5.3	Fenestration air leakage
R402.5.4	Rooms containing fuel burning appliances
R402.5.5	Recessed lighting
R402.5.6	Air-sealed electrical and communication outlet boxes(air sealed boxes)
R406.3	Building thermal envelope
Mechanical	
R403.1	Controls
R403.2	Hot water boiler temperature reset
R403.3	Duct systems
R403.4	Mechanical system piping insulation
R403.5 except Section R403.5.2(staff note: this needs to be fixed with hot water pipe insulation)	Service hot water systems
R403.5.2	Hot water pipe insulation
R403.6	Mechanical ventilation
R403.7, except Section R403.7.1	Equipment sizing and efficiency rating
R403.8	Systems serving multiple dwelling units
R403.9	Snow melt and ice system controls
R403.11	Energy consumption of pools and spas
R403.12	Portable spas
R403.13	Residential pools and permanent residential spas
Electrical Power and Lighting Systems	
R404.1	Lighting equipment
R404.2	Interior lighting controls
~~R404.5~~	~~Electric readiness~~
~~R404.6~~	~~Renewable energy infrastructure~~
~~R404.7~~	~~Electric Vehicle power transfer infrastructure~~

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

Reason: These measures do not implement specific energy efficiency measures but instead only prepare the building for uncertain future efficiency measures. As a consequence, their contribution to building energy efficiency, as designed, cannot be used to calculate the building ERI with validity. Such measures would be more appropriately considered in existing building code coverage.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
The deleted table entries would not affect cost of construction.

Workgroup Recommendation

Proposal # 1466

RED1-163-22 Part I

Proponents: Fredric Zwerg, representing Southwest Gas Corporation (fredric.zwerg@swgas.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

TABLE R406.2 REQUIREMENTS FOR ENERGY RATING INDEX

SECTION[a]	TITLE
General	
R401.3	Certificate
Building Thermal Envelope	
R402.1.1	Vapor retarder
R402.2.4	Eave baffle
R402.2.5.1	Access hatches and doors
R402.2.9	Basement walls
R402.2.9.1	Basement wall insulation installation
R402.2.10.1	Slab-on-grade floor insulation installation
R402.2.11.1	Crawl space wall insulation installation
R402.5.1.1	Installation
R402.5.1.2	Testing
R402.5.2	Fireplaces
R402.5.3	Fenestration air leakage
R402.5.4	Rooms containing fuel burning appliances
R402.5.5	Recessed lighting
R402.5.6	Air-sealed electrical and communication outlet boxes(air sealed boxes)
R406.3	Building thermal envelope
Mechanical	
R403.1	Controls
R403.2	Hot water boiler temperature reset
R403.3	Duct systems
R403.4	Mechanical system piping insulation
R403.5 except Section R403.5.2(staff note: this needs to be fixed with hot water pipe insulation)	Service hot water systems
R403.5.2	Hot water pipe insulation
R403.6	Mechanical ventilation
R403.7, except Section R403.7.1	Equipment sizing and efficiency rating
R403.8	Systems serving multiple dwelling units
R403.9	Snow melt and ice system controls
R403.11	Energy consumption of pools and spas
R403.12	Portable spas
R403.13	Residential pools and permanent residential spas
Electrical Power and Lighting Systems	
R404.1	Lighting equipment
R404.2	Interior lighting controls
~~R404.5~~	~~Electric readiness~~
~~R404.6~~	~~Renewable energy infrastructure~~
~~R404.7~~	~~Electric Vehicle power transfer infrastructure~~

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

Reason: Delete the three electrification references. These are electrification policy proposals and are not energy related.

Cost Impact: The code change proposal will decrease the cost of construction.
The code change proposals will decrease the cost of construction. Removal of the selected references will reduce construction costs.

Workgroup Recommendation

Proposal # 1131

RED1-163-22 Part II

Proponents: Fredric Zwerg, representing Southwest Gas Corporation (fredric.zwerg@swgas.com)

2024 ENERGY Chapter11

Revise as follows:

TABLE N1106.2 REQUIREMENTS FOR ENERGY RATING INDEX

SECTION[a]	TITLE
General	
N1101.14	Certificate
Building Thermal Envelope	
N1102.1.1	Vapor retarder
N1102.2.4	Eave baffle
N1102.2.5.1	Access hatches and doors
N1102.2.9	Basement walls
N1102.2.9.1	Basement wall insulation installation
N1102.2.10.1	Slab-on-grade floor insulation installation
N1102.2.11.1	Crawl space wall insulation installation
N1102.5.1.1	Installation
N1102.5.1.2	Testing
N1102.5.2	Fireplaces
N1102.5.3	Fenestration air leakage
N1102.5.4	Rooms containing fuel burning appliances
N1102.5.5	Recessed lighting
N1102.5.6	Air sealed electrical and communication outlet boxes
N1106.3	Building thermal envelope
Mechanical	
N1103.1	Controls
N1103.2	Hot Water boiler temperature reset
N1103.3 except	Duct systems
N1103.4	Mechanical system piping insulation
N1103.5 except Section N1103.5.2	Service hot water systems
N1103.5.2	Hot water pipe insulation
N1103.6	Mechanical ventilation
N1103.7, except Section N1103.7.1	Equipment sizing and efficiency rating
N1103.8	Systems serving multiple dwelling units
N1103.9	Snow melt and ice system controls
N1103.11	Energy consumption of pools and spas
N1103.12	Portable spas
N1103.13	Residential pools and permanent residential spas
Electrical Power and Lighting Systems	
N1104.1	Lighting equipment
N1104.2	Interior lighting controls
~~N1104.5~~	~~Electric readiness~~
~~N1104.6~~	~~Renewable energy infrastructure~~
~~N1104.7~~	~~Electric Vehicle power transfer infrastructure~~

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

Reason: Delete the three electrification references. These are electrification policy proposals and are not energy related.

Cost Impact: The code change proposal will decrease the cost of construction.
Deleting the three electrification proposals will reduce construction costs. These proposals have no energy savings.

Workgroup Recommendation

Proposal # 1176

RED1-164-22

Proponents: Ted Williams, representing ONE Gas (ngdllc@outlook.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

TABLE R406.2 REQUIREMENTS FOR ENERGY RATING INDEX

SECTION[a]	TITLE
General	
R401.3	Certificate
Building Thermal Envelope	
R402.1.1	Vapor retarder
R402.2.4	Eave baffle
R402.2.5.1	Access hatches and doors
R402.2.9	Basement walls
R402.2.9.1	Basement wall insulation installation
R402.2.10.1	Slab-on-grade floor insulation installation
R402.2.11.1	Crawl space wall insulation installation
R402.5.1.1	Installation
R402.5.1.2	Testing
R402.5.2	Fireplaces
R402.5.3	Fenestration air leakage
R402.5.4	Rooms containing fuel burning appliances
R402.5.5	Recessed lighting
R402.5.6	Air-sealed electrical and communication outlet boxes(air sealed boxes)
R406.3	Building thermal envelope
Mechanical	
R403.1	Controls
R403.2	Hot water boiler temperature reset
R403.3	Duct systems
R403.4	Mechanical system piping insulation
R403.5 except Section R403.5.2(staff note: this needs to be fixed with hot water pipe insulation)	Service hot water systems
R403.5.2	Hot water pipe insulation
R403.6	Mechanical ventilation
R403.7, except Section R403.7.1	Equipment sizing and efficiency rating
R403.8	Systems serving multiple dwelling units
R403.9	Snow melt and ice system controls
R403.11	Energy consumption of pools and spas
R403.12	Portable spas
R403.13	Residential pools and permanent residential spas
Electrical Power and Lighting Systems	
R404.1	Lighting equipment
R404.2	Interior lighting controls
~~R404.5~~	~~Electric readiness~~
~~R404.6~~	~~Renewable energy infrastructure~~
~~R404.7~~	~~Electric Vehicle power transfer infrastructure~~

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

Reason: These measures do not implement specific energy efficiency measures but instead only prepare the building for uncertain future efficiency measures. As a result, their contribution to building energy efficiency, as designed, cannot be used to calculate the building ERI with validity. Such measures would be more appropriately considered in existing building code coverage.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
Elimination of these systems from the ERI calculation will not affect cost of construction.

Workgroup Recommendation

Proposal # 1416

RED1-165-22 Part I

Proponents: Tom Ortiz, representing National Propane Gas Association (tortiz@npga.org); Bruce Swiecicki, representing National Propane Gas Association (bswiecicki@npga.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R406.7.3 Renewable energy certificate (REC) documentation. Where on-site renewable electrical energy power production is included in the calculation of an ERI, documentation shall comply with Section R404.4. one of the following forms of documentation shall be provided to the code official:
1. Substantiation that the RECs associated with the on-site renewable energy are owned by, or retired on behalf of, the homeowner.
2. A contract that conveys to the homeowner the RECs associated with the on-site renewable energy, or conveys to the homeowner an equivalent quantity of RECs associated with other renewable energy.

Reason: Renewable energy systems may be used for purposes other than producing power, e.g. renewable hydrocarbon or renewable biomass used to provide home heating.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This proposal will neither increase nor decrease the cost of construction.

Workgroup Recommendation

Proposal # 1257

RED1-165-22 Part II

Proponents: Tom Ortiz, representing National Propane Gas Association (tortiz@npga.org); Bruce Swiecicki, representing National Propane Gas Association (bswiecicki@npga.org)

2024 ENERGY Chapter11

Revise as follows:

N1106.7.3 Renewable energy certificate (REC) documentation. Where on-site renewable electrical energy power production is included in the calculation of an ERI, documentation shall comply with Section N1104.4. one of the following forms of documentation shall be provided to the code official:
1. Substantiation that the RECs associated with the on-site renewable energy are owned by, or retired on behalf of, the homeowner.
2. A contract that conveys to the homeowner the RECs associated with the on-site renewable energy, or conveys to the homeowner an equivalent quantity of RECs associated with other renewable energy.

Reason: Renewable energy systems may be used for purposes other than producing power, e.g. renewable hydrocarbon or renewable biomass used to provide home heating.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This proposal will have no effect on the cost of construction.

Workgroup Recommendation

Proposal # 1293

RED1-166-22

Proponents: Michael Jouaneh, representing Lutron Electronics Co., Inc. (mjouaneh@lutron.com)

2024 International Energy Conservation Code [RE Project]

SECTION R408
ADDITIONAL EFFICIENCY REQUIREMENTS

R408.1 Scope. This section establishes additional efficiency credits to achieve additional energy efficiency in accordance with Section R401.2.5.

R408.2 Additional energy efficiency credit requirements . Two of the additional measures shall be selected from Table R408.2 that meet or exceed a total of ten credits. Five additional credits shall be selected for dwelling units with greater than 5,000 square feet (465 m^2) of living space floor area located above grade plane. Each measure selected shall meet the relevant subsections of Section R408 and receive credit as specified in Table R408.2 for the specific Climate Zone. Interpolation of credits between measures shall not be permitted.

Revise as follows:

TABLE R408.2 CREDITS FOR ADDITIONAL ENERGY EFFICIENCY

Portions of table not shown remain unchanged.

Measure Number	Measure Description	Credit Value								
		Climate Zone 0 & 1	Climate Zone 2	Climate Zone 3	Climate Zone 4	Climate Zone 4C	Climate Zone 5	Climate Zone 6	Climate Zone 7	Climate Zone 8
R408.2.10	Whole home lighting control	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD

Add new text as follows:

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

Exceptions:

1. Up to 5% of the total lighting power may remain uncontrolled.

2. Spaces where lighting is controlled by a count-down timer or *occupant sensor control*.

Reason: This proposal is similar to one that was submitted as a mandatory requirement for the base energy code but was rejected by the consensus committee even though it was approved and recommended by the PLR subcommittee. I believe this provision makes sense as an optional energy credit. This would provide a lighting option in the energy credit section. Currently there are no lighting options in the energy credit section.
This proposal is similar to what is mandatory in ASHRAE 90.2-2018 and similar to what has been approved so far for dwelling units in the energy credits section of the IECC 2024 commercial energy code. The intent to require lighting to have a control system or smart light fixtures such that the lighting can be shut-off from the exit or remote locations (e.g., using a phone app). This control strategy will save energy by allowing occupants to shutoff the lighting as they leave (or while they are away) so that unneeded lighting is not left on when no one is home. In the U.K. this feature is called "the last man out button". Note that the intent is for lighting to have the capability to be shutoff, not mandate lighting be shutoff.

Cost Impact: The code change proposal will increase the cost of construction.
Energy savings is 11% and cost $150 per the Bonnaville power study (see bibliography). I calculated scalar ratio on this and got 9.5 with scalar ratio limit of 14.6 so it is cost effective. See attachment. Keep in mind this is one of many optional provisions in the energy credit section and the only lighting one.

Bibliography: ASHRAE 90.2 section 7.5.3. http://ashrae.iwrapper.com/ASHRAE_PREVIEW_ONLY_STANDARDS/STD_90.2_2018

FutureResLightingPaper FINAL DRAFT docx - 2018-08-15.pdf (bpa.gov) http://legacy.bpa.gov/EE/Technology/EE-emerging-technologies/Projects-Reports-Archives/Documents/FutureResLightingPaper%20FINAL%20DRAFT%20docx%20-%202018-08-15.pdf [11% lighting savings from energy management system, cost is $150 at high end. See page 37]

Attached Files

- **Cost Effectiveness Tool (large home control system).pdf**
  https://energy.cdpaccess.com/proposal/1378/2744/files/download/489/

Workgroup Recommendation

RED1-167-22

Proponents: Jennifer Amann, representing ACEEE (jamann@aceee.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R408.2.6 Energy efficient appliances. Appliances installed in a dwelling unit shall meet the product energy efficiency specifications listed in Table R408.2.6, or equivalent energy efficiency specifications. Not less than three appliance types from Table R408.2.6 shall be installed for compliance with this section.

TABLE R408.2.6 MINIMUM EFFICIENCY REQUIREMENTS: APPLIANCES ~~APPLICANCE SPECIFICATION REFERENCE DOCUMENT~~

Appliance	Efficiency Improvement	Test Procedure
Refrigerator	~~Energy Star Program Requirements, Product Specification for Consumer Refrigeration Products, Version 5.1 (08/05/2021)~~ Maximum Annual Energy Consumption (AEC): No greater than 620 kWh/yr	10 CFR 430, Subpart B, Appendix A
Dishwasher	~~Energy Star Program Requirements for Residential Dishwashers, Version 6.0 (01/29/2016)~~ Maximum Annual Energy Consumption (AEC): No greater than 240 kWh/yr	10 CFR 430, Subpart B, Appendix C1 or Appendix C2 (whichever is required by DOE at time of purchase)
~~Clothes dryer~~	~~Energy Star Program Requirements, Product Specification for Clothes Dryers, Version 1.1 (05/05/2017)~~	
Clothes Washer and Electric Clothes Dryer	~~Energy Star Program Requirements, Product Specification for Clothes Washers, Version 8.1 (02/05/2018)~~ Maximum Annual Energy Consumption (AEC): No greater than 540 kWh/yr Clothes Dryer Combined Energy Factor (CEF_{base}): No less than 4.30[a]	10 CFR 430, Subpart B, Appendix D2

a. Credit for Clothes Washer and Clothes Dryer pair is based on Clothes Dryer efficiency

Reason: Reason Statement:
The objective of Section R408.2.5 was to encourage installation of appliances meeting ENERGY STAR criteria, but IECC does not allow direct reference to ENERGY STAR product specifications. The intent of the proposed change is to 1) specify and strengthen the requirements by incorporating product specifications that align with the 2023 ENERGY STAR Most Efficient product criteria and 2) make it easy for a code official to confirm compliance.

1)The proposed changes increase the efficiency improvement required to qualify for the credit to ensure that the credit will achieve significant energy savings even as standards and the ENERGY STAR specifications are strengthened over time. The ENERGY STAR Most Efficient criteria represent the anticipated levels for future ENERGY STAR specifications and minimum standards. The proposed change also bases the efficiency of the clothes washer/clothes dryer pair on the efficiency of the clothes dryer. Clothes dryers are the third largest energy end-use in many homes. The ENERGY STAR Most Efficient criteria for dryers represents significantly larger energy savings relative to federal standards than the clothes washer criteria.

2) The proposed change includes maximum Annual Energy Consumption values for Refrigerators, Dishwashers, Clothes Washers, and Clothes Dryers to allow code officials to easily confirm product compliance with any credits taken by checking each appliance's EnergyGuide label.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This proposal neither increases nor decreases the cost of construction. The high-efficiency appliance option is one of many options for improvement in Section R408. Code users can select from the range of options that best balance code compliance, cost-effectiveness, and their business objectives.

Workgroup Recommendation

RED1-168-22 Part I

Proponents: Tom Ortiz, representing National Propane Gas Association (tortiz@npga.org); Bruce Swiecicki, representing National Propane Gas Association (bswiecicki@npga.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R408.2.7 Renewable energy. Electrical Renewable energy resources shall be permanently installed that have the rated capacity to produce a minimum of 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 R404.4.

Reason: Renewable energy systems may not be “installable”. For instance, renewable hydrocarbons or biomass are fuels which are drop-in replacements for use with conventional infrastructure.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
There will be no effect on the cost of construction.

Workgroup Recommendation

Proposal # 1262

RED1-168-22 Part II

Proponents: Tom Ortiz, representing National Propane Gas Association (tortiz@npga.org); Bruce Swiecicki, representing National Propane Gas Association (bswiecicki@npga.org)

2024 ENERGY Chapter11

Revise as follows:

N1108.2.7 Renewable energy. Renewable <u>electrical </u>energy resources shall be permanently installed that have the rated capacity to produce a minimum of 1.0 watt of on-site renewable energy per square foot of conditioned floor area. To qualify for this option, re-newable energy certificate (REC) documentation shall meet the requirements of N1104.4.

Reason: Renewable energy systems may not be “installable”. For instance, renewable hydrocarbons or biomass are fuels which are drop-in replacements for use with conventional infrastructure.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This change will not affect the cost of construction.

Workgroup Recommendation

Proposal # 1298

RED1-169-22

Proponents: Greg Johnson, representing National Multifamily Housing Council (gjohnsonconsulting@gmail.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R404.6.2 Group R occupancies. Buildings in Group R-2, R-3 and R-4 shall comply with Appendix ~~CB~~ RB.

APPENDIX RB
SOLAR-READY PROVISIONS~~—DETACHED ONE- AND TWO-FAMILY DWELLINGS AND TOWNHOUSES~~ R-2, R-3, AND R-4 BUILDINGS

SECTION RB101
SCOPE

Revise as follows:

RB101.1 General. These provisions shall be applicable for new construction of R-2, R-3, and R-4 buildings 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

Revise as follows:

RB103.1 General. ~~New detached one- and two-family dwellings, and townhouses with not less than 600 square feet (55.74 m²) of roof area oriented between 110 degrees and 270 degrees of true north shall comply with Sections RB103.2 through RB103.8.~~ A solar-ready zone shall be located on the roof of **residential** buildings that are ~~five~~ three stories or less in height above grade plane,and are oriented between 110 degrees and 270 degrees of true north or have low-slope roofs. Solar-ready zones shall comply with Sections RB103.2 through RB103.8.

Exceptions:

1. ~~New residential buildings with a permanently installed on-site renewable energy system.~~ A building 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.~~ A building with a solar-ready zone that is shaded for more than 70 percent of daylight hours annually
3. A building where ~~the licensed design professional~~ 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 ~~the licensed design professional~~ an approved party certifies that the solar zone area required by Section RB103.3 cannot be met because of extensive rooftop equipment, skylights, vegetative roof areas or other obstructions.

RB103.2 Construction document requirements for solar-ready zone. Construction documents shall indicate the solar-ready zone.

Revise as follows:

RB103.3 Solar-ready zone area. ~~The total solar-ready zone area shall be not less than 300 square feet (27.87 m²) 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 m²) per dwelling shall have a solar-ready zone area of not less than 150 square feet (13.94 m²). 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 m²) exclusive of access or setback areas as required by the *International Fire Code*.~~ 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 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.

RB103.4 Obstructions. Solar-ready zones shall be free from obstructions, including but not limited to vents, chimneys, and roof-mounted equipment.

Revise as follows:

RB103.~~7~~ 5 Roof load documentation. ~~The structural design loads for roof dead load and roof live load shall be clearly indicated on the construction documents.~~ A collateral dead load of not less than 5 pounds per square foot (5 psf) (24.41 kg/m2) or in accordance with approved design 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 ~~Page 1 of 2~~ indicated on the construction documents.

RB103.~~8~~ 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.

RB103.~~9~~ 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 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~~ 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 by the builder or registered design professional.

Reason: Solar-ready provisions for single-family dwellings have now become part of the main body of the residential code, so Appendix RB is no longer needed. The new Section R404.6.2 for multi-family buildings states that "Buildings in Group R-2, R-3 and R-4 shall comply with Appendix CB" in the commercial provisions of the code. In lieu of pointing the user of residential provisions to the commercial portion of the code, this change brings the applicable provisions from Appendix CB to the revised Appendix RB in the residential code so that the residential code remains a stand-alone set of provisions.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
The change will have no effect on construction costs.

Workgroup Recommendation

Proposal # 1324

RED1-170-22

Proponents: Steven Rosenstock, representing Edison Electric Institute (srosenstock@eei.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

RD101.1 General. These provisions shall be applicable for new construction where solar-ready measures or an onsite ~~solar PV~~ <u>renewable energy</u> system are required.

RD103.2 Electrical energy storage energy capacity. Each building shall have a ESS with a minimum rated energy capacity of 5 kWh <u>or at least 1 hour of peak on-site renewable energy system production equivalent, which ever is greater</u>, with a minimum of four ESS supplied branch circuits.

RD103.3.4 Branch circuits served by ESS. A minimum of 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.
4. <u>All hard-wired life safety systems, including but not limited to smoke detectors and carbon monoxide detectors, that do not contain their own battery back-up system.</u>
5. <u>Hard-wired home security system.</u>

Reason: The proposed changes improve this appendix by accounting for multiple renewable energy production technologies in the Scope, updating the capacity to align with the production output of an on-site renewable energy system, and to require more essential systems to be powered by the ESS if needed.
The average residential home in the US uses about 10,629 kWh per year (based on 2021 data), or about 29 kWh per day on average.

Cost Impact: The code change proposal will increase the cost of construction.
By requiring more equipment to be connected to the ESS, and by requiring a larger ESS where the on-site renewable energy production system has a peak output of more than 5.0 kW.

Workgroup Recommendation

Proposal # 1081

RED1-171-22 Part I

Proponents: Fredric Zwerg, representing Southwest Gas Corporation (fredric.zwerg@swgas.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

RD102.1 ENERGY STORAGE SYSTEM (ESS). One or more devices, assembled together, capable of storing energy in order to supply electrical energy ~~at a future time~~.

Reason: Delete "...at a future time..." which is not necessary. Storage implies energy kept for future usage. Future is an arbitrary and vague term.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
No cost impact.

Workgroup Recommendation

Proposal # 1145

RED1-171-22 Part II

Proponents: Fredric Zwerg, representing Southwest Gas Corporation (fredric.zwerg@swgas.com)

2024 ENERGY Chapter11

Revise as follows:

AU102.1 ENERGY STORAGE SYSTEM (ESS). One or more devices, assembled together, capable of storing energy in order to supply electrical energy~~ at a future time~~.

Reason: Delete the last text referring to "future time". This is not necessary. Storage implies energy kept for a future usage. Future is an arbitrary and vague term.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
No cost impact.

Workgroup Recommendation

Proposal # 1177

RED1-172-22 Part I

Proponents: Fredric Zwerg, representing Southwest Gas Corporation (fredric.zwerg@swgas.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

RD103.3 Electrical energy storage system ~~ready~~ requirements.. Each building ~~shall be~~ energy storage ~~ready in accordance~~ system shall comply with Sections RB103.3.1 through RB103.3.4.

Reason: Revise text as indicated. This section is providing the requirements for an ESS and for the building's electrical system to meet the need of the ESS. It doesn't make sense to be built "ESS ready" in this context since it will not be built ESS ready and then be built at the same time. It's all done during construction. Section RD101.1 states this is for new construction of an ESS, not for the future.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
No cost impact.

Workgroup Recommendation

Proposal # 1146

RED1-172-22 Part II

Proponents: Fredric Zwerg, representing Southwest Gas Corporation (fredric.zwerg@swgas.com)

2024 ENERGY Chapter11

Revise as follows:

AU103.3 Electrical energy storage system ~~ready~~ requirements. Each building ~~shall be~~ energy storage ~~ready in accordance~~ system shall comply with Sections AU103.3.1 through AU103.3.4.

Reason: Revise text as shown. This section is providing the requirements for an ES and for a new building's electrical system. It will not be built ESS ready first and then the ESS system to be added. Section RD101.1 states it is for new construction of an ESS.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
No cost impact.

Workgroup Recommendation

Proposal # 1178

RED1-173-22

Proponents: Kevin Duell, representing NW Natural

2024 International Energy Conservation Code [RE Project]

Delete without substitution:

~~APPENDIX RE~~
~~ALL-ELECTRIC RESIDENTIAL BUILDINGS~~

~~RE101~~
~~GENERAL~~

~~**RE101.1 Intent.** The intent of this Appendix 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.~~

~~**RE101.2 Scope.** This appendix applies to new residential buildings.~~

~~RE102~~
~~GENERAL DEFINTITIONS~~

~~**RE102.1 . 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 and/or lighting that uses fuel gas or fuel oil.~~
~~**EQUIPMENT.** Piping, ducts, vents, control devices and other components of systems other than appliances 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.~~
~~**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).~~

~~RE103~~
~~ALL-ELECTRIC RESIDENTIAL BUILDINGS~~

~~**RE103.1 Application.** Residential buildings shall be *all-electric buildings* and comply with Section R401.2.5 and either Sections R401.2.1, R401.2.2, R401.2.3 or R401.2.4.~~

Reason: It is unclear how the original proposal will improve energy efficiency - has it been analyzed for cost-effectiveness or life cycle cost across all climate zones?

The original proposal appears to be driven by ideology rather than building science. There are many ways to reduce GHG emissions from buildings, including improving the energy source - green electrons and green molecules. When we decided to reduce emissions from the electrical grid we didn't decide to 'cut the wires', we chose to improve the source. And this is imperative since the majority of emissions from residential buildings stem from electrical generation. We can do the same for gaseous fuels: rather than 'cut the pipes' we can source carbon reducing or even carbon subtracting molecules and maintain the flexibility, reliability, redundancy and capacity of our existing energy infrastructure. In fact, that work is underway. In addition, optionality enables affordability - both for individuals and for society as a whole. Rather than prescribing rigid pathways, taking an 'all of the above' approach enables nimble policy, innovation and adaptive responses to needed changes and unforeseen changes to come.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
Different building designs will have higher or lower costs depending on the approach taken. However, providing more flexibility with this code change could reduce construction cost as it would allow designers and builders to follow the least-cost path to compliance.

Workgroup Recommendation

RED1-174-22

Proponents: Ted Williams, representing ONE Gas (ngdllc@outlook.com)

2024 International Energy Conservation Code [RE Project]

Delete without substitution:

~~APPENDIX RE~~
~~ALL-ELECTRIC RESIDENTIAL BUILDINGS~~

~~RE101~~
~~GENERAL~~

~~**RE101.1 Intent.** The intent of this Appendix 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.~~

~~**RE101.2 Scope.** This appendix applies to new residential buildings.~~

~~RE102~~
~~GENERAL DEFINTITIONS~~

~~**RE102.1 . 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 and/or lighting that uses fuel gas or fuel oil.~~
~~**EQUIPMENT.** Piping, ducts, vents, control devices and other components of systems other than appliances 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.~~
~~**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).~~

~~**RE103.1 Application.** Residential buildings shall be *all-electric buildings* and comply with Section R401.2.5 and either Sections R401.2.1, R401.2.2, R401.2.3 or R401.2.4.~~

Reason: Inclusion of this material in an IECC appendix inappropriately facilitates code adoption as minimum code requirements by jurisdictions, even while the requirements will not have been vetted for that purpose. The IECC Residential Consensus Committee should only consider such requirements as either minimum code requirements or disapprove of such measures explicitly.
If adopted as requirements, the appendix would eliminate important consumer energy choice alternatives that would include least-cost energy options for many consumers. This elimination of consumer options would most negatively impact economically-disadvantaged consumers who could have to pay for economically inefficient energy end uses. In such instances, impacts upon consumers would be regressively burdensome. Also, elimination of these consumer options would pre-empt consumer choices of higher efficiency gas appliances, including appliances and equipment that are above code efficiency requirements and federal minimum efficiency standards. In many cases, these options represent more cost-effective options for a variety of consumer groups, including lower-income households.

The Appendix unjustifiably presumes that full fuel cycle energy and emissions will decrease due to upstream primary energy changes. This presumption is not justified and runs counter to current and the most likely electricity generation prospects based upon:

- Overall growth in generation capacity utilizing fossil fuels (specifically natural gas),
- Currently employed generation capacity,
- Dispatched generation capacity and time-of-use electricity demand devoted to peak electricity demand.
- Electricity generation infrastructure capacity to meet increased demand and time-of-use demand imposed by additional end use appliance demand.

In fact, under current and foreseeable electricity generation growth, a switch from natural gas to electricity residential end uses will increase full fuel cycle energy consumption and carbon emissions on a national average basis by approximately 2.5 times compared onsite energy consumption and carbon emissions from direct use of natural gas. Despite the growth of renewable electricity entering the national grid, the need to sustain time-dependent power demands and grid electrical frequency stability places limits on the foreseeable extent that renewable electricity will replace fossil fuel-fired generation, particularly with growing natural gas fired generation capacity and activity. Also, since the continued expansion of natural gas fired generation capacity is continuing (and recent judicial defeats of the federal Clean Power Plan), natural gas fired generation investment will continue to be used, displacing higher carbon generation fuels but nevertheless growing carbon emissions. The IECC should not incentivize this growth in carbon emissions and instead allow consumers to choose onsite use of natural gas and actually help mitigate this growth in emissions (again precipitated by an approximate 2.5 to one advantage of onsite consumption of natural gas as opposed to powering electric generation). Proponents of the Appendix do not provide persuasive arguments countering these economic trends.

Similar national average considerations work against the proposed Appendix with respect to societal cost of compliance. The implicit expectation, supported by erroneous energy price forecasts published by the U. S. Energy Information Administration in its Annual Energy Outlook, is that electricity prices will decline as more renewable electricity comes to the national grid and that natural gas prices will increase over time in a "hockey stick" trend. Both of these energy price forecast series over time have not borne out across successive Annual Energy Outlook forecasts. Indeed, financial community forecasts of electricity prices show marked increases over the long term. The cumulative effect of the actual energy price trends would argue that all-electric residential building requirements would increase societal cost, perhaps to a significant degree.

The Appendix requirements for all-electric residential building are not supported by cost effectiveness justification that would take into consideration both the full fuel cycle and emissions benefits (argued here as negative) and the costs to consumers and society in general (argued as positive). It is presumed that the importance of cost effectiveness is reduced because of placement of the requirements in an IECC appendix, possible code adoption as mandatory requirements as discussed above could lead to the issue of cost effectiveness absent from adoption debates. Adopting jurisdictions would be inclined to expect that IECC had evaluated the Appendix as well as mandatory requirements for cost effectiveness, but this expectation would be unfulfilled. ICC should not encourage such a lapse in justification in the IECC.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
Prescribing energy systems will not affect cost of construction.

Workgroup Recommendation

Proposal # 1421

RED1-175-22 Part I

Proponents: Andrea Papageorge, representing Southern Company Gas (apapageo@southernco.com)

2024 International Energy Conservation Code [RE Project]

Delete without substitution:

~~APPENDIX RE~~
~~ALL-ELECTRIC RESIDENTIAL BUILDINGS~~

~~RE101~~
~~GENERAL~~

~~**RE101.1 Intent.** The intent of this Appendix 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.~~

~~**RE101.2 Scope.** This appendix applies to new residential buildings.~~

~~RE103~~
~~ALL-ELECTRIC RESIDENTIAL BUILDINGS~~

~~**RE103.1 Application.** Residential buildings shall be *all-electric buildings* and comply with Section R401.2.5 and either Sections R401.2.1, R401.2.2, R401.2.3 or R401.2.4.~~

~~RE102~~
~~GENERAL DEFINTITIONS~~

~~**RE102.1 . 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 and/or lighting that uses fuel gas or fuel oil.~~
~~**EQUIPMENT.** Piping, ducts, vents, control devices and other components of systems other than appliances 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.~~
~~**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).~~

Reason: The intent of this comment is to delete Appendix RE in its entirety without substitution.

- There are numerous flaws throughout the appendix, including the assumption that the use of electric appliances would be more cost effective for the consumers. There is ample evidence that electric appliances are not superior to gas appliances at the basic level of efficiency (especially when using source energy) and cost effectiveness.
- This appendix would eliminate all gas appliances, a source of energy that is not only cost effective and energy efficient but preferred by a large number of consumers. Eliminating all gas appliances would eliminate consumer choice.
- There is nothing in the appendix that demonstrates there is guaranteed energy savings or greenhouse gas reductions. Such claims of savings and reductions are not reliably quantifiable.
- Jurisdictions that adopt this appendix as the energy code for residential construction will be eliminating consumer choice without any justification or consideration of their constituents.
- There will be unintended consequences on forcing he use of electric appliances, especially upon lower income individuals in the form of higher energy costs and unreliability of the electric grid especially at times of high energy demand, specifically in the heat of the summer and the coldest winter months.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
Not including this appendix will not change costs of construction.

Workgroup Recommendation

RED1-175-22 Part II

Proponents: Andrea Papageorge, representing Southern Company Gas (apapageo@southernco.com)

2024 ENERGY Chapter11

Delete without substitution:

~~APPENDIX AY~~
~~ALL-ELECTIC RESIDENTIAL BUILDINGS~~

~~AY101~~
~~GENERAL~~

~~**AY101.1 Intent.** The intent of this Appendix 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.~~

~~**AY101.2 Scope.** This appendix applies to new residential buildings.~~

~~AY102~~
~~GENERAL DEFINITIONS~~

~~**AY102.1 . 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 and/or lighting that uses fuel gas or fuel oil.~~
~~**EQUIPMENT.** Piping, ducts, vents, control devices and other components of systems other than appliances 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.~~
~~**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).~~

Reason: The intent of this comment is to delete Appendix RE in its entirety without substitution.

- There are numerous flaws throughout the appendix, including the assumption that the use of electric appliances would be more cost effective for the consumers. There is ample evidence that electric appliances are not superior to gas appliances at the basic level of efficiency (especially when using source energy) and cost effectiveness.
- This appendix would eliminate all gas appliances, a source of energy that is not only cost effective and energy efficient but preferred by a large number of consumers. Eliminating all gas appliances would eliminate consumer choice.
- There is nothing in the appendix that demonstrates there is guaranteed energy savings or greenhouse gas reductions. Such claims of savings and reductions are not reliably quantifiable.
- Jurisdictions that adopt this appendix as the energy code for residential construction will be eliminating consumer choice without any justification or consideration of their constituents.
- There will be unintended consequences on forcing he use of electric appliances, especially upon lower income individuals in the form of higher energy costs and unreliability of the electric grid especially at times of high energy demand, specifically in the heat of the summer and the coldest winter months.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
Deleting this appendix will have no effect on the cost of construction.

Workgroup Recommendation

Proposal # 1471

RED1-176-22

Proponents: Ian Casey, representing NW Natural

2024 International Energy Conservation Code [RE Project]

Delete without substitution:

~~APPENDIX RE~~
~~ALL-ELECTRIC RESIDENTIAL BUILDINGS~~

~~RE101~~
~~GENERAL~~

~~**RE101.1 Intent.** The intent of this Appendix 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.~~

~~**RE101.2 Scope.** This appendix applies to new residential buildings.~~

~~RE102~~
~~GENERAL DEFINTITIONS~~

~~**RE102.1 . 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 and/or lighting that uses fuel gas or fuel oil.~~
~~**EQUIPMENT.** Piping, ducts, vents, control devices and other components of systems other than appliances 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.~~
~~**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).~~

~~RE103~~
~~ALL-ELECTRIC RESIDENTIAL BUILDINGS~~

Revise as follows:

~~**RE103.1 Application.** Residential buildings shall be *all-electric buildings* and comply with Section R401.2.5 and either Sections R401.2.1, R401.2.2, R401.2.3 or R401.2.4.~~

Reason: This proposal does not belong in the energy code. There is no guarantee that all-electric appliances will reduce the energy consumed by the building. Additionally, there is no guarantee that overall emissions will be reduced when considering the source emissions from electric power generation.
Furthermore, RE101.1 of this proposal states that removing combustion appliances from buildings will improve health and safety of buildings. This is the proponent's opinion and should not be included in code language. Without presenting conclusive statistical data that all-electric infrastructure in buildings is safer than mixed fuel buildings, this statement should not be allowed in code.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
Maintaining fuel choice in new buildings will provide flexibility to provide solutions that offer the best performance, efficiency and affordability for builders and end users.

Workgroup Recommendation

Proposal # 1458

RED1-177-22

Proponents: Eric Tate, representing Atmos Energy (eric.tate@atmosenergy.com)

2024 International Energy Conservation Code [RE Project]

Delete without substitution:

~~RE101~~
~~GENERAL~~

~~**RE101.1 Intent.** The intent of this Appendix 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.~~

~~**RE101.2 Scope.** This appendix applies to new residential buildings.~~

~~APPENDIX RE~~
~~ALL-ELECTRIC RESIDENTIAL BUILDINGS~~

~~RE102~~
~~GENERAL DEFINTITIONS~~

~~**RE102.1 . 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 and/or lighting that uses fuel gas or fuel oil.~~
~~**EQUIPMENT.** Piping, ducts, vents, control devices and other components of systems other than appliances 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.~~
~~**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).~~

Revise as follows:

~~RE103~~
~~ALL-ELECTRIC RESIDENTIAL BUILDINGS~~

~~**RE103.1 Application.** Residential buildings shall be *all-electric buildings* and comply with Section R401.2.5 and either Sections R401.2.1, R401.2.2, R401.2.3 or R401.2.4.~~

Reason: Inclusion of this material in an IECC appendix inappropriately facilitates code adoption as minimum code requirements by jurisdictions, even while the requirements have not been vetted for that purpose. The IECC Residential Consensus Committee is tasked with considering these extreme requirements as minimum code requirements, and if they are not appropriate for inclusion as minimum requirements, the Committee should disapprove such measures explicitly.

If adopted as requirements, the appendix would eliminate important consumer energy choice alternatives that would include least-cost energy options for many consumers. This elimination of consumer options would most negatively impact economically-disadvantaged consumers who could have to pay for economically inefficient energy end uses. In such instances, impacts upon consumers would be regressively burdensome.

The Appendix unjustifiably presumes that full fuel cycle energy and emissions will decrease due to upstream primary energy changes. This presumption is not justified and runs counter to current and the most likely electricity generation prospects based upon:

- Overall growth in generation capacity utilizing fossil fuels (specifically natural gas),
- Currently employed generation capacity,
- Dispatched generation capacity and time-of-use electricity demand devoted to peak electricity demand.
- Electricity generation infrastructure capacity to meet increased demand and time-of-use demand imposed by additional end use appliance demand.

In fact, under current and foreseeable electricity generation growth, a switch from natural gas to electricity residential end uses will increase full fuel cycle energy consumption and carbon emissions on a national average basis by approximately 2.5 times compared onsite energy consumption and carbon emissions from direct use of natural gas. Despite the growth of renewable electricity entering the national grid, the need to sustain time-dependent power demands and grid electrical frequency stability places limits on the foreseeable extent that renewable electricity will replace fossil fuel-fired generation, particularly with growing natural gas fired generation capacity and activity. Also, since the continued expansion of natural gas fired generation capacity is continuing (and recent judicial defeats of the federal Clean Power Plan), natural gas fired generation investment will continue to be used, displacing higher carbon generation fuels but nevertheless growing carbon emissions. The IECC should not incentivize this growth in carbon emissions and instead allow consumers to choose onsite use of natural gas and actually help mitigate this growth in emissions (again precipitated by an approximate 2.5 to one advantage of onsite consumption of natural gas as opposed to powering electric generation). Proponents of the Appendix do not provide persuasive arguments countering these economic trends.

In addition, this proposal for electric readiness does not take into account accurate forecasts of the price of electricity versus the price of natural gas. Contrary to the energy price predictions of the U. S. Energy Information Administration in its Annual Energy Outlook (which have proven to be consistently inaccurate by underestimating the price of electricity and overestimating the price of natural gas in the out years), financial community forecasts of electricity prices show marked increases over the long term. The cumulative effect of the actual energy price trends demonstrate that all-electric residential building conversions would increase societal cost, perhaps to a significant degree.

The Appendix requirements for all-electric residential building are not supported by cost effectiveness justification that would take into consideration both the full fuel cycle and emissions benefits (argued here as negative) and the costs to consumers and society in general (argued as positive). It is presumed that the importance of cost effectiveness is reduced because of placement of the requirements in an IECC appendix, possible code adoption as mandatory requirements as discussed above could lead to the issue of cost effectiveness absent from adoption debates. Adopting jurisdictions would be inclined to expect that IECC had evaluated the Appendix as well as mandatory requirements for cost effectiveness, but this expectation would be unfulfilled. ICC should not encourage such a lapse in justification in the IECC.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
The appendix would not alter the cost of construction for building designed for all-electric end use applications.

Workgroup Recommendation

Proposal # 1470

RED1-178-22 Part I

Proponents: Tom Ortiz, representing National Propane Gas Association (tortiz@npga.org); Bruce Swiecicki, representing National Propane Gas Association (bswiecicki@npga.org)

2024 International Energy Conservation Code [RE Project]

Delete without substitution:

~~APPENDIX RE~~
~~ALL-ELECTRIC RESIDENTIAL BUILDINGS~~

~~RE101~~
~~GENERAL~~

~~**RE101.1 Intent.** The intent of this Appendix 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.~~

~~**RE101.2 Scope.** This appendix applies to new residential buildings.~~

~~RE102~~
~~GENERAL DEFINTITIONS~~

~~**RE102.1 . 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 and/or lighting that uses fuel gas or fuel oil.~~
~~**EQUIPMENT.** Piping, ducts, vents, control devices and other components of systems other than appliances 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.~~
~~**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).~~

~~RE103~~
~~ALL-ELECTRIC RESIDENTIAL BUILDINGS~~

~~**RE103.1 Application.** Residential buildings shall be *all-electric buildings* and comply with Section R401.2.5 and either Sections R401.2.1, R401.2.2, R401.2.3 or R401.2.4.~~

Reason: This mandates all-electric buildings for all new residential construction, which is not in keeping with the stated goal of decarbonization because it precludes the use of renewable combustion fuels such as renewable hydrocarbons, alcohols, renewable biomass-derived fuels, or hydrogen. *This appendix should be deleted in its entirety*.
We propose the following general principles as a pathway to achieving net zero carbon buildings:

1. It is highly doubtful that society, given the constraints of practicality and financial resources, would be able to fully upgrade the electric grid or provide enough on-site renewable energy to meet the demand that would be imposed with a "full-steam-ahead" electrification policy, which many are trying to achieve with the 2024 IECC.

2. The "real" issue we are addressing is not so much energy conservation, but carbon conservation in the form of limiting CO_2e emissions. No energy sources should be discounted if, on a source-basis, they can achieve a superior level of performance than other sources.

3. The code is revised and published every three years. A step-wise approach to be taken is the most prudent, as it allows the grid to be upgraded to handle the additional loads expected (much of it due to electrification of vehicles) and to allow implementation of two-way technology for returning electrons to the grid, which most locations to not currently permit.

It is very apparent that the huge ambitions held by some electrification advocates will outstrip the capacity of our infrastructure to deliver. The cost to build a "future-proof" grid will likely be somewhere between $1 trillion (Reuters[1]) and $7 trillion (Oilprice.com[2]). This is an expenditure on the order of what the US spent[3] on the wars in Iraq and Afghanistan between 2001 – 2021. The appetite for policymakers and ratepayers to absorb such costs is a question that is yet to be answered.

Meanwhile, the US EIA has documented that average electric transmission system outage times have roughly doubled between 2013 - 2021[4]. We therefore are facing the prospect of adding massive new load to a network that is already badly in need of maintenance, without knowing with any degree of certainty how much investment capital will be available to: a) enable safe and robust bi-directional power flow for distributed storage and generation; b) protect this new “smart” grid against cyberattack and other forms of sabotage; and c) procure enough domestic supplies of scarce critical minerals (e.g. lithium, cobalt, neodymium) to ensure a secure and affordable source for the—literally—billions of batteries that are intended to serve the electric vehicle, residential and commercial energy storage, utility-scale energy storage, and consumer electronics industries.

(And, not to be dismissed, when fusion energy becomes widespread, we will need yet more lithium from which to manufacture tritium—one necessary component of the most feasible fuel for any prospective fusion power plant.)

Therefore, we view inclusion of mandatory electrification in building codes as far more than an energy efficiency, or even a greenhouse gas, issue: it also has massive national security and health/safety implications that, in our opinions, are not being adequately analyzed. While building codes may not, per se, be tasked with solving all of those problems, they are nevertheless relied upon by decisionmakers as being rational, reliable, and conservative bases for managing the building stock of our nation’s homes and businesses. Based on the foregoing, there should be consideration for more agnostically defining what is meant by a sustainable (rather than, strictly speaking, renewable) resource in the hope that we can use every feasible tool imaginable to optimize our energy system with respect to its myriad technical and environmental constraints.

[1] McLaughlin, T. (2022), “Creaky U.S. power grid threatens progress on renewables, EVs”, Reuters, https://www.reuters.com/investigates/special-report/usa-renewables-electric-grid/

[2] Hyman, L. and Tilles, W. (2021), “The $7 Trillion Cost Of Upgrading The U.S. Power Grid”, Oilprice.com, https://oilprice.com/Energy/Energy-General/The-7-Trillion-Cost-Of-Upgrading-The-US-Power-Grid.html .

[3] https://www.brown.edu/news/2021-09-01/costsofwar

[4] US Energy Information Administration (2022), “Table 11.2. Reliability metrics using IEEE of U.S. distribution system by state”, https://www.eia.gov/electricity/annual/ .

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This code change proposal will not affect the cost of construction.

Bibliography: [1] McLaughlin, T. (2022), “Creaky U.S. power grid threatens progress on renewables, EVs”, Reuters, https://www.reuters.com/investigates/special-report/usa-renewables-electric-grid/
[2] Hyman, L. and Tilles, W. (2021), “The $7 Trillion Cost Of Upgrading The U.S. Power Grid”, Oilprice.com, https://oilprice.com/Energy/Energy-General/The-7-Trillion-Cost-Of-Upgrading-The-US-Power-Grid.html .

[3] https://www.brown.edu/news/2021-09-01/costsofwar

[4] US Energy Information Administration (2022), “Table 11.2. Reliability metrics using IEEE of U.S. distribution system by state”, https://www.eia.gov/electricity/annual/ .

Workgroup Recommendation

Proposal # 1263

RED1-178-22 Part II

Proponents: Tom Ortiz, representing National Propane Gas Association (tortiz@npga.org); Bruce Swiecicki, representing National Propane Gas Association (bswiecicki@npga.org)

2024 ENERGY Chapter11

Delete without substitution:

~~APPENDIX AY~~
~~ALL-ELECTIC RESIDENTIAL BUILDINGS~~

~~AY101~~
~~GENERAL~~

~~**AY101.1 Intent.** The intent of this Appendix 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.~~

~~**AY101.2 Scope.** This appendix applies to new residential buildings.~~

~~AY102~~
~~GENERAL DEFINITIONS~~

~~**AY102.1 . 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 and/or lighting that uses fuel gas or fuel oil.~~
~~**EQUIPMENT.** Piping, ducts, vents, control devices and other components of systems other than appliances 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.~~
~~**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).~~

~~AY103~~
~~ALL-ELECTRIC RESIDENTIAL BUILDINGS~~

~~**AY103.1 Application.** Residential buildings shall be *all-electric buildings* and comply with Section R401.2.5 and either Sections R401.2.1, R401.2.2, R401.2.3 or R401.2.4.~~

Reason: This mandates all-electric buildings for all new residential construction, which is not in keeping with the stated goal of decarbonization because it precludes the use of renewable combustion fuels such as renewable hydrocarbons, alcohols, renewable biomass-derived fuels, or hydrogen. *This appendix should be deleted in its entirety*.
We propose the following general principles as a pathway to achieving net zero carbon buildings:

1. It is highly doubtful that society, given the constraints of practicality and financial resources, would be able to fully upgrade the electric grid or provide enough on-site renewable energy to meet the demand that would be imposed with a “full-steam-ahead” electrification policy, which many are trying to achieve with the 2024 IECC.

2. The “real” issue we are addressing is not so much energy conservation, but carbon conservation in the form of limiting CO_2e emissions. No energy sources should be discounted if, on a source-basis, they can achieve a superior level of performance than other sources.

3. The code is revised and published every three years. A step-wise approach to be taken is the most prudent, as it allows the grid to be upgraded to handle the additional loads expected (much of it due to electrification of vehicles) and to allow implementation of two-way technology for returning electrons to the grid, which most locations to not currently permit.

It is very apparent that the huge ambitions held by some electrification advocates will outstrip the capacity of our infrastructure to deliver. The cost to build a “future-proof” grid will likely be somewhere between $1 trillion (Reuters[1]) and $7 trillion (Oilprice.com[2]). This is an expenditure on the order of what the US spent[3] on the wars in Iraq and Afghanistan between 2001 – 2021. The appetite for policymakers and ratepayers to absorb such costs is a question that is yet to be answered.

Meanwhile, the US EIA has documented that average electric transmission system outage times have roughly doubled between 2013 - 2021[4]. We therefore are facing the prospect of adding massive new load to a network that is already badly in need of maintenance, without knowing with any degree of certainty how much investment capital will be available to: a) enable safe and robust bi-directional power flow for distributed storage and generation; b) protect this new “smart” grid against cyberattack and other forms of sabotage; and c) procure enough domestic supplies of scarce critical minerals (e.g. lithium, cobalt, neodymium) to ensure a secure and affordable source for the—literally—billions of batteries that are intended to serve the electric vehicle, residential and commercial energy storage, utility-scale energy storage, and consumer electronics industries.

(And, not to be dismissed, when fusion energy becomes widespread, we will need yet more lithium from which to manufacture tritium—one necessary component of the most feasible fuel for any prospective fusion power plant.)

Therefore, we view inclusion of mandatory electrification in building codes as far more than an energy efficiency, or even a greenhouse gas, issue: it also has massive national security and health/safety implications that, in our opinions, are not being adequately analyzed. While building codes may not, per se, be tasked with solving all of those problems, they are nevertheless relied upon by decisionmakers as being rational, reliable, and conservative bases for managing the building stock of our nation’s homes and businesses. Based on the foregoing, there should be consideration for more agnostically defining what is meant by a sustainable (rather than, strictly speaking, renewable) resource in the hope that we can use every feasible tool imaginable to optimize our energy system with respect to its myriad technical and environmental constraints.

[1] McLaughlin, T. (2022), “Creaky U.S. power grid threatens progress on renewables, EVs”, Reuters, https://www.reuters.com/investigates/special-report/usa-renewables-electric-grid/

[2] Hyman, L. and Tilles, W. (2021), “The $7 Trillion Cost Of Upgrading The U.S. Power Grid”, Oilprice.com, https://oilprice.com/Energy/Energy-General/The-7-Trillion-Cost-Of-Upgrading-The-US-Power-Grid.html .

[3] https://www.brown.edu/news/2021-09-01/costsofwar

[4] US Energy Information Administration (2022), “Table 11.2. Reliability metrics using IEEE of U.S. distribution system by state”, https://www.eia.gov/electricity/annual/ .

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
No impact on cost

Workgroup Recommendation

Proposal # 1300

RED1-179-22

Proponents: Steven Rosenstock, representing Edison Electric Institute (srosenstock@eei.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

RE102.1 . ALL-ELECTRIC BUILDING. A building that contains no combustion equipment, or ~~plumbing~~ piping for combustion equipment, installed within the boundary of 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 and/or lighting that uses fuel gas or fuel oil.
EQUIPMENT. Piping, ducts, vents, control devices and other components of systems other than appliances 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.
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).

Reason: The proposed changes are designed to clarify the definition. The term "plumbing" typically refers to equipment that conveys water, or other liquids combined with water, but not gases that can be used for combustion. Below are some of the definitions found:
https://www.merriam-webster.com/dictionary/plumbing "the apparatus (such as pipes and fixtures) concerned in the distribution and use of water in a building"
https://www.dictionary.com/browse/plumbing "the system of pipes and other apparatus for conveying water, liquid wastes, etc., as in a building."

https://www.oxfordlearnersdictionaries.com/us/definition/english/plumbing "the system of pipes, etc. that supply water to a building"

The term "piping" is a better "umbrella" term to use for this definition (a pipe is defined as "a tube through which liquids and gases can flow.") that can apply to combustion equipment that uses either gases or liquids.

Adding the word "boundary" is designed to further clarify the definition.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This change is only designed to clarify a definition and will have no impact on the cost of construction.

Workgroup Recommendation

Proposal # 1194

RED1-180-22

Proponents: Mark Lyles, representing California IOUs (markl@newbuildings.org); Ben Larson, representing Larson Energy Research (ben@larsonenergyresearch.com); Erin Sherman, representing RMI (esherman@rmi.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

RE103.1 Application. Residential buildings shall be *all-electric buildings* and comply with ~~Section R401.2.5 and~~ either Sections R401.2.1, R401.2.2, R401.2.3 or R401.2.4 and RE103.2.

Add new text as follows:

RE103.2 Heat pump water heating. Service hot water in one- and two- family dwellings and multiple single-family dwellings (townhouses) shall be provided by a heat pump system.

Exceptions:

1. Electric water heaters with a rated water storage volume of no greater than 20 gallons.
2. Dwelling units with no more than 1,000 square feet of conditioned floor area.
3. Solar water heating systems.
4. Waste heat and energy recovery systems.
5. Heat trace freeze protection systems.

RE103.2.1 Supplementary heat for heat pump water heating systems.
Heat pump systems having supplementary water heating equipment such as electric resistance elements shall minimize the use of those supplemental systems in the default or factory set operational mode as indicated in the manufacturer's installation and/or operation manual.

Reason:
The proposed change to the supplementary heat section is intended to restrict the routine use of supplemental heating in heat pump water heaters, by limiting routine use of electric resistance elements. The most effective way to limit electric resistance element use in heat pump water heaters is to ensure that the heat pump water used is listed as Tier 3 or 4 on the Northwest Energy Efficiency Alliance's Qualified Product List. Unfortunately referring to such a list is not allowed in the IECC. As such, we are proposing to require installation of heat pump water heaters that have a default or factory set operational mode that minimizes electric resistance element use, which can be verified by review of the manufacturer's installation and/or operation manual. We also propose deleting the exceptions for when electric resistance element use may be used, since manufacturers do not typically specify in such detail how their controls work.

Reference language from the Washington State Energy Code:
R403.5.7 Heat pump water heating. Service hot water in one- and two-family dwellings and multiple single-family dwellings (townhouses) shall be provided by a heat pump system. The heat pump water heating system shall be sized to provide 100 percent of peak hot water demand. Where the heat pump is located in unconditioned space, the heat pump water heating system shall be sized to provide 100 percent of peak hot water demand at an entering source dry bulb (or wet bulb if rated for wet bulb temperatures) air temperature of 40°F (4°C).
EXCEPTIONS:
1. Resistance heating elements integrated into heat pump equipment.
2. Electric water heaters with a rated water storage volume of no greater than 20 gallons.
3. Dwelling units with no more than 1,000 square feet of conditioned floor area.
4. Supplementary water heating systems in accordance with Section R403.5.7.1, provided the system capacity does not exceed the capacity of the heat pump water heating system.
5. Solar water heating systems.
6. Waste heat and energy recovery systems.
7. Heat trace freeze protection systems.
8. Snow and ice melt systems.
R403.5.7.1 Supplementary heat for heat pump water heating systems. Heat pumps used for water heating and having supplementary water heating equipment shall have controls that limit supplementary water heating equipment operation to only those times when one of the following applies:
1. The heat pump water heater cannot meet hot water demand.
2. For heat pumps located in unconditioned space, the outside air temperature is below 40°F (4°C).
3. The heat pump is operating in defrost mode.
4. The vapor compression cycle malfunctions or loses power.
EXCEPTION:Heat trace temperature maintenance systems, provided the system capacity does not exceed the capacity of the heat pump water heating system.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.

NA

Workgroup Recommendation

Proposal # 1206

RED1-181-22 Part I

Proponents: Fredric Zwerg, representing Southwest Gas Corporation (fredric.zwerg@swgas.com)

2024 International Energy Conservation Code [RE Project]

Delete without substitution:

~~APPENDIX RE~~
~~ALL-ELECTRIC RESIDENTIAL BUILDINGS~~

~~RE103~~
~~ALL-ELECTRIC RESIDENTIAL BUILDINGS~~

~~**RE103.1 Application.** Residential buildings shall be *all-electric buildings* and comply with Section R401.2.5 and either Sections R401.2.1, R401.2.2, R401.2.3 or R401.2.4.~~

Reason: Delete this Appendix entirely. All-electric homes are automatically required to comply with the energy code and the IRC. This appendix is not necessary. This section is a policy decision, not energy conservation. Policies are opinionated and are usually influenced by politics which can change. This appendix has not proven energy savings and will increase the cost of the building's construction and energy usage.

Cost Impact: The code change proposal will decrease the cost of construction.
Eliminating the appendix will reduce construction costs and operating costs.

Workgroup Recommendation

Proposal # 1147

RED1-181-22 Part II

Proponents: Fredric Zwerg, representing Southwest Gas Corporation (fredric.zwerg@swgas.com)

2024 ENERGY Chapter11

Delete without substitution:

~~APPENDIX AY~~
~~ALL-ELECTIC RESIDENTIAL BUILDINGS~~

~~AY103~~
~~ALL-ELECTRIC RESIDENTIAL BUILDINGS~~

~~**AY103.1 Application.** Residential buildings shall be *all-electric buildings* and comply with Section R401.2.5 and either Sections R401.2.1, R401.2.2, R401.2.3 or R401.2.4.~~

Reason: Delete this appendix entirely. All-electric homes are automatically required to comply with the energy code and the IRC. This appendix is not necessary. This section is a policy decision, not energy conservation. Policies are opinionated and are usually influenced by politics which can change. This appendix has no proven energy savings and will increase the cost of the building's construction and energy usage.

Cost Impact: The code change proposal will decrease the cost of construction.
The deletion of this appendix will decrease the cost of construction.

Workgroup Recommendation

Proposal # 1180

RED1-182-22

Proponents: Aaron Phillips, representing Asphalt Roofing Manufacturers Association (aphillips@asphaltroofing.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

LOW SLOPE~~LOW-SLOPED ROOF~~. A roof slope less than 2 units vertical in 12 units horizontal (17 percent slope).

STEEP SLOPE~~STEEP-SLOPED ROOF~~. A roof slope 2 units vertical in 12 units horizontal (17 percent slope) or greater.

TABLE R408.2.1.3 MINIMUM ROOF REFLECTANCE[a]

ROOF SLOPE	THREE-YEAR AGED SOLAR REFLECTANCE INDEX[b]
Low slope ~~Low-slope~~	75[b, c]
Steep slope ~~Steep-slope~~	16

a. The use of area-weighted averages to comply with these requirements shall be permitted. Materials lacking 3-year-aged tested values for solar reflectance shall be assigned a 3-year-aged solar reflectance in accordance with Section R408.2.1.3.1.

b. Aged solar reflectance tested in accordance with ASTM C1549, ASTM E903 or ASTM E1918 or CRRC-S100.

c. Solar reflectance index (SRI) shall be determined in accordance with ASTM E1980 using a convection coefficient of 2.1 Btu/h × ft^2 × °F (12 W/m^2 × K). Calculation of aged SRI shall be based on aged tested values of solar reflectance and thermal emittance.

2024 ENERGY Chapter11

Revise as follows:

LOW SLOPE~~LOW-SLOPED ROOF~~. A roof slope less than 2 units vertical in 12 units horizontal (17 percent slope).

STEEP SLOPE~~STEEP-SLOPED ROOF~~. A roof slope 2 units vertical in 12 units horizontal (17 percent slope) or greater.

TABLE N1108.2.1.3 MINIMUM ROOF REFLECTANCE[a]

ROOF SLOPE	THREE-YEAR AGED SOLAR REFLECTANCE INDEX[b]
Low slope ~~Low-slope~~	75[b,c]
Steep slope ~~Steep-slope~~	16

a. The use of area-weighted averages to comply with these requirements shall be permitted. Materials lacking 3-year-aged tested values for solar reflectance shall be assigned a 3-year aged solar reflectance in accordance with Section N1108.2.1.3.1.

b. Aged solar reflectance tested in accordance with ASTM C1549, ASTM E903 or ASTM E1918 or CRRC-S100.

c. Aged solar reflectance tested in accordance with ASTM C1549, ASTM E903 or ASTM E1918 or CRRC-S100.

Reason: This comment changes the new defined terms "low-sloped roof" and "steep-sloped roof" to "low slope" and "steep slope." Doing so aligns these new IECC residential/IRC Chapter 11 terms with the existing IBC definition of "steep slope" [i.e., A roof slope 2 units vertical in 12 units horizontal (17-percent slope) or greater]. The phrase "sloped roof" is not present in the Residential 1st Public Comment Draft (except as the defined terms), so there are no uses of the new terms "low-sloped roof" and "steep-sloped roof" within the 1st Public Comment Draft. "Slope" is used in conjunction with "roof" in three sections (R407.2/N1107.2, Table R408.2.1.3/N1108.2.1.3, and RB103.6/AT103.6), and the changes proposed do not affect interpretation of the provisions of those sections. The change in terms (e.g., "low-sloped roof" to "low slope") also matches the terms and associated definitions appropriately. Finally, this comment changes the hyphenated terms "low-slope" and "steep-slope" to the proposed defined terms "low slope" and "steep slope" in Tables R408.2.1.3. and N1108.2.1.3 to clarify that the defined terms apply.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This comment makes editorial changes to defined terms without any technical effect, so there is no change in cost of construction.

Workgroup Recommendation

Proposal # 951

RED1-183-22

Proponents: Theresa Weston, representing ABAA (Air Barrier Association of America) (holtweston88@gmail.com)

2024 ENERGY Chapter11

Revise as follows:

TABLE N1102.5.1.1 AIR BARRIER, AIR SEALING AND INSULATION INSTALLATION[a]

Portions of table not shown remain unchanged.

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
Windows, skylights and doors	The space between framing and skylights, and the jambs of windows and doors, shall be sealed.	~~Framing cavities around windows, skylights and doors shall be completely filled with insulation or insulated per window manufacturer's instructions.~~ Framing cavities around windows, skylights and doors shall be insulated. Insulation installation shall be in accordance with window manufacturer's instructions, where available.

For SI: 1 inch = 25.4 mm.

a. Inspection of log walls shall be in accordance with the provisions of ICC 400.

b. Insulation full enclosure is not required in unconditioned/ventilated attic spaces and at rim joists.

Reason: This proposal edits the text to better represent what information is available in window installation instructions. Insulating the framing cavities around windows is important to energy performance. However, the way in which these areas are insulated also affects the water management (drainage) of the installed window. Window manufacturers may also provide information on the compatibility of specific types of insulation with their window product. That being said, not all window manufacturer instructions contain information on insulation. For example, storefront/curtain wall instructions typically cover the anchoring method (spacing / shimming space) around the frame but not the insulation installation.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This proposal does not change the requirements and therefore does not effect the cost of construction. It only seeks better coordination with typical construction practice.

Workgroup Recommendation

Proposal # 1312

RED1-184-22 Part I

Proponents: Theresa Weston, representing ABAA (Air Barrier Association of America) (holtweston88@gmail.com)

2024 ENERGY Chapter11

Revise as follows:

N1102.5.1.2 Testing and maximum air leakage rate. The *building* or each *dwelling 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 4.0 air changes per hour or 0.22 cfm/ft^2 (1.1 L/s x m^2) of building or dwelling unit enclosure area. Testing shall be conducted in accordance with ANSI/RESNET/ICC 380, ASTM E779, ASTM E1827 or ASTM E3158 and reported at a pressure differential of 0.2 inch water gauge (50 Pa). 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.
<u>During testing:</u>

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

Exceptions:

1. When testing individual dwelling units, an air leakage rate not exceeding 0.27 cubic feet per minute per square foot [1.35 L/s x m^2] 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 water gauge (50 Pa), shall be permitted in all climate zones for:

   1.1 Attached single and multiple family building dwelling units.

   1.2 Buildings or dwelling units that are 1,500 square feet (139.4 m^2) or smaller.

2. 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 N1102.5.1.1, 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 conditioned spaces in accordance with Sections N1102.2.13 and N1102.4.5, as applicable.
3. Where tested in accordance with N1102.5.1.2, testing of each dwelling unit is not required.

~~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.~~

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

Reason: This proposal is editorial. It moves the details of testing conditions which should be a part of the section to the end of the section (before the exception list). No technical changes are made.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This is an editorial change and does not change any code requirements, and therefore does not change the cost of construction.

Workgroup Recommendation

Proposal # 1318

RED1-184-22 Part II

Proponents: Theresa Weston, representing ABAA (Air Barrier Association of America) (holtweston88@gmail.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R402.5.1.2 Testing. The *building* or each *dwelling unit* in the buildingshall be tested for air leakage. The maximum air leakage rate for any *building* or *dwelling unit* under any compliance path shall not exceed 4.0 air changes per hour or 0.22 cfm/ft^2(1.1 L/s x m^2) of building or dwelling unit enclosure area. Testing shall be conducted in accordance with ANSI/RESNET/ICC 380, ASTM E779, ASTM E1827 or ASTM E3158 and reported at a pressure differential of 0.2 inch water gauge (50 Pa). 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.
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:

1. When testing individual dwelling units, an air leakage rate not exceeding 0.27 cubic feet per minute per square foot [1.35 L/s x m^2)] 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:

   1.1 Attached single and multiple family building dwelling units.

   1.2 Buildings or dwelling units that are 1,500 square feet (139.4 m^2) or smaller.

2. 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.

3. Where tested in accordance with R402.5.1.4, testing of each dwelling unit is not required.

~~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.~~

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.

Reason: This proposal is editorial. It moves the details of testing conditions which should be a part of the section to the end of the section (before the exception list). No technical changes are made.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This is an editorial change and does not change any code requirements, and therefore does not change the cost of construction.

Workgroup Recommendation

Proposal # 1260

RED1-185-22

Proponents: Aaron Phillips, representing Asphalt Roofing Manufacturers Association (aphillips@asphaltroofing.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R102.1.1 Above code programs. The *code official* or other authority having jurisdiction 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* UA, which is the sum of U-factor times assembly area, shall be less than or equal to the *building thermal envelope*~~building thermal envelope~~ UA using the prescriptive U-factors from Table R402.1.2 multiplied by 1.08 in Climate Zones 0, 1, 2, and by 1.15 in Climate Zones 3 through 8, in accordance with Equation 4-1. The area-weighted maximum fenestration SHGC permitted in Climate Zones 0 through 3 shall be 0.30.

$$\text{For Climate Zones 0-2: } UA_{\text{Proposed design}} \leq 1.08 \text{ x } UA_{\text{Prescriptive reference design}}$$

$$\text{For Climate Zones 3-8: } UA_{\text{Proposed design}} \leq 1.15\text{x } UA_{\text{Prescriptive reference design}}$$

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*~~envelope~~.

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*~~building 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*~~building 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 R408.
8. Where a solar-ready zone is provided, the certificate shall indicate the location, and dimensions.

R402.1.5 Component performance alternative. Where the proposed total *building thermal envelope thermal conductance* is less than or equal to the required total *building thermal envelope* ~~building thermal envelope~~ conductance using factors in Table R402.1.2 the *building* shall be considered to be in compliance with Table R402.1.2. The total thermal conductance shall be determined in accordance with Equation 4-1. Proposed *U*-factors and slab-on-grade *F*-factors shall be taken from 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. In addition to total thermal conductance compliance, the SHGC requirements of Table R402.1.2 and the maximum fenestration *U*-factors of Section R402.6 shall be met.

Equation 4-1

$$(\text{Up A} + \text{Fp P}) \leq (\text{Ur A} + \text{Fr P})$$

Up A = the sum of proposed *U*-factors times the assembly areas in the proposed building.

Fp P = the sum of proposed *F*-factors times the slab-on-grade perimeter lengths in the proposed building.
Ur A = the sum of *U*-factors in Table R402.1.2 times the same assembly areas as in the proposed building.
Fr P = the sum of *F*-factors in Table R402.1.2 times the same slab-on-grade perimeter lengths as in the proposed building.

R402.2.7 Steel-frame ceilings, walls and floors. Steel-frame ceilings, walls, and floors shall comply with the *U*-factor requirements of Table R402.1.2. The calculation of the *U*-factor for a steel-framed ceilings and walls in ~~an~~ *building thermal envelope*~~envelope~~ assembly shall be determined in accordance with AISI S250 as modified herein.

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 the AISI S250 shall be used without any modifications.
4. Where the steel-framed wall contains other than standard C-shape framing members the AISI S250 calculation option for other than standard C-shape framing is permitted to be used.

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, domestic hot water, 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 weatherstripped in accordance with Section R402.5.
6. The *building thermal envelope*~~building thermal envelope~~ separating the basement from adjacent conditioned spaces complies with Section R402.5.

TABLE R402.5.1.1 AIR BARRIER, AIR SEALING AND INSULATION INSTALLATION[a]

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
General requirements	A continuous air barrier shall be installed in the *building thermal envelope*~~building envelope~~. Breaks or joints in the air barrier shall be sealed.	Air-permeable insulation shall not be used as a sealing material.
Ceiling/attic	A sealed air barrier shall be installed in any dropped ceiling or soffit to separate it from unconditioned space. Access openings, drop down stairs or knee wall doors to unconditioned attic spaces shall be air 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. Access hatches and doors shall be installed and insulated in accordance with Section R402.2.5 Eave Baffles shall be installed in accordance with Section R402.2.4
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 *building thermal envelope*~~thermal envelope~~ insulation for framed walls shall be installed in substantial contact and continuous alignment with the air barrier.
Windows, skylights and doors	The space between framing and skylights, and the jambs of windows and doors, shall be sealed.	Framing cavities around windows, skylights and doors shall be completely filled with insulation or insulated per window manufacturer's instructions.
Rim joists	Rim joists shall include an air barrier. 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.[b]
Floors, including cantilevered floors and floors above garages	The air barrier shall be installed at any exposed edge of insulation.	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.
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 *International Residential Code*.	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 R402.2.11.
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*~~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*~~building thermal envelope~~ shall be air sealed in accordance with Section R402.5.5.	Recessed light fixtures installed in the *building thermal envelope*~~building thermal envelope~~ shall be airtight and IC rated, and shall be buried 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	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

	air sealed.	to the exterior side of the obstructions.
Showers, tubs, and fireplaces adjacent to the *building thermal envelope*~~building thermal envelope~~	An air barrier shall separate insulation in the *building thermal envelope* from the shower, tub, and fireplace assemblies.	Exterior framed walls adjacent to showers, tubs and fireplaces shall be insulated.
Electrical,communication, and other equipment boxes, housings, and enclosures	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. The continuity of the air barrier shall be maintained around boxes, housings, and enclosures that penetrate the air barrier. Alternatively, air-sealed boxes shall be installed in accordance with R402.5.6.	Boxes, housing, and enclosures shall be burried in or surrounded by insulation.
HVAC register boots	HVAC supply and return register boots that penetrate *building thermal envelope*~~building thermal envelope~~ shall be sealed to the subfloor, wall covering or ceiling penetrated by the boot.	HVAC supply and return register boots located in the *building thermal envelope*~~building's thermal envelope~~ shall be buried and 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	Air sealing materials recognized in a listed fire-resistance rated common wall or double wall design and installed in accordance with the listing, or air sealing materials recognized in an approved design, shall be used. Common walls or double walls shall be considered an exterior wall for the purposes of air barrier and air sealing application of this Table.	Insulation materials recognized in the listed common wall or double-wall design and installed in accordance with the listing, or insulation materials recognized in the approved design, shall be used.

a. Inspection of log walls shall be in accordance with the provisions of ICC 400.

b. Insulation full enclosure is not required in unconditioned/ventilated attic spaces and at rim joists.

R402.5.1.2 Testing. The *building* or each *dwelling unit* in the buildingshall be tested for air leakage. The maximum air leakage rate for any *building* or *dwelling unit* under any compliance path shall not exceed 4.0 air changes per hour or 0.22 cfm/ft^2(1.1 L/s x m^2) of building or dwelling unit enclosure area. Testing shall be conducted in accordance with ANSI/RESNET/ICC 380, ASTM E779, ASTM E1827 or ASTM E3158 and reported at a pressure differential of 0.2 inch water gauge (50 Pa). 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.

Exceptions:

1. When testing individual dwelling units, an air leakage rate not exceeding 0.27 cubic feet per minute per square foot [1.35 L/s x m^2)] 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:

   1.1 Attached single and multiple family building dwelling units.

   1.2 Buildings or dwelling units that are 1,500 square feet (139.4 m^2) or smaller.

2. 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*~~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.
3. Where tested in accordance with R402.5.1.4, testing of each dwelling unit is not required.

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.

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.

R402.5.4 Rooms containing fuel-burning appliances. In Climate Zones 3 through 8, where open combustion air ducts provide combustion air to open combustion fuel-burning appliances, the appliances and combustion air opening shall be located outside the *building thermal envelope* or enclosed in a room that is isolated from inside the *building thermal envelope*~~thermal envelope~~. Such rooms shall be sealed and insulated in accordance with the *building thermal envelope*~~envelope~~ requirements of Table R402.1.3, where the walls, floors and ceilings shall meet a minimum of the *basement wall R*-value requirement. The door into the room shall be fully gasketed and any water lines and ducts in the room insulated in accordance with Section R403. The combustion air duct shall be insulated where it passes through *conditioned space* to an *R*-value of not less than R-8.

Exceptions:

1. Direct vent appliances with both intake and exhaust pipes installed continuous to the outside.
2. Fireplaces and stoves complying with Section R402.5.2 and Section R1006 of the International Residential Code.

R402.5.6 Air-Sealed electrical and communication outlet boxes. Air-sealed electrical and communication outlet boxes that penetrate the air barrier of the *building thermal envelope*~~building thermal envelope~~ shall be caulked, 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 shall be tested and marked in accordance with NEMA OS 4. Air-sealed boxes shall be installed in accordance with the manufacturer's instructions .

R403.3.2 Ducts located in conditioned space. For ductwork to be considered inside a *conditioned space,* it shall comply with one of the following:

1. The duct system shall be located completely within the *continuous air barrier* and within the *building thermal envelope*~~building thermal envelope~~.

2. Ductwork in ventilated attic spaces or unvented attic with vapor diffusion port shall be buried within ceiling insulation in accordance with Section R403.3.3 and all of 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. The duct leakage, as measured either by a rough-in test of the ducts or a post-construction total system leakage test to outside the *building thermal envelope* in accordance with Section R403.3.6, is less than or equal to 1.5 cubic feet per minute (42.5 L/min) per 100 square feet (9.29 m^2) of *conditioned floor area* served by the duct system.

   2.3. The ceiling insulation *R*-value installed against and above the insulated duct is greater than or equal to the proposed ceiling insulation *R*-value, less the *R*-value of the insulation on the duct.

3. Ductwork located in wall or floor building 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 the duct and the unconditioned space.

   3.2. Ducts shall be installed in accordance with Section R403.3.1.

   Exception: Where the building assembly cavities containing ducts have been air sealed in accordance with Section R402.5.1, duct insulation is not required.

   3.3. Not less than R-10 insulation, and not less than 50 percent of the required R-value specified in Table R402.1.3, shall be located between the duct and the unconditioned space.

   3.4 For ducts in these building assemblies to be considered within conditioned space, the air handling equipment shall be installed within conditioned space.

R405.2 Simulated performance compliance. Compliance based on total building performance requires that a *proposed design* meets all of the following:

1. The requirements of the sections indicated within Table R405.2.
2. The proposed total *building thermal envelope*~~building thermal envelope~~ UA, which is the sum of the U-factor times assembly area, shall be less than or equal to the *building thermal envelope*~~building thermal envelope~~ UA using the prescriptive U-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. The area-weighted maximum fenestration SHGC permitted in Climate Zones 0 through 3 shall be 0.30.

(Equation 4-2)

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

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

3. For buildings without a fuel burning appliance for space heating or water heating, the annual energy cost of the proposed design that is less than or equal to 85 percent of the annual energy cost of the *standard reference design*. For buildings with a fuel burning appliance for space heating or water heating, the annual energy cost of the proposed design that is less than or equal to 80 percent of the annual energy cost of the standard reference design. For dwelling units with greater than 5,000 square feet (465 m^2) of living space floor area located above grade plane, the annual energy cost of the proposed design shall be reduced by an additional 5 percent of annual energy cost of the standard reference design. Energy prices shall be taken from a source *approved* by the *code official*, such as the Department of Energy, 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 multipliers for all energy sources shall be obtained from ASHRAE Standard 105 (Tables K2, K4, or K8) or from another data source approved by the *code official*.
   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 for an all-electric building with on-site renewable energy installed.

R405.3.2.1 Compliance report for permit application. A compliance report submitted 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 the software used to produce the results for the reference design and/or the rated home.
5. A certificate indicating that the proposed design complies with Section R405.3. 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*~~building 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 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.

R405.3.2.2 Compliance report for certificate of occupancy. A compliance report submitted for obtaining the certificate of occupancy shall include the following:

1. Building street address, or other building site identification.
2. Declaration of the 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.
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.
6. A final confirmed certificate indicating compliance based on inspection, and a statement indicating that the 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, including component-level insulation *R*-values or *U*-factors; results from any required duct system and *building thermal envelope*~~building 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.

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 Table R402.1.2.	As proposed
	Solar absorptance = 0.75.	As proposed
	Emittance = 0.90.	As proposed
Basement and crawl space walls	Type: same as proposed.	As proposed
	Gross area: same as proposed.	As proposed
	U-factor: as specified in Table R402.1.2, with the insulation layer on the interior side of the walls.	As proposed
Above-grade floors	Type: wood frame.	As proposed
	Gross area: same as proposed.	As proposed
	U-factor: as specified in Table R402.1.2.	As proposed
Ceilings	Type: wood frame.	As proposed
	Gross area: same as proposed.	As proposed
	U-factor: as specified in Table R402.1.2.	As proposed
Roofs	Type: composition shingle on wood sheathing.	As proposed
	Gross area: same as proposed.	As proposed
	Solar absorptance = 0.75.	As proposed
	Emittance = 0.90.	As proposed
Attics	Type: vented with an aperture of 1 ft^2 per 300 ft^2 of ceiling area.	As proposed
Foundations	Type: same as proposed.	As proposed
	Foundation wall area above and below grade and soil characteristics: same as proposed.	As proposed
Opaque doors	Area: 40 ft^2.	As proposed
	Orientation: North.	As proposed
	U-factor: same as fenestration as specified in Table R402.1.2.	As proposed
Vertical fenestration other than opaque doors	Total area[h] = (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 Table R402.1.2.	As proposed
	SHGC: as specified in Table R402.1.2 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 × SHGC for the standard reference design).	Interior shade fraction: 0.92 – (0.21 × SHGC as proposed)
	External shading: none	As proposed
Skylights	None	As proposed
Thermally isolated sunrooms	None	As proposed
	The air leakage rate at a pressure of 0.2 inch w.g. (50 Pa) shall be Climate Zones 0 through 2: 5.0 air changes per hour. Climate Zones 3 , 4, and 5: 3.0 air changes per hour. Climate Zones 6 through 8: 2.5 air changes per hour.	The measured air exchange rate.[a]
	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 B × M	

Air exchange rate	shall be the same as in the proposed design, but not greater than B x M where: B = 0.01 × CFA + 7.5 × (Nbr + 1), cfm. M = 1.0 where the measured air exchange rate is > = 3.0 air changes per hour at 50 Pascals, and otherwise, M = minimum (1.7, Q/B) Q = the proposed mechanical ventilation rate, cfm. CFA = conditioned floor area, ft2. Nbr = number of bedrooms. 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 Section R403.6.1. Heat recovery or energy recovery shall not be modeled for mechanical ventilation where not required by Section R403.6.1.	The mechanical ventilation rate[b], Q, shall be in addition to the air leakage rate and shall be as proposed.
Mechanical ventilation	Where mechanical ventilation is not specified in the proposed design: None Where mechanical ventilation is specified in the proposed design, the annual vent fan energy use, in units of kWh/yr, shall equal (8.76 × B × M)/ef where: B and M are determined in accordance with the Air Exchange Rate row of this table. e_f = the minimum fan efficacy, as specified in Table 403.6.2, corresponding to the system type at a flow rate of B × M. *CFA* = conditioned floor area, ft^2. N_{br} = number of bedrooms.	As proposed
Internal gains	IGain, in units of Btu/day per dwelling unit, shall equal 17,900 + 23.8 ×*CFA* + 4,104 × N_{br} where: *CFA* = conditioned floor area, ft^2. N_{br} = number of bedrooms.	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[c] but not integral to the *building thermal envelope*~~building 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 Table R402.1.3, 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[d, e, j, k]	For other than electric heating without a heat pump: as proposed. 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 Section R403.7.	
	Fuel Type/Capacity: Same as proposed design	As proposed
	Product class: Same as proposed design	As proposed
	Efficiencies:	As proposed
	Heat pump: Complying with 10 CFR §430.32	As proposed
	Non-electric furnaces: Complying with 10 CFR §430.32	As proposed
	Non-electric boilers: Complying with 10 CFR §430.32	As proposed
Cooling systems[d, f, k]	As proposed. Capacity: sized in accordance with Section R403.7.	
	Fuel Type: Electric Capacity: Same as proposed design	As proposed
	Efficiencies: Complying with 10 CFR §430.32	As proposed
		As proposed Use, in units of gal/day = 25.5 + (8.5 × N_{br}) × (1

<table>
<tr>
<td rowspan="6">Service water heating[d, g, k]</td>
<td>As proposed.
Use, in units of gal/day = 25.5 + (8.5 × N_{br})
where: N_{br} = number of bedrooms.</td>
<td>Use, in units of gal/day = 25.5 + (8.5 × N_{br}) × (1 – HWDS)
where:
N_{br} = number of bedrooms.
HWDS = factor for the compactness of the hot water distribution system.
<table>
<tr><td colspan="2">Compactness ratio[i] factor</td><td>HWDS</td></tr>
<tr><td>1 story</td><td>2 or more stories</td><td></td></tr>
<tr><td>> 60%</td><td>> 30%</td><td>0</td></tr>
<tr><td>> 30% to ≤ 60%</td><td>> 15% to ≤ 30%</td><td>0.05</td></tr>
<tr><td>> 15% to ≤ 30%</td><td>> 7.5% to ≤ 15%</td><td>0.10</td></tr>
<tr><td>< 15%</td><td>< 7.5%</td><td>0.15</td></tr>
</table>
</td>
</tr>
<tr><td>Fuel Type: Same as proposed design</td><td>As proposed</td></tr>
<tr><td>Rated Storage Volume: Same as proposed design</td><td>As proposed</td></tr>
<tr><td>Draw Pattern: Same as proposed design</td><td>As proposed</td></tr>
<tr><td>Efficiencies: Uniform Energy Factor complying with 10 CFR §430.32</td><td>As proposed</td></tr>
<tr><td>Tank Temperature: 120° F (48.9° C)</td><td>Same as standard reference design</td></tr>
<tr>
<td rowspan="4">Thermal distribution systems</td>
<td>Duct location:
<table>
<tr><td>Foundation Type</td><td>Slab on grade</td><td>Unconditioned crawl space</td><td>Basement or conditioned crawl space</td></tr>
<tr><td>Duct location (supply and return)</td><td>One-story building: 100% in unconditioned attic

All other: 75% in unconditioned attic and 25% inside conditioned space</td><td>One-story building: 100% in unconditioned crawlspace

All other: 75% in unconditioned crawlspace and 25% inside conditioned space</td><td>50% inside conditioned space

50% unconditioned attic</td></tr>
</table>
</td>
<td>Duct location: as proposed.</td>
</tr>
<tr><td>Duct insulation: in accordance with Section R403.3.1.</td><td>Duct insulation: as proposed.</td></tr>
<tr>
<td>Duct system leakage to outside:
For duct systems serving > 1,000ft2 of conditioned floor area, the duct leakage to outside rate shall be 4 cfm (113.3 L/min) per 100 ft2 (9.29 m2) of conditioned floor area.
For duct systems serving ≤ 1,000ft2 of conditioned floor area, the duct leakage to outside rate shall be 40 cfm (1132.7 L/min).</td>
<td>Duct System Leakage to Outside: The measure total duct system leakage rate shall be entered into the software as the duct system leakage to outside rate.
Exceptions:
<table>
<tr><td>1.</td><td>When duct system leakage to outside is tested in accordance ANSI/ RESNET/ICC 380 or ASTM E1554, the measured value shall be permitted to be entered.</td></tr>
<tr><td>2.</td><td>When total duct system leakage is measured without the air handler installed, the simulation value shall be 4 cfm (113.3 L/min) per 100 ft^2 (9.29 m^2) of conditioned floor area.</td></tr>
</table>
</td>
</tr>
<tr><td>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.</td><td>For hydronic systems and ductless systems, DSE shall be as specified in Table R405.4.2(2).</td></tr>
<tr><td>Thermostat</td><td>Type: Manual, cooling temperature setpoint = 75°F;
Heating temperature setpoint = 72°F.</td><td>Same as standard reference design.</td></tr>
<tr><td>Dehumidistat</td><td>Where a mechanical ventilation system with latent heat recovery is not specified in the proposed design: None. Where the proposed design utilizes a mechanical ventilation system with latent heat recovery:
Dehumidistat type: manual, setpoint = 60% relative humidity.</td><td>Same as standard reference design.</td></tr>
</table>

	Dehumidifier: whole-dwelling with integrated energy factor = 1.77 liters/kWh.	

For SI: 1 square foot = 0.93 m^2, 1 British thermal unit = 1055 J, 1 pound per square foot = 4.88 kg/m^2, 1 gallon (US) = 3.785 L, °C = (°F-32)/1.8, 1 degree = 0.79 rad.

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.

g. For a proposed design the following assumptions shall be made for both the proposed design and standard reference design.

   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 §130.32

h. For residences with conditioned basements, R-2 and R-4 residences, and for townhouse units, 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.

i. 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 Table R405.4.2(1), the standard reference design shall be the same as proposed design.

TABLE R406.2 REQUIREMENTS FOR ENERGY RATING INDEX

SECTION[a]	TITLE
General	
R401.3	Certificate
Building Thermal Envelope	
R402.1.1	Vapor retarder
R402.2.4	Eave baffle
R402.2.5.1	Access hatches and doors
R402.2.9	Basement walls
R402.2.9.1	Basement wall insulation installation
R402.2.10.1	Slab-on-grade floor insulation installation
R402.2.11.1	Crawl space wall insulation installation
R402.5.1.1	Installation
R402.5.1.2	Testing
R402.5.2	Fireplaces
R402.5.3	Fenestration air leakage
R402.5.4	Rooms containing fuel burning appliances
R402.5.5	Recessed lighting
R402.5.6	Air-sealed electrical and communication outlet boxes(air sealed boxes)
R406.3	*Building thermal envelope* ~~Building thermal envelope~~
Mechanical	
R403.1	Controls
R403.2	Hot water boiler temperature reset
R403.3	Duct systems
R403.4	Mechanical system piping insulation
R403.5 except Section R403.5.2(staff note: this needs to be fixed with hot water pipe insulation)	Service hot water systems
R403.5.2	Hot water pipe insulation
R403.6	Mechanical ventilation
R403.7, except Section R403.7.1	Equipment sizing and efficiency rating
R403.8	Systems serving multiple dwelling units
R403.9	Snow melt and ice system controls
R403.11	Energy consumption of pools and spas
R403.12	Portable spas
R403.13	Residential pools and permanent residential spas
Electrical Power and Lighting Systems	
R404.1	Lighting equipment
R404.2	Interior lighting controls
R404.5	Electric readiness
R404.6	Renewable energy infrastructure
R404.7	Electric Vehicle power transfer infrastructure

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

R406.3 Building thermal envelope. The proposed total *building thermal envelope*~~building thermal envelope~~ UA, which is sum of *U*-factor times assembly area, shall be less than or equal to the *building thermal envelope*~~building thermal envelope~~ UA using the prescriptive *U*-factors from Table R402.1.2 multiplied by 1.08 in Climate Zones 0, 1, and 2, and by 1.15 in Climates Zones 3 through 8, in accordance with Equation 4-3. The area-weighted maximum fenestration SHGC permitted in Climate Zones 0 through 3 shall be 0.30.

(Equation 4-3)

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

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

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 reference design and/or the rated home.
6. A certificate indicating that the proposed design has an ERI less than or equal to the appropriate score indicated in Table R406.5 when compared to the ERI reference design. The certificate shall document the building component energy specifications that are included in the calculation, including: component level insulation *R*-values or *U*-factors; assumed duct system and *building thermal envelope*~~building envelope~~ air leakage testing results; and the type and rated efficiencies of proposed heating, cooling, mechanical ventilation, and service water-heating equipment to be installed. If on-site renewable energy systems will be installed, the certificate shall report the type and production size of the proposed system.
7. When a site-specific report is not generated, the proposed design shall be based on the worst-case orientation and configuration of the rated home.

R406.7.2.2 Confirmed compliance report for a certificate of occupancy. A confirmed compliance report submitted for obtaining the certificate of occupancy shall be made site and address specific and include the following:

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

R408.2.1 Enhanced building thermal envelope options. The *building thermal envelope* shall meet the requirements of the following:

1. Section R408.2.1.1 or R408.2.1.2.
2. Section R408.2.1.3.

R408.2.1.1 Enhanced building thermal envelope performance UA. The proposed total *building thermal envelope*~~building thermal envelope~~ UA shall be calculated in accordance with Section R402.1.5 and shall meet one of the following:

1. Not less than 2.5 percent of the total UA of the *building thermal envelope*.
2. Not less than 5 percent of the total UA of the *building thermal envelope*.
3. Not less than 7.5 percent of the total UA of the *building thermal envelope*.

R502.2.1 Building thermal envelope. New *building thermal envelope*~~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.

Exception: New *building thermal envelope*~~envelope~~ assemblies are exempt from the requirements of Section R402.5.1.2.

R503.1.1 Building thermal envelope. Alterations of existing *building thermal envelope*~~building thermal envelope~~ assemblies shall comply with this section. New *building thermal envelope* ~~Building building thermal envelope~~ assemblies that are part of the *alteration* shall comply with Section R402. In no case shall the R-value of insulation be reduced or the U-factor of a *building thermal envelope*~~building thermal envelope~~ assembly be increased as part of a *building thermal envelope*~~building thermal envelope~~ alteration.

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. Roof recover.
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. An existing building undergoing alterations that is demonstrated to be in compliance with Section R405 or Section R406

R503.1.1.4 Floor alterations. Where an alteration to a floor or floor overhang exposes cavities or surfaces to which insulation can be applied and the floor or floor overhang is part of the *building thermal envelope*~~building thermal envelope~~, the floor or floor overhang shall be brought into compliance with Section R402.1 or an approved design. This requirement shall apply to floor alterations where the floor cavities or surfaces are exposed and accessible prior to construction.

R503.1.1.6 Air barrier. *Building thermal envelope*~~Building thermal envelope~~ assemblies altered in accordance with Section R503.1.1 shall be provided with an air barrier in accordance with Section R402.5. The air barrier shall not be required to be made continuous with unaltered portions of the *building thermal envelope*~~building thermal envelope~~. Testing requirements of Section R402.5.1.2 shall not be required.Content

R503.1.5 Additional Efficiency Packages. Alterations shall comply with Section R506 where the alteration contains replacement of two or more of the following:

1. HVAC unitary systems or HVAC central heating or cooling equipment serving the *work area* of the *alteration*.
2. Water heating equipment serving the *work area* of the *alteration*.
3. 50 percent or more of the lighting fixtures in the *work area* of the *alteration*.
4. 50 percent or more of the area of interior surfaces of the *building thermal envelope*~~thermal envelope~~ in the *work area* of the *alteration*.
5. 50 percent or more the area of the building's *exterior wall envelope*.

Exceptions:

1. *Alterations* that are permitted with an *addition* complying with Section R502.3.5.
2. *Alterations* that comply with Section R405 or R406.

R506.1 General. Where required in Section R502 or R503, the building shall comply with one or more additional efficiency package options in accordance with the following:

1. Enhanced *building thermal envelope*~~envelope~~ performance in accordance with Section R408.2.1.
2. More efficient HVAC equipment performance in accordance with Section R408.2.2.
3. Reduced energy use in service water-heating in accordance with Section R408.2.3.
4. More efficient duct thermal distribution system in accordance with Section R408.2.4.
5. Improved air sealing and efficient ventilation system in accordance with Section R408.2.5.

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Revise as follows:

N1101.4 Above code programs. The *code official* or other authority having *jurisdiction* 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. The requirements identified in Table N1105.2andthe proposed total *building thermal envelope UA, which is the sum of U-factor times assembly area, shall be less* than or equal to the *building thermal envelope*~~building thermal envelope~~ UA using the prescriptive U-factors from Table N1102.1.2 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.

$$\underline{UA_{\text{Proposed design}} \leq 1.15 \text{ x } UA_{\text{Prescriptive reference design}}}$$

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*~~envelope~~.

N1101.14 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*, c*rawl 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*~~building 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*~~building 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 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 N1106, 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 N1108.
8. Where a solar-ready zone is provided, the certificate shall indicate the location, and dimensions.

N1102.1.5 Component performance alternative. Where the proposed total *building thermal envelope* thermal conductance is less than or equal to the required total *building thermal envelope* ~~building thermal envelope~~ conductance using factors in Table N1102.1.2 the *building* shall be considered to be incompliance with Table N1102.1.2. The total thermal conductance shall be determined in accordance with Equation 11-5. Proposed U-factors and slab-on-grade F-factors shall be taken from 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. In addition to total thermal conductance compliance, the SHGC requirements of Table N1102.1.2 and the maximum fenestration *U*-factors of Section N1102.6 shall be met.

$$(\text{Up A} + \text{F P}) \leq (\text{Ur A} + \text{Fr P}) \qquad \textbf{(Equation 11-5)}$$

Up A = the sum of proposed U-factors times the assembly areas in the proposed building.
Fp P = the sum of proposed F-factors times the slab-on-grade perimeter lengths in the proposed building.
Ur A = the sum of U-factors in Table N1102.1.2 times the same assembly areas as in the proposed building.
Fr P = the sum of F-factors in Table N1102.1.2 times the same slab-on-grade perimeter lengths as in the proposed building.

N1102.2.7 Steel-frame ceilings, walls, and floors. Steel-frame ceilings, walls, and floors shall comply with the *U*-factor requirements of Table N1102.1.2. The calculation of the *U*-factor for a steel- framed ceilings and walls in ~~an~~ *building thermal envelope*~~envelope~~ assembly shall be determined in accordance with AISI S250 as modified herein.

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 the AISI S250 shall be used without any modifications.
4. Where the steel-framed wall contains other than standard C-shape framing members the AISI S250 calculation option for other than standard C-shape framing is permitted to be used.

N1102.2.9 Basement walls. *Basement walls* shall be insulated in accordance with Table N1102.1.3.

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 N1102.1.3 and applicable provisions of Sections N1102.2 and N1102.2.8.
2. There are no uninsulated duct, domestic hot water 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 N1102.1.3 and applicable provisions of Section N1102.2.
5. The door(s) leading to the basement from conditioned spaces are insulated in accordance with Section N1102.1.3 and applicable provisions of Section N1102.2, and weatherstripped in accordance with Section N1102.5.
6. The <u>*building thermal envelope*</u>~~building thermal envelope~~ separating the basement from adjacent conditioned spaces complies with Section N1102.5.

N1102.4.5 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 *sunroom s* and heated garages with *thermal isolation* and enclosing *conditioned spac e*, 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 garages with thermal isolation from conditioned space shall comply with the <u>*building thermal envelope*</u> ~~building thermal envelope~~ requirements of this code.

TABLE N1102.5.1.1 AIR BARRIER, AIR SEALING AND INSULATION INSTALLATION[a]

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
General requirements	A continuous air barrier shall be installed in the *building thermal envelope*~~building envelope~~. Breaks or joints in the air barrier shall be sealed.	Air-permeable insulation shall not be used as a sealing material.
Ceiling/attic	A sealed air barrier shall be installed in any dropped ceiling or soffit to separate it from unconditioned space . Access openings, drop-down stairs or knee wall doors to unconditioned attic spaces shall be air 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. Access hatches and doors shall be installed and insulated in accordance with Section N1102.2.5 Eave Baffles shall be installed in accordance with Section N1102.2.4.
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 *building thermal envelope*~~thermal envelope~~ insulation for framed walls shall be installed in substantial contact and continuous alignment with the air barrier.
Windows, skylights and doors	The space between framing and skylights, and the jambs of windows and doors, shall be sealed.	Framing cavities around windows, skylights and doors shall be completely filled with insulation or insulated per window manufacturer's instructions.
Rim joists	Rim joists shall include an air barrier. 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.[b]
Floors, including cantilevered floors and floors above garages	The air barrier shall be installed at any exposed edge of insulation.	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.
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 N1102.2.11. 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.	Crawl space insulation, where provided instead of floor insulation, shall be installed in accordance with Section N1102.2.11. Conditioned basement foundation wall insulation shall be installed in accordance with Section N1102.2.9.1. Slab-on-grade floor insulation shall be installed in accordance with Section N1102.2.11.
Shafts, penetrations	Duct and flue shafts and other similar penetrations 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*~~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 N1101.10–N1101.12 and N1102.2.8.
Recessed lighting	Recessed light fixtures installed in the *building thermal envelope*~~building thermal envelope~~ shall be air sealed in accordance with Section N1102.5.5.	Recessed light fixtures installed in the *building thermal envelope*~~building thermal envelope~~ shall be airtight and IC rated, and shall be buried 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	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

	air sealed.	to the exterior side of the obstructions.
Showers, tubs, and fireplaces adjacent to the *building thermal envelope*~~building thermal envelope~~	An air barrier shall separate insulation in the *building thermal envelope* from the shower, tub, and fireplace assemblies.	Exterior framed walls adjacent to showers, tubs and fireplaces shall be insulated.
Electrical,communication, and other equipment boxes, housings, and enclosures	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. The continuity of the air barrier shall be maintained around boxes, housings, and enclosures that penetrate the air barrier. Alternatively, air-sealed boxes shall be installed in accordance with N1102.5.6.	Boxes, housing, and enclosures shall be burried in or surrounded by insulation.
HVAC register boots	HVAC supply and return register boots that penetrate *building thermal envelope*~~building thermal envelope~~ shall be sealed to the subfloor, wall covering or ceiling penetrated by the boot.	HVAC supply and return register boots located in the *building thermal envelope*~~building's thermal envelope~~ shall be buried and 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	Air sealing materials recognized in a listed fire-resistance rated common wall or double wall design and installed in accordance with the listing, or air sealing materials recognized in an approved design, shall be used. Common walls or double walls shall be considered an exterior wall for the purposes of air barrier and air sealing application of this Table.	Insulation materials recognized in the listed common wall or double-wall design and installed in accordance with the listing, or insulation materials recognized in the approved design, shall be used.

For SI: 1 inch = 25.4 mm.

a. Inspection of log walls shall be in accordance with the provisions of ICC 400.

b. Insulation full enclosure is not required in unconditioned/ventilated attic spaces and at rim joists.

N1102.5.1.2 Testing and maximum air leakage rate. The *building* or each *dwelling 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 4.0 air changes per hour or 0.22 cfm/ft^2 (1.1 L/s x m^2) of building or dwelling unit enclosure area. Testing shall be conducted in accordance with ANSI/RESNET/ICC 380, ASTM E779, ASTM E1827 or ASTM E3158 and reported at a pressure differential of 0.2 inch water gauge (50 Pa). 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.

Exceptions:

1. When testing individual dwelling units, an air leakage rate not exceeding 0.27 cubic feet per minute per square foot [1.35 L/s x m^2] 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 water gauge (50 Pa), shall be permitted in all climate zones for:

   1.1 Attached single and multiple family building dwelling units.

   1.2 Buildings or dwelling units that are 1,500 square feet (139.4 m^2) or smaller.

2. 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*~~building envelope~~ tightness and insulation installation shall be considered acceptable where the items in Table N1102.5.1.1, 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 conditioned spaces in accordance with Sections N1102.2.13 and N1102.4.5, as applicable.
3. Where tested in accordance with N1102.5.1.2, testing of each dwelling unit is not required.

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.

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

N1102.5.4 Rooms containing fuel-burning appliances. In Climate Zones 3 through 8, where opencombustion airducts provide combustion air to open combustion fuel-burning appliances, the appliances and combustion air opening shall be located outside the *building thermal envelope* or enclosed in a room that is isolated from inside the *building thermal envelope*~~thermal envelope~~. Such rooms shall be sealed and insulated in accordance with the *building thermal envelope*~~envelope~~ requirements of Table N1102.1.3, where the walls, floors and ceilings shall meet a minimum of the *basement wall R*-value requirement. The door into the room shall be fully gasketed and any water lines and ducts in the room insulated in accordance with Section N1103. The combustion air duct shall be insulated where it passes through *conditioned space* to an *R*-value of not less than R-8.

Exceptions:

1. Direct vent appliances with both intake and exhaust pipes installed continuous to the outside.
2. Fireplaces and stoves complying with Sections N1102.5.2 and R1006.

N1102.5.6 Air-sealed electrical and communication outlet boxes. Air-sealed electrical and communication outlet boxes that penetrate the air barrier of the *building thermal envelope*~~building thermal envelope~~ shall be caulked, taped, gasketed, or otherwise sealed to the air barrier element being penetrated . Air-sealed boxes shall buried in or surrounded by insulation. Air-sealed boxes shall be tested and marked in accordance with NEMA OS 4. Air-sealed boxes shall be installed in accordance with the manufacturer's instructions .

N1105.2 Simulated performance based compliance. Compliance based on simulated building performance requires that a *proposed design* meets all of the following:

1. The requirements of the sections indicated within Table N1105.2.
2. The proposed total *building thermal envelope*~~building thermal envelope~~ UA, which is the sum of the U-factor times assembly area, shall be less than or equal to the *building thermal envelope*~~building thermal envelope~~ UA using the prescriptive U-factors from Table N1102.1.2 multiplied by 1.08 in Climate Zones 0, 1 and 2, and 1.15 in Climates Zones 3 through 8, in accordance with Equation 11-6. The area-weighted maximum fenestration SHGC permitted in Climate Zones 0 through 3 shall be 0.30.

(Equation 11-6)

$$\text{For Climate Zones 0-2: } UA_{\text{Proposed design}} \leq 1.08 \text{ x } UA_{\text{Prescriptive reference design}}$$

$$\text{For Climate Zones 3-8: } UA_{\text{Proposed design}} \leq 1.15\text{x } UA_{\text{Prescriptive reference design}}$$

3. For buildings without a fuel burning appliance for space heating or water heating, the annual energy cost of the proposed design that is less than or equal to 85 percent of the annual energy cost of the *standard reference design*. For buildings with a fuel burning appliance for space heating or water heating, the annual energy cost of the proposed design that is less than or equal to 80 percent of the annual energy cost of the standard reference design. For dwelling units with greater than 5,000 square feet (465 m^2) of living space floor area located above grade plane, the annual energy cost of the proposed design shall be reduced by an additional 5 percent of annual energy cost of the standard reference design.

   Energy prices shall be taken from a source *approved* by the *code official*, such as the Department of Energy, 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. The source energy multipliers for all energy sources shall be obtained from ASHRAE Standard 105 (Tables K2, K4, or K8) or from another data source approved by the code official.
   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 for an all-electric building with on-site renewable energy installed.

N1105.3.2.1 Compliance report for permit application. A compliance report submitted 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 the software used to produce the results for the reference design and/or the rated home.
5. A certificate indicating that the proposed design complies with Section N1105.3. 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*~~building 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 on-site renewable energy systems will be installed, the certificate shall report the type and production size of the proposed system.
6. 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.

N1105.3.2.2 Compliance report for certificate of occupancy. A compliance report submitted for obtaining the certificate of occupancy shall include the following:

1. Building street address, or other building site identification.
2. Declaration of the 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 N1105.3.
4. The name and version of the compliance software tool.
5. A site-specific energy analysis report that is in compliance with Section N1105.3.
6. A final confirmed certificate indicating compliance based on inspection, and a statement indicating that the confirmed rated design of the built home complies with Section N1105.3. The certificate shall report the energy features that were confirmed to be in the home, including component-level insulation *R*-values or *U*-factors; results from any required duct system and *building thermal envelope*~~building envelope~~ air leakage testing; and the type and rated efficiencies of the heating, cooling, mechanical ventilation and service water heating equipment installed.
7. Where on-site renewable energy systems have been installed, the certificate shall report the type and production size of the installed system.

TABLE N1105.4.2(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 Table N1102.1.2.	As proposed
	Solar absorptance = 0.75.	As proposed
	Emittance = 0.90.	As proposed
Basement and crawl space walls	Type: same as proposed.	As proposed
	Gross area: same as proposed.	As proposed
	U-factor: as specified in Table N1102.1.2, with the insulation layer on the interior side of the walls.	As proposed
Above-grade floors	Type: wood frame.	As proposed
	Gross area: same as proposed.	As proposed
	U-factor: as specified in Table N1102.1.2.	As proposed
Ceilings	Type: wood frame.	As proposed
	Gross area: same as proposed.	As proposed
	U-factor: as specified in Table N1102.1.2.	As proposed
Roofs	Type: composition shingle on wood sheathing.	As proposed
	Gross area: same as proposed.	As proposed
	Solar absorptance = 0.75.	As proposed
	Emittance = 0.90.	As proposed
Attics	Type: vented with an aperture of 1 ft^2 per 300 ft^2 of ceiling area.	As proposed
Foundations	Type: same as proposed.	As proposed
	Foundation wall area above and below grade and soil characteristics: same as proposed.	As proposed
Opaque doors	Area: 40 ft^2.	As proposed
	Orientation: North.	As proposed
	U-factor: same as fenestration as specified in Table N1102.1.2.	As proposed
Vertical fenestration other than opaque doors	Total area[h] = (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 Table N1102.1.2.	As proposed
	SHGC: as specified in Table N1102.1.2 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 × SHGC for the standard reference design).	Interior shade fraction: 0.92 – (0.21 × SHGC as proposed)
	External shading: none	As proposed
Skylights	None	As proposed
Thermally isolated sunrooms	None	As proposed
	The air leakage rate at a pressure of 0.2 inch w.g. (50 Pa) shall be Climate Zones 0 through 2: air changes per hour. Climate Zones 3, 4, and 5: 3.0 air changes per hour. Climate Zones 6 through 8: 2.5 air changes per hour.	The measured air exchange rate.[a]

Air exchange rate	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 thanB x M where:B = 0.01 × CFA + 7.5 × (Nbr + 1), cfm. M = 1.0 where the measured air exchange rate is ≥ 3.0 air changes per hour at 50 Pascals, and otherwise, M = minimum (1.7, Q/B) Q = the proposed mechanical ventilation rate, cfm. CFA = conditioned floor area, ft2. Nbr = number of bedrooms.The mechanical ventilation system type shall be the same as in the proposed design. Heat recovery or energy recovery shall be modeled assumed for mechanical ventilation where required by Section N1103.6.1. Heat recovery or energy recovery shall not be modeled for mechanical ventilation where not required by Section N1103.6.1..	The mechanical ventilation rate[b] ,Q, shall be in addition to the air leakage rate and shall be as proposed.
Mechanical ventilation	Where mechanical ventilation is not specified in the proposed design: None Where mechanical ventilation is specified in the proposed design, the annual vent fan energy use, in units of kWh/yr, shall equal (8.76 x B x M)/ef where: e_f = the minimum fan efficacy, as specified in Table N1103.6.2, corresponding to the system type at a flow rate of B x M CFA = conditioned floor area, ft^2. N_{br} = number of bedrooms.	As proposed
Internal gains	IGain, in units of Btu/day per dwelling unit, shall equal 17,900 + 23.8 ×CFA + 4,104 × N_{br} where: CFA = conditioned floor area, ft^2. N_{br} = number of bedrooms.	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[c] but not integral to the *building thermal envelope*~~building 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 Table N1102.1.3, 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[d, e, j, k]	For other than electric heating without a heat pump: as proposed. 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 Section N1103.7.	As proposed
	Fuel Type/Capacity: Same as proposed design	As proposed
	Product class: Same as proposed design	As proposed
	Efficiencies:	As proposed
	Heat pump: Complying with 10 CFR §430.32	As proposed
	Non-electric furnaces: Complying with 10 CFR §430.32	As proposed
	Non-electric boilers: Complying with 10 CFR §430.32	As proposed
Cooling systems[d, f, k]	As proposed. Capacity: sized in accordance with Section N1103.7.	
	Fuel Type: Electric Capacity: Same as proposed design	As proposed
	Efficiencies: Complying with 10 CFR §430.32	As proposed

<table>
<tr>
<td rowspan="6">Service water heating[d, g, k]</td>
<td>As proposed.
Use, in units of gal/day = 25.5 + (8.5 × N_{br})
where: N_{br} = number of bedrooms.</td>
<td>As proposed
Use, in units of gal/day = 25.5 + (8.5 × N_{br}) × (1 – $HWDS$)
where:
N_{br} = number of bedrooms.
$HWDS$ = factor for the compactness of the hot water distribution system.
<table>
<tr><th colspan="2">Compactness ratio[i] factor</th><th>HWDS</th></tr>
<tr><td>1 story</td><td>2 or more stories</td><td></td></tr>
<tr><td>> 60%</td><td>> 30%</td><td>0</td></tr>
<tr><td>> 30% to ≤ 60%</td><td>> 15% to ≤ 30%</td><td>0.05</td></tr>
<tr><td>> 15% to ≤ 30%</td><td>> 7.5% to ≤ 15%</td><td>0.10</td></tr>
<tr><td>< 15%</td><td>< 7.5%</td><td>0.15</td></tr>
</table></td>
</tr>
<tr><td>Fuel Type: Same as proposed design</td><td>As proposed</td></tr>
<tr><td>Rated Storage Volume: Same as proposed design</td><td>As proposed</td></tr>
<tr><td>Draw Pattern: Same as proposed design</td><td>As proposed</td></tr>
<tr><td>Efficiencies: Uniform Energy Factor complying with 10 CFR §430.32</td><td>As proposed</td></tr>
<tr><td>Tank Temperature: 120° F (48.9° C)</td><td>Same as standard reference design</td></tr>
<tr>
<td rowspan="4">Thermal distribution systems</td>
<td>Duct insulation: in accordance with Section N1103.3.2.</td>
<td>Duct insulation: as proposed</td>
</tr>
<tr>
<td>Duct location:
<table>
<tr><td>Foundation type</td><td>Slab on grade</td><td>Unconditioned crawl space</td><td>Basement or conditioned crawl space</td></tr>
<tr><td>Duct location (supply and return)</td><td>One-story building: 100% in unconditioned attic

All other:
75% in unconditioned attic and 25% inside conditioned space</td><td>One-story building: 100% in unconditioned attic

All other:
75% in unconditioned attic and 25% inside conditioned space</td><td>50% inside conditioned space

50% unconditioned attic</td></tr>
</table></td>
<td>Duct location: as proposed</td>
</tr>
<tr>
<td>Duct system leakage to outside: For duct systems serving > 1,000ft2 of conditioned floor area, the duct leakage to outside rate shall be 4 cfm (113.3 L/min) per 100 ft2 (9.29 m2) of conditioned floor area.
For duct systems serving ≤ 1,000ft2 of conditioned floor area, the duct leakage to outside rate shall be 40 cfm (1132.7 L/min).</td>
<td>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.
Exceptions:
<table>
<tr><td>1.</td><td>When duct system leakage to outside is tested in accordance ANSI/RESNET/ICC 380 or ASTM E1554, the measured value shall be permitted to be entered.</td></tr>
<tr><td>2.</td><td>When total duct system leakage is measured without the air handler installed, the simulation value shall be 4 cfm (113.3 L/min) per 100 ft^2(9.29 m^2) of conditioned floor area.</td></tr>
</table></td>
</tr>
<tr>
<td>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.</td>
<td>For hydronic systems and ductless systems, DSE shall be as specified in Table N1105.4.2(2).</td>
</tr>
<tr>
<td>Thermostat</td>
<td>Type: Manual, cooling temperature setpoint = 75°F;
Heating temperature setpoint = 72°F.</td>
<td>Same as standard reference design.</td>
</tr>
<tr>
<td>Dehumidistat</td>
<td>Where a mechanical ventilation system with latent heat recovery is not specified in the proposed design: None. Where the proposed design utilizes a mechanical ventilation system with latent heat recovery: Dehumidistat type: manual, setpoint = 60% relative humidity. Dehumidifier: whole-dwelling with integrated energy factor = 1.77 liters/kWh.</td>
<td>Same as standard reference design.</td>
</tr>
</table>

For SI: 1 square foot = 0.93 m^2, 1 British thermal unit = 1055 J, 1 pound per square foot = 4.88 kg/m^2, 1 gallon (US) = 3.785 L, °C = (°F – 32)/1.8, 1 degree = 0.79 rad.

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.

g. For a proposed design the following assumptions shall be made for both the proposed design and standard reference design.

   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 §130.32

h. For residences with conditioned basements, R-2 and R-4 residences, and for townhouse units, 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.

i. 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 Table N1105.4.2(1), the standard reference design shall be the same as proposed design.

TABLE N1106.2 REQUIREMENTS FOR ENERGY RATING INDEX

SECTION[a]	TITLE
General	
N1101.14	Certificate
Building Thermal Envelope	
N1102.1.1	Vapor retarder
N1102.2.4	Eave baffle
N1102.2.5.1	Access hatches and doors
N1102.2.9	Basement walls
N1102.2.9.1	Basement wall insulation installation
N1102.2.10.1	Slab-on-grade floor insulation installation
N1102.2.11.1	Crawl space wall insulation installation
N1102.5.1.1	Installation
N1102.5.1.2	Testing
N1102.5.2	Fireplaces
N1102.5.3	Fenestration air leakage
N1102.5.4	Rooms containing fuel burning appliances
N1102.5.5	Recessed lighting
N1102.5.6	Air sealed electrical and communication outlet boxes
N1106.3	*Building thermal envelope* ~~Building thermal envelope~~
Mechanical	
N1103.1	Controls
N1103.2	Hot Water boiler temperature reset
N1103.3 except	Duct systems
N1103.4	Mechanical system piping insulation
N1103.5 except Section N1103.5.2	Service hot water systems
N1103.5.2	Hot water pipe insulation
N1103.6	Mechanical ventilation
N1103.7, except Section N1103.7.1	Equipment sizing and efficiency rating
N1103.8	Systems serving multiple dwelling units
N1103.9	Snow melt and ice system controls
N1103.11	Energy consumption of pools and spas
N1103.12	Portable spas
N1103.13	Residential pools and permanent residential spas
Electrical Power and Lighting Systems	
N1104.1	Lighting equipment
N1104.2	Interior lighting controls
N1104.5	Electric readiness
N1104.6	Renewable energy infrastructure
N1104.7	Electric Vehicle power transfer infrastructure

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

N1106.3 Building thermal envelope. The proposed total *building thermal envelope*~~building thermal envelope~~ UA, which is sum of *U*-factor times assembly area, shall be less than or equal to the *building thermal envelope*~~building thermal envelope~~ UA using the prescriptive *U*-factors from Table N1102.1.2 multiplied by 1.08 in Climate Zones 0, 1, and 2, and by 1.15 in Climates Zones 3 through 8, in accordance with Equation 11-7 Equation 11-7. The area-weighted maximum fenestration SHGC permitted in Climate Zones 0 through 3 shall be 0.30.

(Equation 11-7)

$$\text{For Climate Zones 0-2: } UA_{\text{Proposed design}} \leq 1.08 \times UA_{\text{Prescriptive reference design}}$$
$$\text{For Climate Zones 3-8: } UA_{\text{Proposed design}} \leq 1.15\text{x } UA_{\text{Prescriptive reference design}}$$

N1106.7.2.1 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. Declaration of ERI on the title page and on the building plans.
3. The name of the individual performing the analysis and generating the compliance report.
4. The name and version of the compliance software tool.
5. Documentation of all inputs entered into the software used to produce the results for the reference design and/or the rated home.
6. A certificate indicating that the proposed design has an ERI less than or equal to the appropriate score indicated in Table N1106.5 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*~~building envelope~~ air leakage testing results; and the type and rated efficiencies of proposed heating, cooling, mechanical ventilation and service water-heating equipment to be installed. If on-site renewable energy systems will be installed, the certificate shall report the type and production size of the proposed system.
7. When a site-specific report is not generated, the proposed design shall be based on the worst-case orientation and configuration of the rated home.

N1106.7.2.2 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 the title page and on the building plans.
3. The name of the individual performing the analysis and generating the report.
4. The name and version of the compliance software tool.
5. Documentation of all inputs entered into the software used to produce the results for the reference design and/or the rated home.
6. A final confirmed certificate indicating that the confirmed rated design of the built home complies with Sections N1106.2 and N1106.4. The certificate shall report the energy features that were confirmed to be in the home, including: component-level insulation *R*-values or *U*-factors; results from any required duct system and *building thermal envelope*~~building envelope~~ air leakage testing; and the type and rated efficiencies of the heating, cooling, mechanical ventilation, and service water-heating equipment installed. Where on-site renewable energy systems have been installed on or in the home, the certificate shall report the type and production size of the installed system.

N1108.2.1 Enhanced building thermal envelope options. The *building thermal envelope* shall meet the following:

1. Section N1108.2.1.1 or N1108.2.1.2
2. Section N1108.2.1.3

N1108.2.1.1 Enhanced building thermal envelope performance UA. The proposed total *building thermal envelope*~~building thermal envelope~~ UA shall be calculated in accordance with Section N1102.1.5 and shall meet one of the following:

1. Not less than 2.5 percent of the total UA of the *building thermal envelope* ~~building thermal envelope~~.
2. Not less than 5 percent of the total UA of the *building thermal envelope* ~~building thermal envelope~~.
3. Not less than 7.5 percent of the total UA of the *building thermal envelope* ~~building thermal envelope~~.

N1108.2.4 More efficient duct thermal distribution system option. The thermal distribution system shall meet one of the following efficiencies:

1.	100 percent of ductless thermal distribution system or hydronic thermal distribution system located completely inside the *building thermal envelope* ~~building thermal envelope~~.

100 percent of duct thermal distribution system located in conditioned space as defined by Section N1103.3.3.

3.	When ducts are located outside conditioned space, the total leakage of the ducts, measured in accordance with N1103.3.5, shall be in accordance with one of the following: 3.1 Where air handler is installed at the time of testing, 2.0 cubic feet per minute (0.94 L/s) per 100 square feet ($9.29\ m^2$) of conditioned floor area. 3.2 Where air handler is not installed at the time of testing, 1.75 cubic feet per minute (0.83 L/s) per 100 square feet ($9.29\ m^2$) of conditioned floor area.

4. Duct systems designed so the individual room airflow shall be within ±20 percent of the design/application requirements for the supply and return ducts. This shall be demonstrated by using a duct airflow balancing procedure as specified by ANSI/ACCA 5 QI or by other approved methods.

N1110.2.1 Building thermal envelope. New *building thermal envelope*~~envelope~~ assemblies that are part of the *addition* shall comply with Sections N1102.1, N1102.2, N1102.4.1 through N1102.4.5, and N1102.5.

Exception: New *building thermal envelope*~~envelope~~ assemblies are exempt from the requirements of Section N1102.5.1.2.

N1111.1.1 Building thermal envelope. *Alterations* of existing *building thermal envelope* assemblies shall comply with this section. ~~*New*~~ New *building thermal envelope*~~building thermal envelope~~ assemblies that are part of the *alteration* shall comply with Section N1102. In no case shall the R-value of insulation be reduced or the U-factor of a *building thermal envelope*~~building thermal envelope~~ assembly be increased as part of a *building thermal envelope*~~building thermal envelope~~ alteration.

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. *Roof recover*.
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. In no case shall the R-value of insulation be reduced or the U-factor of a *building thermal envelope* ~~building thermal envelope~~ assembly be increased as part of a *building thermal envelope* ~~building thermal envelope~~ alteration.

N1111.1.1.4 Floor alterations. Where an alteration to a floor or floor overhang exposes cavities or surfaces to which insulation can be applied and the floor or floor overhang is part of the *building thermal envelope*~~building thermal envelope~~, the floor or floor overhang shall be brought into compliance with Section N1102.1 or an approved design. This requirement shall apply to floor alterations where the floor cavities or surfaces are exposed and accessible prior to construction.

N1111.1.1.6 Air barrier. *Building thermal envelope*~~Building thermal envelope~~ assemblies altered in accordance with Section N1111.1.1 shall be provided with an air barrier in accordance with Section N1102.4. The air barrier shall not be required to be made continuous with unaltered portions of the *building thermal envelope*~~building thermal envelope~~. Testing requirements of Section N1102.4.1.2 shall not be required.

N1111.1.5 Additional Efficiency Packages. Alterations shall comply with Section N1114 where the alteration contains replacement of two or more of the following:

1. HVAC unitary systems or HVAC central heating or cooling equipment serving the work area of the alteration.
2. Water heating equipment serving the work area of the alteration.
3. 50 percent or more of the lighting fixtures in the work area of the alteration.
4. 50 percent or more of the area of interior surfaces of the *building thermal envelope*~~thermal envelope~~ in the work area of the alteration.
5. 50 percent or more the area of the building's exterior wall envelope.

Exceptions:

1. Alterations that are permitted with an addition complying with Section N1110.3.5.
2. Alterations that comply with Section N1105 or N1106.

N1114.1 General. Where required in Section N1110 or N1111, the building shall comply with one or more additional efficiency package options in accordance with the following:

1. Enhanced *building thermal envelope*~~envelope~~ performance in accordance with Section N1108.2.1.
2. More efficient HVAC equipment performance in accordance with Section N1108.2.2.
3. Reduced energy use in service water-heating in accordance with Section N1108.2.3.
4. More efficient duct thermal distribution system in accordance with Section N1108.2.4.
5. Improved air sealing and efficient ventilation system in accordance with Section N1108.2.5.

Reason: "Building thermal envelope" is a defined term in the IECC, but "building envelope" and "thermal envelope" are not defined. This comment attempts to standardize terminology throughout the residential provisions by replacing instances of "building envelope," "thermal envelope," and "envelope" with the defined term "building thermal envelope."
This replacement is made thirteen times for "building envelope," three times for "thermal envelope," and six times for "envelope" within both the IECC residential provisions and IRC Chapter 11 of the 1st Public Comment Draft. In addition, there are twenty-four cases in the IECC residential provisions and twenty-nine cases in IRC Chapter 11 where "building thermal envelope" is proposed to be italicized. It is understood that the decision to italicize rests with ICC staff, but identification of these instances is offered to assist staff and because they illustrate the potential for confusion that may arise on this topic when the defined term is not explicitly triggered via italicization.

If there are technically valid reasons to retain existing terminology in specific situations, please consider amending this comment for those sections, as necessary.

Companion comment CED1-92-22 offers similar changes for the commercial provisions to ensure consistency throughout the entire IECC.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This comment is intended solely to clarify terminology without any technical impact. There should be no impact on cost of construction.

Workgroup Recommendation

Proposal # 964

RED1-186-22

Proponents: Gayathri Vijayakumar, representing Steven Winter Associates, Inc. (gvijayakumar@swinter.com)

2024 International Energy Conservation Code [RE Project]

SECTION R102
ALTERNATIVE MATERIALS, DESIGN AND METHODS OF CONSTRUCTION AND EQUIPMENT

Revise as follows:

R102.1.1 Above code programs. The *code official* or other authority having jurisdiction 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* <u>thermal conductance *TC*</u>~~UA, which is the sum of U-factor times assembly area,~~ shall be less than or equal to the <u>total</u> *building thermal envelope* <u>thermal conductance TC</u> ~~UA~~ using the prescriptive U-factors<u> and F-factors</u> from Table R402.1.2 multiplied by 1.08 in Climate Zones 0, 1, 2, and by 1.15 in Climate Zones 3 through 8, in accordance with Equation 4-1. The area-weighted maximum fenestration SHGC permitted in Climate Zones 0 through 3 shall be 0.30.

For Climate Zones 0-2: <u>TC</u>~~UA~~$_{\text{Proposed design}}$ ≤ 1.08 x <u>TC</u>~~UA~~$_{\text{Prescriptive reference design}}$ **(Equation 4-1)**

For Climate Zones 3-8: <u>TC</u>~~UA~~$_{\text{Proposed design}}$ ≤ 1.15 x <u>TC</u>~~UA~~$_{\text{Prescriptive reference design}}$ **(Equation 4-1)**

SECTION R402
BUILDING THERMAL ENVELOPE

Revise as follows:

R402.1.5 Component performance alternative. Where the proposed total *building thermal envelope* thermal conductance <u>TC_p</u> is less than or equal to the required total *building thermal envelope* <u>thermal</u> conductance <u>TC_r</u> using factors in Table R402.1.2<u>,</u> the *building* shall be considered to be in compliance with Table R402.1.2. The total thermal conductance <u>TC</u> shall be determined in accordance with Equation 4-1. Proposed *U*-factors and slab-on-grade *F*-factors shall be taken from 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. In addition to total thermal conductance <u>TC</u> compliance, the SHGC requirements of Table R402.1.2 and the maximum fenestration *U*-factors of Section R402.6 shall be met.

Equation 4-1

$$(\text{Up A} + \text{Fp P}) \leq (\text{Ur A} + \text{Fr P})$$

<u>$TC_p \leq TC_r$</u>
<u>where:</u>
<u>$TC_p = U_p A + F_p P$</u>

<u>$TC_r = U_r A + F_r P$</u>
U_p A = the sum of proposed *U*-factors times the assembly areas in the proposed building.

F_p P = the sum of proposed *F*-factors times the slab-on-grade perimeter lengths in the proposed building.
U_r A = the sum of *U*-factors in Table R402.1.2 times the same assembly areas as in the proposed building.
F_r P = the sum of *F*-factors in Table R402.1.2 times the same slab-on-grade perimeter lengths as in the proposed building.

R402.2.1 Ceilings with attics. 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 <u>Component performance</u>~~Total UA~~ 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^2) or 20 percent of the total insulated ceiling area, whichever is less. This reduction shall not apply to the <u>Component performance</u>~~Total UA~~ alternative in Section R402.1.5.

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^2).

   2.4. The perimeter of the hatch edge shall be weatherstripped.

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

R402.4.3 Glazed fenestration exemption. Not greater than 15 square feet (1.4 m^2) 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 Component performance~~Total UA~~ alternative in Section R402.1.5.

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

SECTION R405
SIMULATED BUILDING PERFORMANCE

Revise as follows:

R405.2 Simulated performance compliance. Compliance based on total building performance requires that a *proposed design* meets all of the following:

1. The requirements of the sections indicated within Table R405.2.
2. The proposed total *building thermal envelope* thermal conductance TC ~~UA, which is the sum of the U-factor times assembly area,~~ shall be less than or equal to the *building thermal envelope* thermal conductance TC~~UA~~ 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 R402.1.5. The area-weighted maximum fenestration SHGC permitted in Climate Zones 0 through 3 shall be 0.30.

   For Climate Zones 0-2: $TC\cancel{UA}_{\text{Proposed Design}} \leq 1.08 \times TC\cancel{UA}_{\text{Prescriptive reference design}}$ **(Equation 4-2)**

   For Climate Zones 3-8: $TC\cancel{UA}_{\text{Proposed Design}} \leq 1.15 \times TC\cancel{UA}_{\text{Prescriptive reference design}}$ **(Equation 4-2)**

3. For buildings without a fuel burning appliance for space heating or water heating, the annual energy cost of the proposed design that is less than or equal to 85 percent of the annual energy cost of the *standard reference design*. For buildings with a fuel burning appliance for space heating or water heating, the annual energy cost of the proposed design that is less than or equal to 80 percent of the annual energy cost of the standard reference design. For dwelling units with greater than 5,000 square feet (465 m^2) of living space floor area located above grade plane, the annual energy cost of the proposed design shall be reduced by an additional 5 percent of annual energy cost of the standard reference design. Energy prices shall be taken from a source *approved* by the *code official*, such as the Department of Energy, 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 multipliers for all energy sources shall be obtained from ASHRAE Standard 105 (Tables K2, K4, or K8) or from another data source approved by the *code official*.
   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 for an all-electric building with on-site renewable energy installed.

SECTION R406
ENERGY RATING INDEX COMPLIANCE ALTERNATIVE

Revise as follows:

R406.3 Building thermal envelope. The proposed total *building thermal envelope* thermal conductance TC~~UA, which is sum of *U*-factor times assembly area,~~ shall be less than or equal to the *building thermal envelope* thermal conductance TC ~~UA~~ 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 Climates Zones 3 through 8, in accordance with Equation 4-3 and R402.1.5. The area-weighted maximum fenestration SHGC permitted in Climate Zones 0 through 3 shall be 0.30.

For Climate Zones 0-2: $TC\cancel{UA}_{\text{Proposed design}} \leq 1.08 \times TC\cancel{UA}_{\text{Prescriptive reference design}}$ **(Equation 4-3)**

For Climate Zones 3-8: $TC\cancel{UA}_{\text{Proposed design}} \leq 1.15 \times TC\cancel{UA}_{\text{Prescriptive reference design}}$ **(Equation 4-3)**

SECTION R408
ADDITIONAL EFFICIENCY REQUIREMENTS

R408.2 Additional energy efficiency credit requirements . Two of the additional measures shall be selected from Table R408.2 that meet or exceed a total of ten credits. Five additional credits shall be selected for dwelling units with greater than 5,000 square feet (465 m^2) of living space floor area located above grade plane. Each measure selected shall meet the relevant subsections of Section R408 and receive credit as specified in Table R408.2 for the specific Climate Zone. Interpolation of credits between measures shall not be permitted.

Revise as follows:

TABLE R408.2 CREDITS FOR ADDITIONAL ENERGY EFFICIENCY

Portions of table not shown remain unchanged.

Measure Number	Measure Description	Credit Value								
		Climate Zone 0 & 1	Climate Zone 2	Climate Zone 3	Climate Zone 4	Climate Zone 4C	Climate Zone 5	Climate Zone 6	Climate Zone 7	Climate Zone 8
R408.2.1.1(1)	≥2.5% Reduction in total TC~~UA~~	0	0	0	1	1	1	1	1	1
R408.2.1.1(2)	≥5% reduction in total TC~~UA~~	0	1	1	2	2	3	3	3	3
R408.2.1.1(3)	>7.5% reduction in total TC~~UA~~	0	1	2	2	2	3	3	4	4

R408.2.1.1 Enhanced envelope performance ~~UA~~. The proposed total *building thermal envelope* thermal conductance TC~~UA~~ shall be calculated in accordance with Section R402.1.5 and shall meet one of the following:

1. Not less than 2.5 percent of the total TC~~UA~~ of the *building thermal envelope*.
2. Not less than 5 percent of the total TC~~UA~~ of the *building thermal envelope*.
3. Not less than 7.5 percent of the total TC~~UA~~ of the *building thermal envelope*.

Reason: The Committee approved REPI-26, a DOE proposal, to replace 'total UA' alternative with 'Component performance' alternative but other sections still rely on and reference “UA”. This public comment updates uses of “UA” with “TC” for thermal conductance, the term being used in R402.1.5.

Other solutions to address this problem will likely be submitted and all these public comments should be assigned to an Envelope SC working group to identify the best solution.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.

None

Bibliography: None

Workgroup Recommendation

Proposal # 1157

RED1-187-22 Part I

Proponents: Christopher McWhite, representing Region VI (cmcwhite@me.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

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 <u>intended purpose of the parking</u> of an automobile

Reason: The definition appears to be intended to relieve the Residential property Owner from incurring the expense of installing EV-ready, EV-Capable, or EVSE connections where such technology is not desired by the builder. Therefore the intent should be provided for in the definition. It would confuse a builder to provide an EV ready space where the location was not intentionally designed for parking of automobiles. The installation of a garage does not automatically mean an automobile is intended. An example would be the local Zoning allows for a detached structure that is 200 square feet or greater to be constructed but defines such structures as a garage. This would have the effect of forcing a builder to provide for the compliance with this section even though the intended use is not for the parking of automobiles.
This definition appears to be more appropriately placed within the body of the IZC, not the IECC.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
Clarifying the intent of an automobile parking space will have no impact on the cost of construction.

Bibliography: I am a career, 22 year Building Code Official who has served communities in five states from the Midwest, to the South, and now in New England. Through The Rhode Island Building Code Standards Committee, I am accepted as a certified Building Official; *R.I.G.L. Ch. 23-27.3 §107.5*. Through The International Code Council, I am exam certified as a Certified Building Official, Housing Code Official, Combination Residential Building Inspector, and a Residential and Commercial Plans Examiner. Through the State of Massachusetts I am a certified/licensed Inspector of Buildings/Building Commissioner. Currently I am working as the Department Head Building and Zoning Official in the Town of Smithfield Rhode Island. Here we are committed to our communities' development through partnerships with local and statewide organizations, institutions, and people who are dedicated and/or focused on the process of maintaining existing buildings and constructing new edifices with the goal of making an ever safer built community. I am committed to pursuing improved life safety in residential and commercial structures and the judicious enforcement of current building code and its referenced standards through effective leadership both within the builders and design community and with the professional staff I have the honor to lead. My personal goal is the building of a team of amicable, fair, ethical, and consistently equitable Officials utilizing State and Local building regulations while also judiciously incorporating relevant 28 CFR, ADA requirements. My role is also to communicate these goals with political bodies, large stakeholder investors in high profile projects, local community projects, and simple renovations with homeowners, without parity. I am also a decades-long member of the International Code Council, the non-profit agency that develops and publishes the building Codes. I've twice served as a selected committee member for code development on the national level and I am currently serving as an elected, Governing Board Member with one ICC Membership Council while chairing a subcommittee in another.

Workgroup Recommendation

Proposal # 1211

RED1-187-22 Part II

Proponents: Christopher McWhite, representing Region VI (cmcwhite@me.com)

2024 ENERGY Chapter11

Revise as follows:

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 intended purpose of the parking of an automobile.

Reason: The definition appears to be intended to relieve the Residential property Owner from incurring the expense of installing EV-ready, EV-Capable, or EVSE connections where such technology is not desired by the builder. Therefore the intent should be provided for in the definition. It would confuse a builder to provide an EV ready space where the location was not intentionally designed for parking of automobiles. The installation of a garage does not automatically mean an automobile is intended. An example would be the local Zoning allows for a detached structure that is 200 square feet or greater to be constructed but defines such structures as a garage. This would have the effect of forcing a builder to provide for the compliance with this section even though the intended use is not for the parking of vehicles.

Cost Impact: The code change proposal will decrease the cost of construction.
Approving this proposal will have the net effect of reducing costs by eliminating unintended construction costs.

Bibliography: I am a career, 22 year Building Code Official who has served communities in five states from the Midwest, to the South, and now in New England. Through The Rhode Island Building Code Standards Committee, I am accepted as a certified Building Official; *R.I.G.L. Ch. 23-27.3 §107.5*. Through The International Code Council, I am exam certified as a Certified Building Official, Housing Code Official, Combination Residential Building Inspector, and a Residential and Commercial Plans Examiner. Through the State of Massachusetts I am a certified/licensed Inspector of Buildings/Building Commissioner. Currently I am working as the Department Head Building and Zoning Official in the Town of Smithfield Rhode Island. Here we are committed to our communities' development through partnerships with local and statewide organizations, institutions, and people who are dedicated and/or focused on the process of maintaining existing buildings and constructing new edifices with the goal of making an ever safer built community. I am committed to pursuing improved life safety in residential and commercial structures and the judicious enforcement of current building code and its referenced standards through effective leadership both within the builders and design community and with the professional staff I have the honor to lead. My personal goal is the building of a team of amicable, fair, ethical, and consistently equitable Officials utilizing State and Local building regulations while also judiciously incorporating relevant 28 CFR, ADA requirements. My role is also to communicate these goals with political bodies, large stakeholder investors in high profile projects, local community projects, and simple renovations with homeowners, without parity. I am also a decades-long member of the International Code Council, the non-profit agency that develops and publishes the building Codes. I've twice served as a selected committee member for code development on the national level and I am currently serving as an elected, Governing Board Member with one ICC Membership Council while chairing a subcommittee in another.

Workgroup Recommendation

Proposal # 1220

RED1-188-22

Proponents: Christopher McWhite, representing Region VI (cmcwhite@me.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

EMITTANCE. The ratio of the radiant heat flux emitted by a specimen to that emitted ~~by a blackbody at the same temperature and~~ under the same conditions.

Reason: Unless there is an industry term that supports this, the inclusion of the language “black body” is inherently tone deaf and completely out of place in any ICC published Code with respect to black humans.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This proposal corrects what appears to be racially insensitive language and has no effect on the cost of construction

Bibliography: I am a career, 22 year Building Code Official who has served communities in five states from the Midwest, to the South, and now in New England. Through The Rhode Island Building Code Standards Committee, I am accepted as a certified Building Official; *R.I.G.L. Ch. 23-27.3 §107.5*. Through The International Code Council, I am exam certified as a Certified Building Official, Housing Code Official, Combination Residential Building Inspector, and a Residential and Commercial Plans Examiner. Through the State of Massachusetts I am a certified/licensed Inspector of Buildings/Building Commissioner. Currently I am working as the Department Head Building and Zoning Official in the Town of Smithfield Rhode Island. Here we are committed to our communities’ development through partnerships with local and statewide organizations, institutions, and people who are dedicated and/or focused on the process of maintaining existing buildings and constructing new edifices with the goal of making an ever safer built community. I am committed to pursuing improved life safety in residential and commercial structures and the judicious enforcement of current building code and its referenced standards through effective leadership both within the builders and design community and with the professional staff I have the honor to lead. My personal goal is the building of a team of amicable, fair, ethical, and consistently equitable Officials utilizing State and Local building regulations while also judiciously incorporating relevant 28 CFR, ADA requirements. My role is also to communicate these goals with political bodies, large stakeholder investors in high profile projects, local community projects, and simple renovations with homeowners, without parity. I am also a decades-long member of the International Code Council, the non-profit agency that develops and publishes the building Codes. I’ve twice served as a selected committee member for code development on the national level and I am currently serving as an elected, Governing Board Member with one ICC Membership Council while chairing a subcommittee in another.

Workgroup Recommendation

Proposal # 1214

RED1-189-22

Proponents: Christopher McWhite, representing Region VI (cmcwhite@me.com)

2024 ENERGY Chapter11

Revise as follows:

EMITTANCE. The ratio of the radiant heat flux emitted by a specimen to that emitted by ~~a blackbody~~ at the same temperature and under the same conditions.

Reason: Unless there is an industry term that supports this, the inclusion of the language “black body” is inherently tone deaf and completely out of place in any ICC published Code with respect to black humans.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
There is no cost associated with this proposed change

Bibliography: I am a career, 22 year Building Code Official who has served communities in five states from the Midwest, to the South, and now in New England. Through The Rhode Island Building Code Standards Committee, I am accepted as a certified Building Official; *R.I.G.L. Ch. 23-27.3 §107.5*. Through The International Code Council, I am exam certified as a Certified Building Official, Housing Code Official, Combination Residential Building Inspector, and a Residential and Commercial Plans Examiner. Through the State of Massachusetts I am a certified/licensed Inspector of Buildings/Building Commissioner. Currently I am working as the Department Head Building and Zoning Official in the Town of Smithfield Rhode Island. Here we are committed to our communities’ development through partnerships with local and statewide organizations, institutions, and people who are dedicated and/or focused on the process of maintaining existing buildings and constructing new edifices with the goal of making an ever safer built community. I am committed to pursuing improved life safety in residential and commercial structures and the judicious enforcement of current building code and its referenced standards through effective leadership both within the builders and design community and with the professional staff I have the honor to lead. My personal goal is the building of a team of amicable, fair, ethical, and consistently equitable Officials utilizing State and Local building regulations while also judiciously incorporating relevant 28 CFR, ADA requirements. My role is also to communicate these goals with political bodies, large stakeholder investors in high profile projects, local community projects, and simple renovations with homeowners, without parity. I am also a decades-long member of the International Code Council, the non-profit agency that develops and publishes the building Codes. I’ve twice served as a selected committee member for code development on the national level and I am currently serving as an elected, Governing Board Member with one ICC Membership Council while chairing a subcommittee in another.

Workgroup Recommendation

Proposal # 1223

RED1-190-22

Proponents: Robert Salcido, representing DOE (victor.salcido@pnnl.gov)

2024 International Energy Conservation Code [RE Project]

Add new definition as follows:

Envelope Heat Transfer Factor (UA)

. Overall average heat transmission of the gross area of the exterior building envelope. The UA is calculated as the summation of each envelope assembly area multiplied by U-factors in Table R402.1.2 plus slab on-grade F-factors in Table R402.1.2 multiplied by the slab perimeter length.

Reason: Section R402.1.5 for the Component Performance Alternative includes the standard UA value plus the newly added FP calculation for on-grade slabs. However, for the 2024 IECC, all performance compliance pathways have envelope backstops as a function of the UA value. Read in its pure form, that would mean that slabs would not be part of the envelope backstop UA calculation. Rather than updating all the envelope backstop equations in the residential sections, it would be worthy to have a "UA" definition that includes the UA + FP calculation and thus all equations throughout the code would have the definition to ensure the slap portion is included.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
No Cost Impact

Workgroup Recommendation

Proposal # 1187

RED1-191-22 Part I

Proponents: Christopher McWhite, representing Region VI (cmcwhite@me.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

EXTERIOR WALL ENVELOPE. A system or assembly of exterior wall components, including exterior wall finish materials, that provides protection of the building structural <u>and or non-structural </u>members, including framing and sheathing materials, and conditioned interior space, from the detrimental effects of the exterior environment.

Reason: The exclusion of non-structural exterior wall elements could unintentionally exclude such installations as curtain walls and other non-load bearing exterior building elements that are intended to provide a delineation from unconditioned versus conditioned space.

Cost Impact: The code change proposal will increase the cost of construction.
The cost will increase because the inclusion of non-structural building elements will require the installation of materials intended to provide thermal resistance or thermal transmittance.

Bibliography: I am a career, 22 year Building Code Official who has served communities in five states from the Midwest, to the South, and now in New England. Through The Rhode Island Building Code Standards Committee, I am accepted as a certified Building Official; *R.I.G.L. Ch. 23-27.3 §107.5*. Through The International Code Council, I am exam certified as a Certified Building Official, Housing Code Official, Combination Residential Building Inspector, and a Residential and Commercial Plans Examiner. Through the State of Massachusetts I am a certified/licensed Inspector of Buildings/Building Commissioner. Currently I am working as the Department Head Building and Zoning Official in the Town of Smithfield Rhode Island. Here we are committed to our communities' development through partnerships with local and statewide organizations, institutions, and people who are dedicated and/or focused on the process of maintaining existing buildings and constructing new edifices with the goal of making an ever safer built community. I am committed to pursuing improved life safety in residential and commercial structures and the judicious enforcement of current building code and its referenced standards through effective leadership both within the builders and design community and with the professional staff I have the honor to lead. My personal goal is the building of a team of amicable, fair, ethical, and consistently equitable Officials utilizing State and Local building regulations while also judiciously incorporating relevant 28 CFR, ADA requirements. My role is also to communicate these goals with political bodies, large stakeholder investors in high profile projects, local community projects, and simple renovations with homeowners, without parity. I am also a decades-long member of the International Code Council, the non-profit agency that develops and publishes the building Codes. I've twice served as a selected committee member for code development on the national level and I am currently serving as an elected, Governing Board Member with one ICC Membership Council while chairing a subcommittee in another.

Workgroup Recommendation

Proposal # 1215

RED1-191-22 Part II

Proponents: Christopher McWhite, representing Region VI (cmcwhite@me.com)

2024 ENERGY Chapter11

Revise as follows:

EXTERIOR WALL ENVELOPE. A system or assembly of exterior wall components, including exterior wall finish materials, that provides protection of the building structural <u>and or non-structural </u>members, including framing and sheathing materials, and conditioned interior space, from the detrimental effects of the exterior environment.

Reason: The exclusion of non-structural exterior wall elements could unintentionally exclude such installations as curtain walls and other non-load bearing exterior building elements that are intended to provide a delineation from unconditioned versus conditioned space.

Cost Impact: The code change proposal will increase the cost of construction.
There cost will increase because the inclusion of non-structural building elements will require the installation of materials intended to provide thermal resistance or thermal transmittance.

Bibliography: I am a career, 22 year Building Code Official who has served communities in five states from the Midwest, to the South, and now in New England. Through The Rhode Island Building Code Standards Committee, I am accepted as a certified Building Official; *R.I.G.L. Ch. 23-27.3 §107.5*. Through The International Code Council, I am exam certified as a Certified Building Official, Housing Code Official, Combination Residential Building Inspector, and a Residential and Commercial Plans Examiner. Through the State of Massachusetts I am a certified/licensed Inspector of Buildings/Building Commissioner. Currently I am working as the Department Head Building and Zoning Official in the Town of Smithfield Rhode Island. Here we are committed to our communities' development through partnerships with local and statewide organizations, institutions, and people who are dedicated and/or focused on the process of maintaining existing buildings and constructing new edifices with the goal of making an ever safer built community. I am committed to pursuing improved life safety in residential and commercial structures and the judicious enforcement of current building code and its referenced standards through effective leadership both within the builders and design community and with the professional staff I have the honor to lead. My personal goal is the building of a team of amicable, fair, ethical, and consistently equitable Officials utilizing State and Local building regulations while also judiciously incorporating relevant 28 CFR, ADA requirements. My role is also to communicate these goals with political bodies, large stakeholder investors in high profile projects, local community projects, and simple renovations with homeowners, without parity. I am also a decades-long member of the International Code Council, the non-profit agency that develops and publishes the building Codes. I've twice served as a selected committee member for code development on the national level and I am currently serving as an elected, Governing Board Member with one ICC Membership Council while chairing a subcommittee in another.

Workgroup Recommendation

Proposal # 1224

RED1-192-22

Proponents: Greg Johnson, representing National Multifamily Housing Council (gjohnsonconsulting@gmail.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

KNEE WALL. An above-grade wall assembly, or wall defined by vertical truss members, of any height that separate conditioned space from unconditioned buffer spaces, such as ventilated attics and entry porch roofs, rather than ambient outdoors. <u>Walls separating garages from dwelling units are not considered knee walls.</u>

Reason: Garage/dwelling unit separations are outside of the scope of the original code change that added this definition. Adding this sentence will clarify that the definition is not intended to apply to walls separating garages and dwelling units.

Cost Impact: The code change proposal will decrease the cost of construction.
This code change will forestall misinterpretations of the intent of the code & save owner and government resources.

Bibliography: None

Workgroup Recommendation

Proposal # 996

RED1-193-22

Proponents: Robert Schwarz, representing BUILDTank, Inc. (robby@btankinc.com)

2024 International Energy Conservation Code [RE Project]

Add new definition as follows:

Window-to-Wall Ratio.. The fraction of above and below grade wall area separating conditioned space from unconditioned space that is covered by fenestration, calculated as the ratio of the wall fenestration area to the gross above and below grade wall area.

Window-to-Floor Ratio.. The fraction of the below grade and above grade conditioned floor area in relation to the fenestration area in the above and below grade walls, calculated as the ratio of the wall fenestration area to the gross above and below grade conditioned floor area

Revise as follows:

R103.2 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

10.. *Window to wall ratio* and *window to floor ratio*

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

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

Add new text as follows:

R402.4.1.1 Window to wall, window to floor ratio. When using a prescriptive compliance option, the building or dwelling unit window to wall and window to floor ratio shall be calculated. When the window to wall or window to floor ratio for and building or dwelling unit is above 17 percent the U-factor of the installed fenestration unit shall be less than or equal to 0.40 in Climate zones 0 and 2, 0.30 in climate zone 2, 0.27 in climate zones 3 through 6, and 0.26 in climate zone 8.

Reason: Windows are simply the weakest link in the building's thermal envelop and they dramatically impact the total whole wall R-value of the assembly. When the window to floor area is greater than 15% the performance compliance options as outlined in Sections R405 and RE406 begin to penalize the house making it more difficult to use those compliance approaches. It is logical that this is done but and equal "penalty" for reduced whole wall R-value is not applied when using the prescriptive compliance options. This proposal helps with creating parity within the compliance options by requiring better performing windows in homes that have excessive window to wall or floor ratios.
Although window to floor ratio is used in the reference homes in section R405 and in the ANSI 301 standard reference home used in Section R406, window to wall ratio is a more commonly understood metric amongst energy construction design professionals. Using both ratios in this proposal will help begin the discussion of which metric should be used because although the ratios are not completely equal, requiring the calculation of both ratios and the use of both ratios in this code proposal brings attention to the issue of excessive window placement in home design.

This proposal will improve the energy performance of the home and will begin to bring forward design parameters that look at the best use and placement of windows installed to provide egress, light and a connection to the outdoors and views. It will encourage not placing using excessive glazing on west facing elevations, for example, that increased heating or cooling loads.

In addition, it will incentivize window selection of windows. For example, by encouraging that all windows don't have to be operably which generally improves the U-factor, potentially a selection of windows based off their air infiltration qualities such as casement windows vs. sliders, and a overall reduction of window in exchange for better placement of the glass to maintain views, light, and a connection to the outdoor space.

Cost Impact: The code change proposal will increase the cost of construction.
This would increase the cost of construction. However, the code's consistent effort to regulate the energy loss and gain through the building's thermal envelop would be enhanced significantly. In addition, greater parity between the different compliance options would be increased.

Workgroup Recommendation

Proposal # 1486

RED1-194-22

Proponents: Jay Crandell, representing Foam Sheathing Committee of the American Chemistry Council (jcrandell@aresconsulting.biz)

2024 International Energy Conservation Code [RE Project]

Add new text as follows:

R303.1.5 Air spaces.. Where the *R-value* of an *enclosed reflective air space* or enclosed non-reflective air space is used for compliance with this standard, the air space shall be enclosed in an unventilated cavity bounded on all sides by building components and constructed to minimize airflow into and out of the enclosed air space. Airflow shall be deemed minimized where one of the following conditions occur:
1. The enclosed air space is unventilated.
2. The enclosed air space is bounded on at least one side 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 of the air space and spaced not less than 15 inches (381 mm) on center with the top of the cavity air space closed.

The *R-value* of an *enclosed reflective air space* shall be determined in accordance with Part 460 of US-FTC CFR Title 16 or ANSI/ASHRAE/IESNA 90.1, Appendix A, based on the building component containing the air space, air space thickness, effective *emittance* of the air space, and climate zone. *Radiant barriers* installed without facing an *enclosed reflective air space* shall not be counted as having an *R-value*. Enclosed non-reflective air spaces of minimum 1/2-inch (12.6 mm) thickness shall be assigned an R-value of R-0.9 or an R-value determined in accordance with ANSI/ASHRAE/IESNA 90.1, Appendix A, using an effective *emittance* of 0.82.

Exception: For ventilated cavities, the effect of the ventilation of air spaces 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 air space at an air movement rate of not less than 70 mm/second.

Revise as follows:

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 sheet(s), the number and thickness of the enclosed reflective air space(s) and the R-value for the installed assembly determined in accordance with Section R303.1.5, 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.

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

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.

Reason: Air space R-values can vary by as much as a factor of 8 depending on various conditions of use (see ASHRAE 90.1 Appendix A). This proposal provides needed requirements to ensure air space R-values are properly specified and applied for both reflective and non-reflective air spaces.
Foam sheathing products with foil facers, various types of structural sheathing products with reflective facers, batt insulation products with reflective facers, and reflective insulation sheet goods (including radiant barriers) rely on an air space to achieve an R-value or thermal performance benefits that can vary significantly based on installation conditions, climate, air-space orientation and heat flow direction at different seasons of the year, and other factors. The FSC membership is among manufacturers and code users that rely on appropriate characterization of air spaces to provide added thermal performance under appropriate conditions of use. It is important that the R-value performance of such air spaces are consistently and properly characterized for code compliance purposes, just as is the case for the variety of insulation materials that rely on material based R-values alone and do not rely on combination with a reflective or non-reflective air space. It is the intent of this proposal to address air space R-values in a manner that is consistent with the determination of R-values for other materials and in a way that transparently addresses the unique considerations that are important to air space R-values.The charging language of the first paragraph of the new proposed Section R303.1.5, including items 1 and 2, are consistent with provisions for air spaces found in Section C402.2.7 of the IECC commercial provisions. It also makes use of the newly added definition "enclosed reflective air space" to ensure that it as well as other air spaces that are not reflective are properly constructed to attain (or nearly attain) the idealized R-values that are typically assigned to such air spaces. The exception provided at the end of the proposed new Section R303.1.5 provides flexibility to address ventilated air spaces (not meeting the requirements for an enclosed, unventilated air space) and also is part of the IECC commercial provisions in Section C402.2.7.

The 2nd paragraph gives needed direction on how to determine R-values for compliant air spaces. The FTC R-value rule is referenced as it is for insulation products in Section R303.1.4 because it does address reflective insulation and associated enclosed air spaces. However, the FTC R-value rule does not address horizontal air spaces such as found in floor or roof systems which have R-values that vary seasonally based on direction of heat flow and the magnitude of this effect on air space R-value depends on the climate zone. Therefore, reference to ASHRAE 90.1 Appendix A is provided which does address proper climate-based seasonal weighting to arrive at a single R-value for a given climate that is necessary to determine compliance with the R-value or U-factor requirements of the IECC standard. It also addresses R-value determination for non-reflective air spaces which also are not addressed in the FTC R-value Rule but which are commonly used to support compliance with the IECC. Finally, there is no means of assigning an R-value to radiant barrier applications unless they are installed together with and facing an enclosed reflective air space also meeting the air space construction requirements in R303.1.5.

To complement the above, Section R303.1.1 is revised to require that reflective insulation and associated enclosed reflective air spaces comply with the proposed new Section R303.1.5. Finally, Section R303.2.2 for radiant barriers is revised to a reference standard that addresses installation which is the purpose of Section R303.2. The currently referenced ASTM standard only addresses material properties, not installation.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This proposal is a clarification that doesn't change appropriate methods for determining and applying air space R-values which the IECC-R provisions have been silent on. It relies on practices and references that are commonly used for this purpose. There may be a cost increase associated with air spaces that have been applied and characterized in a manner inconsistent with accepted practice.

Workgroup Recommendation

Proposal # 1135

RED1-195-22

Proponents: Hendrik Shank, representing New York State, Department of State (hendrikus.shank@dos.ny.gov); Daniel Carroll, representing Division of Building Standards & Codes (daniel.carroll@dos.ny.gov)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

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* ~~envelope~~ *thermal envelope*.

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 envelope~~ *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 envelope~~ *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 R408.
8. Where a solar-ready zone is provided, the certificate shall indicate the location, and dimensions.

TABLE R402.5.1.1 AIR BARRIER, AIR SEALING AND INSULATION INSTALLATION[a]

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
General requirements	A continuous air barrier shall be installed in the ~~building envelope~~*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	A sealed air barrier shall be installed in any dropped ceiling or soffit to separate it from unconditioned space. Access openings, drop down stairs or knee wall doors to unconditioned attic spaces shall be air 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. Access hatches and doors shall be installed and insulated in accordance with Section R402.2.5 Eave Baffles shall be installed in accordance with Section R402.2.4
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 thermal envelope insulation for framed walls shall be installed in substantial contact and continuous alignment with the air barrier.
Windows, skylights and doors	The space between framing and skylights, and the jambs of windows and doors, shall be sealed.	Framing cavities around windows, skylights and doors shall be completely filled with insulation or insulated per window manufacturer's instructions.
Rim joists	Rim joists shall include an air barrier. 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.[b]
Floors, including cantilevered floors and floors above garages	The air barrier shall be installed at any exposed edge of insulation.	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.
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 *International Residential Code*.	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 R402.2.11.
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 Section R402.5.5.	Recessed light fixtures installed in the building thermal envelope shall be airtight and IC rated, and shall be buried 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.
Showers, tubs, and	An air barrier shall separate insulation in the	

Showers, tubs, and fireplaces adjacent to the building thermal envelope	An air barrier shall separate insulation in the *building thermal envelope* from the shower , tub , and fireplace assemblies.	Exterior framed walls adjacent to showers , tubs and fireplaces shall be insulated.
Electrical,communication, and other equipment boxes, housings, and enclosures	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. The continuity of the air barrier shall be maintained around boxes, housings, and enclosures that penetrate the air barrier. Alternatively, air-sealed boxes shall be installed in accordance with R402.5.6.	Boxes, housing, and enclosures shall be burried 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 in the building's thermal envelope shall be buried and 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	Air sealing materials recognized in a listed fire-resistance rated common wall or double wall design and installed in accordance with the listing, or air sealing materials recognized in an approved design, shall be used. Common walls or double walls shall be considered an exterior wall for the purposes of air barrier and air sealing application of this Table.	Insulation materials recognized in the listed common wall or double-wall design and installed in accordance with the listing, or insulation materials recognized in the approved design, shall be used.

a. Inspection of log walls shall be in accordance with the provisions of ICC 400.

b. Insulation full enclosure is not required in unconditioned/ventilated attic spaces and at rim joists.

R402.5.1.2 Testing. The *building* or each *dwelling unit* in the buildingshall be tested for air leakage. The maximum air leakage rate for any *building* or *dwelling unit* under any compliance path shall not exceed 4.0 air changes per hour or 0.22 cfm/ft^2(1.1 L/s x m^2) of building or dwelling unit enclosure area. Testing shall be conducted in accordance with ANSI/RESNET/ICC 380, ASTM E779, ASTM E1827 or ASTM E3158 and reported at a pressure differential of 0.2 inch water gauge (50 Pa). 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.

Exceptions:

1. When testing individual dwelling units, an air leakage rate not exceeding 0.27 cubic feet per minute per square foot [1.35 L/s x m^2)] 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:

   1.1 Attached single and multiple family building dwelling units.

   1.2 Buildings or dwelling units that are 1,500 square feet (139.4 m^2) or smaller.

2. 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~~ *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.
3. Where tested in accordance with R402.5.1.4, testing of each dwelling unit is not required.

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.

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.

R405.3.2.1 Compliance report for permit application. A compliance report submitted 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 the software used to produce the results for the reference design and/or the rated home.
5. A certificate indicating that the proposed design complies with Section R405.3. 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 envelope~~ *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 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.

R405.3.2.2 Compliance report for certificate of occupancy. A compliance report submitted for obtaining the certificate of occupancy shall include the following:

1. Building street address, or other building site identification.
2. Declaration of the 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.
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.
6. A final confirmed certificate indicating compliance based on inspection, and a statement indicating that the 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, including component-level insulation *R*-values or *U*-factors; results from any required duct system and ~~building envelope~~ *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.

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 Table R402.1.2.	As proposed
	Solar absorptance = 0.75.	As proposed
	Emittance = 0.90.	As proposed
Basement and crawl space walls	Type: same as proposed.	As proposed
	Gross area: same as proposed.	As proposed
	U-factor: as specified in Table R402.1.2, with the insulation layer on the interior side of the walls.	As proposed
Above-grade floors	Type: wood frame.	As proposed
	Gross area: same as proposed.	As proposed
	U-factor: as specified in Table R402.1.2.	As proposed
Ceilings	Type: wood frame.	As proposed
	Gross area: same as proposed.	As proposed
	U-factor: as specified in Table R402.1.2.	As proposed
Roofs	Type: composition shingle on wood sheathing.	As proposed
	Gross area: same as proposed.	As proposed
	Solar absorptance = 0.75.	As proposed
	Emittance = 0.90.	As proposed
Attics	Type: vented with an aperture of 1 ft^2 per 300 ft^2 of ceiling area.	As proposed
Foundations	Type: same as proposed.	As proposed
	Foundation wall area above and below grade and soil characteristics: same as proposed.	As proposed
Opaque doors	Area: 40 ft^2.	As proposed
	Orientation: North.	As proposed
	U-factor: same as fenestration as specified in Table R402.1.2.	As proposed
Vertical fenestration other than opaque doors	Total area[h] = (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 Table R402.1.2.	As proposed
	SHGC: as specified in Table R402.1.2 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 × SHGC for the standard reference design).	Interior shade fraction: 0.92 – (0.21 × SHGC as proposed)
	External shading: none	As proposed
Skylights	None	As proposed
Thermally isolated sunrooms	None	As proposed
	The air leakage rate at a pressure of 0.2 inch w.g. (50 Pa) shall be Climate Zones 0 through 2: 5.0 air changes per hour. Climate Zones 3 , 4, and 5: 3.0 air changes per hour. Climate Zones 6 through 8: 2.5 air changes per hour.	The measured air exchange rate.[a]
	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 B × M	

Air exchange rate	shall be the same as in the proposed design, but not greater than B x M where: B = 0.01 × CFA + 7.5 × (Nbr + 1), cfm. M = 1.0 where the measured air exchange rate is > = 3.0 air changes per hour at 50 Pascals, and otherwise, M = minimum (1.7, Q/B) Q = the proposed mechanical ventilation rate, cfm. CFA = conditioned floor area, ft2. Nbr = number of bedrooms. 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 Section R403.6.1. Heat recovery or energy recovery shall not be modeled for mechanical ventilation where not required by Section R403.6.1.	The mechanical ventilation rate[b] , Q, shall be in addition to the air leakage rate and shall be as proposed.
Mechanical ventilation	Where mechanical ventilation is not specified in the proposed design: None Where mechanical ventilation is specified in the proposed design, the annual vent fan energy use, in units of kWh/yr, shall equal (8.76 × B × M)/ef where: B and M are determined in accordance with the Air Exchange Rate row of this table. e_f = the minimum fan efficacy, as specified in Table 403.6.2, corresponding to the system type at a flow rate of B × M. *CFA* = conditioned floor area, ft^2. N_{br} = number of bedrooms.	As proposed
Internal gains	IGain, in units of Btu/day per dwelling unit, shall equal 17,900 + 23.8 ×*CFA* + 4,104 × N_{br} where: *CFA* = conditioned floor area, ft^2. N_{br} = number of bedrooms.	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[c] but not integral to the ~~building envelope~~ *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 Table R402.1.3, 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[d, e, j, k]	For other than electric heating without a heat pump: as proposed. 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 Section R403.7.	
	Fuel Type/Capacity: Same as proposed design	As proposed
	Product class: Same as proposed design	As proposed
	Efficiencies:	As proposed
	Heat pump: Complying with 10 CFR §430.32	As proposed
	Non-electric furnaces: Complying with 10 CFR §430.32	As proposed
	Non-electric boilers: Complying with 10 CFR §430.32	As proposed
Cooling systems[d, f, k]	As proposed. Capacity: sized in accordance with Section R403.7.	
	Fuel Type: Electric Capacity: Same as proposed design	As proposed
	Efficiencies: Complying with 10 CFR §430.32	As proposed
		As proposed

<table>
<tr><td rowspan="7">Service water heating[d, g, k]</td><td>As proposed.
Use, in units of gal/day = 25.5 + (8.5 × N_{br})
where: N_{br} = number of bedrooms.</td><td>As proposed
Use, in units of gal/day = 25.5 + (8.5 × N_{br}) × (1 – $HWDS$)
where:
N_{br} = number of bedrooms.
$HWDS$ = factor for the compactness of the hot water distribution system.<table>
<tr><th colspan="2">Compactness ratio[i] factor</th><th>HWDS</th></tr>
<tr><td>1 story</td><td>2 or more stories</td><td></td></tr>
<tr><td>> 60%</td><td>> 30%</td><td>0</td></tr>
<tr><td>> 30% to ≤ 60%</td><td>> 15% to ≤ 30%</td><td>0.05</td></tr>
<tr><td>> 15% to ≤ 30%</td><td>> 7.5% to ≤ 15%</td><td>0.10</td></tr>
<tr><td>< 15%</td><td>< 7.5%</td><td>0.15</td></tr>
</table></td></tr>
<tr><td>Fuel Type: Same as proposed design</td><td>As proposed</td></tr>
<tr><td>Rated Storage Volume: Same as proposed design</td><td>As proposed</td></tr>
<tr><td>Draw Pattern: Same as proposed design</td><td>As proposed</td></tr>
<tr><td>Efficiencies: Uniform Energy Factor complying with 10 CFR §430.32</td><td>As proposed</td></tr>
<tr><td>Tank Temperature: 120° F (48.9° C)</td><td>Same as standard reference design</td></tr>
<tr><td></td><td></td></tr>
<tr><td rowspan="4">Thermal distribution systems</td><td>Duct location:<table>
<tr><td>Foundation Type</td><td>Slab on grade</td><td>Unconditioned crawl space</td><td>Basement or conditioned crawl space</td></tr>
<tr><td>Duct location (supply and return)</td><td>One-story building: 100% in unconditioned attic

All other: 75% in unconditioned attic and 25% inside conditioned space</td><td>One-story building: 100% in unconditioned crawlspace

All other: 75% in unconditioned crawlspace and 25% inside conditioned space</td><td>50% inside conditioned space

50% unconditioned attic</td></tr>
</table></td><td>Duct location: as proposed.</td></tr>
<tr><td>Duct insulation: in accordance with Section R403.3.1.</td><td>Duct insulation: as proposed.</td></tr>
<tr><td>Duct system leakage to outside:
For duct systems serving > 1,000ft2 of conditioned floor area, the duct leakage to outside rate shall be 4 cfm (113.3 L/min) per 100 ft2 (9.29 m2) of conditioned floor area.
For duct systems serving ≤ 1,000ft2 of conditioned floor area, the duct leakage to outside rate shall be 40 cfm (1132.7 L/min).</td><td>Duct System Leakage to Outside: The measure total duct system leakage rate shall be entered into the software as the duct system leakage to outside rate.
Exceptions:<table>
<tr><td>1.</td><td>When duct system leakage to outside is tested in accordance ANSI/ RESNET/ICC 380 or ASTM E1554, the measured value shall be permitted to be entered.</td></tr>
<tr><td>2.</td><td>When total duct system leakage is measured without the air handler installed, the simulation value shall be 4 cfm (113.3 L/min) per 100 ft^2 (9.29 m^2) of conditioned floor area.</td></tr>
</table></td></tr>
<tr><td>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.</td><td>For hydronic systems and ductless systems, DSE shall be as specified in Table R405.4.2(2).</td></tr>
<tr><td>Thermostat</td><td>Type: Manual, cooling temperature setpoint = 75°F;
Heating temperature setpoint = 72°F.</td><td>Same as standard reference design.</td></tr>
<tr><td>Dehumidistat</td><td>Where a mechanical ventilation system with latent heat recovery is not specified in the proposed design: None. Where the proposed design utilizes a mechanical ventilation system with latent heat recovery:</td><td>Same as standard reference design.</td></tr>
</table>

	Dehumidistat type: manual, setpoint = 60% relative humidity. Dehumidifier: whole-dwelling with integrated energy factor = 1.77 liters/kWh.	

For SI: 1 square foot = 0.93 m^2, 1 British thermal unit = 1055 J, 1 pound per square foot = 4.88 kg/m^2, 1 gallon (US) = 3.785 L, °C = (°F-32)/1.8, 1 degree = 0.79 rad.

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.

g. For a proposed design the following assumptions shall be made for both the proposed design and standard reference design.

   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 §130.32

h. For residences with conditioned basements, R-2 and R-4 residences, and for townhouse units, 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.

i. 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 Table R405.4.2(1), the standard reference design shall be the same as proposed design.

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 reference design and/or the rated home.
6. A certificate indicating that the proposed design has an ERI less than or equal to the appropriate score indicated in Table R406.5 when compared to the ERI reference design. The certificate shall document the building component energy specifications that are included in the calculation, including: component level insulation *R*-values or *U*-factors; assumed duct system and ~~building envelope~~ <u>*building thermal envelope*</u> air leakage testing results; and the type and rated efficiencies of proposed heating, cooling, mechanical ventilation, and service water-heating equipment to be installed. If on-site renewable energy systems will be installed, the certificate shall report the type and production size of the proposed system.
7. When a site-specific report is not generated, the proposed design shall be based on the worst-case orientation and configuration of the rated home.

R406.7.2.2 Confirmed compliance report for a certificate of occupancy. A confirmed compliance report submitted for obtaining the certificate of occupancy shall be made site and address specific and include the following:

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

R502.2.1 Building envelope. New *building* ~~envelope~~ <u>*thermal envelope*</u> 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.

Exception: New envelope assemblies are exempt from the requirements of Section R402.5.1.2.

R503.1.1 Building thermal envelope. Alterations of existing building thermal envelope assemblies shall comply with this section. New ~~Building building thermal envelope~~ *building thermal envelope* assemblies that are part of the *alteration* shall comply with Section R402. In no case shall the R-value of insulation be reduced or the U-factor of a building thermal envelope assembly be increased as part of a building thermal envelope alteration.

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. Roof recover.
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. An existing building undergoing alterations that is demonstrated to be in compliance with Section R405 or Section R406

Reason: The purpose of this code change proposal is to create consistency by replacing instances of the wording “building envelope” with the defined term in Chapter 2; *“building thermal envelope.”*

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This code change proposal is editorial so there is no cost impact associated with it.

Workgroup Recommendation

Proposal # 1195

RED1-196-22

Proponents: Daniel Carroll, representing Division of Building Standards & Codes (daniel.carroll@dos.ny.gov); Hendrik Shank, representing New York State, Department of State (hendrikus.shank@dos.ny.gov)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

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

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^2 (10.7 W/m^2) or 1.0 watt/ft^2 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.

Reason: This modification clarifies that there are two options that can be used to demonstrate compliance with the Residential prescriptive building thermal envelope Provisions of the 2024 IECC. Essentially, the vapor retarder Provision identified in Section R402.1.1 is always applicable and the user may utilize the U-factor, f-factor, and R-value provisions identified in Sections R402.1.2 through R402.1.4 as one option, and the component performance alternative identified in Section R402.1.5 as another option.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This code change proposal is editorial so there is no cost impact associated with it.

Workgroup Recommendation

Proposal # 1199

RED1-197-22

Proponents: Amy Boyce, representing Energy Efficient Codes Coalition (EECC) (amy.boyce@imt.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

TABLE R402.1.2 MAXIMUM ASSEMBLY U-FACTORS[a] AND FENESTRATION REQUIREMENTS

CLIMATE ZONE	0	1	2	3	4 except Marine	5 and Marine 4	6	7 and 8
FENESTRATION U-FACTOR	0.50	0.50	0.40	0.30	0.30	0.28[e]	0.28[e]	0.27[e]
SKYLIGHT[d] *U*-FACTOR	0.60	0.60	0.60	0.53	0.53	0.50	0.50	0.50
GLAZED FENESTRATION SHGC[d]	0.25	0.25	0.25	0.25	0.40	NR	NR	NR
CEILING *U*-FACTOR[f]	0.035	0.035	~~0.030~~ 0.026	~~0.030~~ 0.026	~~0.026~~ 0.024	~~0.026~~ 0.024	~~0.026~~ 0.024	~~0.026~~ 0.024
WOOD FRAME WALL *U*-FACTOR	0.084	0.084	0.084	0.060	0.045	0.045	0.045	0.045
MASS WALL U-FACTOR[b]	0.197	0.197	0.165	0.098	0.098	0.082	0.060	0.057
FLOOR *U*-FACTOR	0.064	0.064	0.064	0.047	0.047	0.033	0.033	0.028
BASEMENT WALL *U*-FACTOR	0.360	0.360	0.360	0.091[c]	0.059	0.050	0.050	0.050
UNHEATED SLAB F-FACTOR	0.73	0.73	0.73	0.54	0.54	0.54	0.48	0.48
HEATED SLAB F-FACTOR[g]	1.03	1.03	1.03	0.77	0.68	0.68	0.68	0.68
CRAWL SPACE *U*-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 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 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 0.28.

e. 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*.

f. Roofs with insulation entirely above deck shall comply with Section C402.2.1 and the Group R U-factors of Table C402.1.2.

g. F-factors for heated slabs correspond to the configuration described by footnote (d) of Table R402.1.3

TABLE R402.1.3 INSULATION MINIMUM R-VALUES AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	0	1	2	3	4 except Marine	5 and Marine 4	6	7 and 8
FENESTRATION U-FACTOR[b, i]	0.50	0.50	0.40	0.30	0.30	0.28 [h]	0.28 [h]	0.27 [h]
SKYLIGHT[b] *U*-FACTOR	0.60	0.60	0.60	0.53	0.53	0.50	0.50	0.50
GLAZED FENESTRATION SHGC[b, e]	0.25	0.25	0.25	0.25	0.40	NR	NR	NR
CEILING *R*-VALUE[i]	30	30	~~38~~ 49	~~38~~ 49	~~49~~ 60	~~49~~ 60	~~49~~ 60	~~49~~ 60
WOOD FRAME WALL R-VALUE[g]	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[h]	3/4	3/4	4/6	8/13	8/13	13/17	15/20	19/21
FLOOR *R*-VALUE[h, j]	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[c, g] WALL *R*-VALUE	0	0	0	5ci or 13[f]	10ci or 13	15ci or 19 or 13&5ci	15ci or 19 or 13&5ci	15ci or 19 or 13& 5ci
SLAB[d] R-VALUE & DEPTH	0	0	0	10ci, 2 ft	10ci, 4 ft	10ci, 4 ft	10ci, 4 ft	10ci, 4 ft
CRAWL SPACE[c, g] WALL R-VALUE	0	0	0	5ci or 13[f]	10ci or 13	15ci or 19 or 13&5ci	15ci or 19 or 13&5ci	15ci or 19 or 13&5ci

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. 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 0.28.

c. “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.

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

f. 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.

g. 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.

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

i. Roofs with insulation entirely above deck shall comply with Section C402.2.1 and the Group R R-values of Table C402.1.2.

j. "30 or 19+7.5ci or 20ci" means R30 cavity insulation alone or R19 cavity insulation with R7.5 continuous insulation or R20 continuous insulation alone.

Reason: This proposal helps maintain the efficiency of the IECC by restoring the 2021 IECC ceiling insulation requirements for climate zones 2-8. Proposal REPI-33 rolled back the requirements for ceiling insulation in these climate zones, which would lead to higher energy use in homes built to the prescriptive and performance compliance options in the 2024 IECC. That would place these two compliance paths in direct conflict with new section R101.3 Intent of the 2024 IECC, as written by the ICC Board of Directors, that the code will be updated on a “three-year cycle with each subsequent edition providing increased energy savings over the prior edition.” The proponent of REPI-33 did not provide any energy or economic analysis to support this reduction in efficiency. This is a clear reduction in efficiency that would affect nearly every jurisdiction in the United States that could adopt the 2024 IECC. The improvements in the 2021 IECC, including the insulation requirements, were approved by over 75% of Governmental Member Voting Representatives in the 2021 IECC update cycle, who voted in record numbers to support a meaningful improvement in energy efficiency.Ceiling insulation will provide both comfort and energy savings benefits over the full useful lifetime of the building, and it is most cost-effectively installed at construction. We recommend that the Residential Consensus Committee reverse this unnecessary rollback in efficiency in order to maintain—and ideally advance—the efficiency of buildings in the 2024 IECC.
Please see attached "Support Letter - EECC Comments" for a list of government representatives and organizations supporting this proposal.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This proposal neither increases nor decreases the cost of construction because it maintains the ceiling insulation requirements exactly as they are published in the 2021 IECC. The U.S. Department of Energy found the 2021 IECC to be cost-effective (see https://www.energycodes.gov/sites/default/files/2021-07/2021IECC_CostEffectiveness_Final_Residential.pdf); these findings were further confirmed by ICF International in a follow-up analysis of cost-effectiveness (see https://energyefficientcodes.org/wp-content/uploads/Cost-Effectiveness-of-the-Residential-Provisions-of-the-2021-IECC-Rev-June-2022.pdf). Because REPI-33 would diverge from the 2021 IECC, the burden is on the proponent of REPI-33 to explain how an efficiency rollback is consistent with Section R101.3 Intent, and that burden was not met.

Attached Files

- **Support Letter - EECC Comments.pdf**
  https://energy.cdpaccess.com/proposal/1231/2647/files/download/481/

Workgroup Recommendation

Proposal # 1231

RED1-198-22

Proponents: Greg Johnson, representing National Multifamily Housing Council (gjohnsonconsulting@gmail.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

TABLE R402.1.2 MAXIMUM ASSEMBLY U-FACTORS[a] AND FENESTRATION REQUIREMENTS

Portions of table not shown remain unchanged.

CLIMATE ZONE	0	1	2	3	4 except Marine	5 and Marine 4	6	7 and 8
FENESTRATION U-FACTOR	0.50	0.50	0.40	0.30	0.30	0.28[e]	0.28[e]	~~0.27~~ 0.28[e]
SKYLIGHT[d] *U*-FACTOR	0.60	0.60	0.60	0.53	0.53	0.50	0.50	0.50

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 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 0.28.

e. 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*.

f. Roofs with insulation entirely above deck shall comply with Section C402.2.1 and the Group R U-factors of Table C402.1.2.

g. F-factors for heated slabs correspond to the configuration described by footnote (d) of Table R402.1.3

Reason: This change is a very slight relaxation of the fenestration U-factor requirements in Climate Zones 7 & 8.
This is an important consistency of market issue for builders in Aroostook County Maine (population about 67,000), 22 counties in Minnesota (636,000), and 15 counties in North Dakota, the states with both CZ 6 and CZ 7. These counties are predominately rural, with relatively little building activity, with towns or cities that serve much larger (geographically) areas.

Alaska has 3 CZ 5 counties, 5 CZ 6 counties, 11 CZ 7 counties and 8 CZ 8 counties with a total population of about 733,000.

Using Census data, for year 2021, and applying the percentage of population of CZ 7 with respect to their state populations to building permits issued in 2021 for new privately owned housing units, the approximate number of permits issued in CZ7 counties by state is: Alaska, 1,055; Maine, 327; Minnesota, 3,700; and North Dakota, 684, for 5,766 estimated total units. Not very many in the context of a 0.01 U-factor stringency increase.

Suppliers of windows, contractors, and building departments in central MN should not have to worry about potential confusion and conflict due to slightly different requirements for windows when the difference is only 0.01 in U-factors.

Note that in the 2021 IECC-R windows in CZ 3 - CZ 8 all had to have a 0.30 U-factor. Since the requirements were the same for CZ 6 - CZ 8 then it should be okay to have them the same now, particularly given the benefit to the efficient workings of the market, construction, and code administration.

Cost Impact: The code change proposal will decrease the cost of construction.
There may be some cost savings for the slightly less stringent window products, but it may not be enough to brag about.

Workgroup Recommendation

Proposal # 1088

RED1-199-22

Proponents: Jennifer Hatfield, representing Fenestration & Glazing Industry Alliance (formerly AAMA) (jen@jhatfieldandassociates.com)

2024 International Energy Conservation Code [RE Project]

TABLE R402.1.2 MAXIMUM ASSEMBLY U-FACTORS[a] AND FENESTRATION REQUIREMENTS

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 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 0.28.

e. 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*.

f. Roofs with insulation entirely above deck shall comply with Section C402.2.1 and the Group R U-factors of Table C402.1.2.

g. F-factors for heated slabs correspond to the configuration described by footnote (d) of Table R402.1.3

Revise as follows:

TABLE R402.1.3 INSULATION MINIMUM R-VALUES AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	0	1	2	3	4 except Marine	5 and Marine 4	6	7 and 8
FENESTRATION U-FACTOR[b, i]	0.50	0.50	0.40	0.30	0.30	0.28 [h]	0.28 [h]	0.27 [h]
SKYLIGHT[b] *U*-FACTOR	0.60	0.60	0.60	0.53	0.53	0.50	0.50	0.50
GLAZED FENESTRATION SHGC[b, e]	0.25	0.25	0.25	0.25	0.40	NR	NR	NR
CEILING *R*-VALUE[i]	30	30	38	38	49	49	49	49
WOOD FRAME WALL R-VALUE[g]	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[h]	3/4	3/4	4/6	8/13	8/13	13/17	15/20	19/21
FLOOR *R*-VALUE[h, i]	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[c, g] WALL *R*-VALUE	0	0	0	5ci or 13[f]	10ci or 13	15ci or 19 or 13&5ci	15ci or 19 or 13&5ci	15ci or 19 or 13& 5ci
SLAB[d] R-VALUE & DEPTH	0	0	0	10ci, 2 ft	10ci, 4 ft	10ci, 4 ft	10ci, 4 ft	10ci, 4 ft
CRAWL SPACE[c, g] WALL R-VALUE	0	0	0	5ci or 13[f]	10ci or 13	15ci or 19 or 13&5ci	15ci or 19 or 13&5ci	15ci or 19 or 13&5ci

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. 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 0.28.

c. “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.

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

f. 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.

g. 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.

h. A maximum *U*-factor of 0.3 0~~2~~ shall apply in Marine Climate Zone 4 and Climate Zones 5~~3~~ through 8 to vertical fenestration products installed in buildings located either:

1. Above 4,000 feet in elevation, or
2. In windborne debris regions where protection of openings is required by Section R301.2.1.2 of the *International Residential Code*.

i. Roofs with insulation entirely above deck shall comply with Section C402.2.1 and the Group R R-values of Table C402.1.2.
j. "30 or 19+7.5ci or 20ci" means R30 cavity insulation alone or R19 cavity insulation with R7.5 continuous insulation or R20 continuous insulation alone.

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TABLE N1102.1.2 MAXIMUM ASSEMBLY U-FACTORS[a] AND FENESTRATION REQUIREMENTS

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 R402.2.5. 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 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 0.28.

e. 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.

f. Roofs with insulation entirely above deck shall comply with Section C402.2.1 and the Group R U-factors ofTable C402.1.2.

g. F-factors for heated slabs correspond to the configuration described by footnote (d) of Table R402.1.3.

Revise as follows:

TABLE N1102.1.3 INSULATION MINIMUM R-VALUES AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

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. 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 0.28.
c. “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.
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. Basement wall insulation shall not be required in Warm Humid locations as defined by Figure N1101.7 and Table N1101.7.
f. 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.
g. Mass walls shall be in accordance with Section N1102.2.6. The second *R*-value applies where more than half of the insulation is on the interior of the mass wall.
h. A maximum *U*-factor of 0.30~~2~~ shall apply in Marine Climate Zone 4 and Climate Zones 5~~3~~ through 8 to vertical fenestration products installed in buildings located either:

   1. Above 4,000 feet in elevation, or
   2. In windborne debris regions where protection of openings is required by Section R301.2.1.2.
i. Roofs with insulation entirely above deck shall comply with Section C402.2.1 and the Group R R-values of Table C402.1.2.
j. "30 or 19+7.5ci or 20ci" means R30 cavity insulation alone or R19 cavity insulation with R7.5 continuous insulation or R20 continuous insulation alone.

Reason: This public comment is errata as it simply addresses what we believe was an error in Public Comment Draft #1. It simply aligns with the consensus proposal, REPI-28, that was adopted during the first round by making edits to the following footnotes:

- Table R402.1.3, footnote h – the consensus agreement that passed changed this from 0.32 to 0.30 and it should be for CZs Marine 4 and 5-8 (matching the same change to Table R402.1.2, footnote e).
- This same error is in Table N1102.1.3, footnote h of the IRC, Chapter 11 document and the fix aligns with Table N1102.1.2, footnote e.

The proposal includes both Tables to show how this errata provides for consistency between table footnotes.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
Simply fixing what we believe to be a publishing error in PC Draft #1.

Workgroup Recommendation

RED1-200-22

Proponents: Gayathri Vijayakumar, representing Steven Winter Associates, Inc. (gvijayakumar@swinter.com)

2024 International Energy Conservation Code [RE Project]

SECTION R402
BUILDING THERMAL ENVELOPE

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 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.

Revise as follows:

TABLE R402.1.2 MAXIMUM ASSEMBLY U-FACTORS[a] AND FENESTRATION REQUIREMENTS

CLIMATE ZONE	0	1	2	3	4 except Marine	5 and Marine 4	6	7 and 8
FENESTRATION U-FACTOR	0.50	0.50	0.40	0.30	0.30	0.28[e]	0.28[e]	0.27[e]
SKYLIGHT[d] *U*-FACTOR	0.60	0.60	0.60	0.53	0.53	0.50	0.50	0.50
GLAZED FENESTRATION SHGC[d]	0.25	0.25	0.25	0.25	0.40	NR	NR	NR
CEILING *U*-FACTOR[f]	0.035	0.035	0.030	0.030	0.026	0.026	0.026	0.026
WOOD FRAME WALL *U*-FACTOR	0.084	0.084	0.084	0.060	0.045[h]	0.045[h]	0.045	0.045
MASS WALL U-FACTOR[b]	0.197	0.197	0.165	0.098	0.098	0.082	0.060	0.057
FLOOR *U*-FACTOR	0.064	0.064	0.064	0.047	0.047	0.033	0.033	0.028
BASEMENT WALL *U*-FACTOR	0.360	0.360	0.360	0.091[c]	0.059	0.050	0.050	0.050
UNHEATED SLAB F-FACTOR	0.73	0.73	0.73	0.54	0.54	0.54	0.48	0.48
HEATED SLAB F-FACTOR[g]	1.03	1.03	1.03	0.77	0.68	0.68	0.68	0.68
CRAWL SPACE *U*-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 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 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 0.28.

e. 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*.

f. Roofs with insulation entirely above deck shall comply with Section C402.2.1 and the Group R U-factors of Table C402.1.2.

g. F-factors for heated slabs correspond to the configuration described by footnote (d) of Table R402.1.3

h. A maximum *U*-factor of 0.060 shall be permitted for wood frame walls in *buildings* in Climate Zones 4 and 5 using the Prescriptive Compliance Option (R401.2.1), 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 R408.2.2.
2. All installed water heaters are heat pumps that meet one of the efficiencies in 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 R408.2.7.

SECTION R408
ADDITIONAL EFFICIENCY REQUIREMENTS

R408.1 Scope. This section establishes additional efficiency credits to achieve additional energy efficiency in accordance with Section R401.2.5.

R408.2 Additional energy efficiency credit requirements . Two of the additional measures shall be selected from Table R408.2 that meet or exceed a total of ten credits. Five additional credits shall be selected for dwelling units with greater than 5,000 square feet (465 m^2) of living space floor area located above grade plane. Each measure selected shall meet the relevant subsections of Section R408 and receive credit as specified in Table R408.2 for the specific Climate Zone. Interpolation of credits between measures shall not be permitted.

Delete without substitution:

~~**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 frame 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 R408.2.2.~~
2. ~~All installed water heaters are heat pumps that meet one of the efficiencies in 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 R408.2.7.~~

Reason: This public comment does not change any technical requirements. It proposes to move the opaque wall option out of R408 to the more appropriate location: a footnote to the U-factor table.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
None

Bibliography: None

Workgroup Recommendation

Proposal # 1149

RED1-201-22

Proponents: Robert Salcido, representing DOE (victor.salcido@pnnl.gov)

2024 International Energy Conservation Code [RE Project]

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 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.

Revise as follows:

TABLE R402.1.2 MAXIMUM ASSEMBLY U-FACTORS[a] AND FENESTRATION REQUIREMENTS

CLIMATE ZONE	0	1	2	3	4 except Marine	5 and Marine 4	6	7 and 8
FENESTRATION U-FACTOR	0.50	0.50	0.40	0.30	0.30	0.28[e]	0.28[e]	0.27[e]
SKYLIGHT[d] *U*-FACTOR	0.60	0.60	0.60	0.53	0.53	0.50	0.50	0.50
GLAZED FENESTRATION SHGC[d]	0.25	0.25	0.25	0.25	0.40	NR	NR	NR
CEILING *U*-FACTOR[f]	0.035	0.035	~~0.030~~ 0.026	~~0.030~~ 0.026	~~0.026~~ 0.024	~~0.026~~ 0.024	~~0.026~~ 0.024	~~0.026~~ 0.024
WOOD FRAME WALL *U*-FACTOR	0.084	0.084	0.084	0.060	0.045	0.045	0.045	0.045
MASS WALL U-FACTOR[b]	0.197	0.197	0.165	0.098	0.098	0.082	0.060	0.057
FLOOR *U*-FACTOR	0.064	0.064	0.064	0.047	0.047	0.033	0.033	0.028
BASEMENT WALL *U*-FACTOR	0.360	0.360	0.360	0.091[c]	0.059	0.050	0.050	0.050
UNHEATED SLAB F-FACTOR	0.73	0.73	0.73	0.54	0.54	0.54	0.48	0.48
HEATED SLAB F-FACTOR[g]	1.03	1.03	1.03	0.77	0.68	0.68	0.68	0.68
CRAWL SPACE *U*-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 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 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 0.28.

e. 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*.

f. Roofs with insulation entirely above deck shall comply with Section C402.2.1 and the Group R U-factors of Table C402.1.2.

g. F-factors for heated slabs correspond to the configuration described by footnote (d) of Table R402.1.3

R402.1.3 R-value alternative. Assemblies with *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. *R*-values of insulation materials for the assemblies specified in Appendix RF that have a *U*-factor less than or equal to the *U*-factor required by Table R402.1.2 shall be permitted

Revise as follows:

TABLE R402.1.3 INSULATION MINIMUM R-VALUES AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	0	1	2	3	4 except Marine	5 and Marine 4	6	7 and 8
FENESTRATION U-FACTOR[b, i]	0.50	0.50	0.40	0.30	0.30	0.28 [h]	0.28 [h]	0.27 [h]
SKYLIGHT[b] U-FACTOR	0.60	0.60	0.60	0.53	0.53	0.50	0.50	0.50
GLAZED FENESTRATION SHGC[b, e]	0.25	0.25	0.25	0.25	0.40	NR	NR	NR
CEILING *R*-VALUE[i]	30	30	~~38~~ 49	~~38~~ 49	~~49~~ 60	~~49~~ 60	~~49~~ 60	~~49~~ 60
WOOD FRAME WALL R-VALUE[g]	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[h]	3/4	3/4	4/6	8/13	8/13	13/17	15/20	19/21
FLOOR *R*-VALUE[h, i]	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[c, g] WALL *R*-VALUE	0	0	0	5ci or 13[f]	10ci or 13	15ci or 19 or 13&5ci	15ci or 19 or 13&5ci	15ci or 19 or 13& 5ci
SLAB[d] R-VALUE & DEPTH	0	0	0	10ci, 2 ft	10ci, 4 ft	10ci, 4 ft	10ci, 4 ft	10ci, 4 ft
CRAWL SPACE[c, g] WALL R-VALUE	0	0	0	5ci or 13[f]	10ci or 13	15ci or 19 or 13&5ci	15ci or 19 or 13&5ci	15ci or 19 or 13&5ci

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. 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 0.28.

c. “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.

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

f. 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.

g. 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.

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

i. Roofs with insulation entirely above deck shall comply with Section C402.2.1 and the Group R R-values of Table C402.1.2.

j. "30 or 19+7.5ci or 20ci" means R30 cavity insulation alone or R19 cavity insulation with R7.5 continuous insulation or R20 continuous insulation alone.

Reason: The ceiling insulation requirements, as proposed for the 2024 IECC, represent a net decrease in energy efficiency.
The proposed ceiling insulation values in climate zones 2 through 8 regress relative to those specified in the 2021 IECC, which stands as the current model energy code for residential buildings under federal law. The U.S. Department of Energy evaluates the energy savings and cost-effectiveness of updated model codes, and found the 2021 IECC to be cost effective across all U.S. climates. See Pacific Northwest National Laboratory (PNNL) analysis, *National Cost-Effectiveness of the Residential Provisions of the 2021 IECC* (https://www.energycodes.gov/sites/default/files/2021-07/2021IECC_CostEffectiveness_Final_Residential.pdf).

Ceiling insulation levels of R49 and R60 are both technologically feasible and included in the package of cost-effective measures approved via the ICC code development process and included in the current 2021 IECC.

The original REPI-033 proposal specified additional energy credits in exchange for the weakened ceiling insulation requirements. Options presented included additional energy efficiency options, such as reduced envelope air leakage, as well as options for higher efficiency HVAC equipment or renewable energy. DOE cautions against this practice, emphasizing that energy efficiency and decarbonization technologies are uniquely different, and the critical importance of measure lifetimes in considering tradeoffs between various measures. An all-of-the-above strategy is needed to optimize building energy consumption toward the goal of reducing energy intensity and decarbonizing homes and commercial buildings, built on a basis which maximizes cost-effective energy efficiency. Cost-effective energy efficiency measures should not be traded when calculating equivalent energy use, including through whole-building performance approaches.

In evaluating REPI-033, PNNL finds the weakened ceiling insulation requirements increase energy use and reduce energy efficiency for homes in climate zones 2 through 8. Energy simulation and analysis results indicate national average increase in residential building energy use of 0.43 percent (2024 IECC, as proposed, compared to 2021 IECC ceiling insulation levels). Expected impacts by climate zone are shown in the tables below.

DOE recommends returning the proposed ceiling insulation values back to the levels specified in the 2021 IECC.

Table R402.1.3 Insulation Minimum R-Values and Fenestration Requirements by Component

	0	1	2	3	4 except Marine	5 and Marine 4	6	7 and 8
2018 IECC Ceiling R-Value	30	30	38	38	49	49	49	49
2021 IECC Ceiling R-Value	30	30	49	49	60	60	60	60
2024 IECC Ceiling R-Value	30	30	49	49	60	60	60	60
2024 IECC Ceiling U-Factor	0.035	0.035	0.030	0.026	0.026	0.026	0.026	0.026

Relative Energy/Cost Savings of 2024 IECC compared to the 2021 IECC by Climate Zone (percent)

Climate Zone	Weight (%)	Site EUI (%)	Source EUI (%)	Energy Cost (%)	CO_2 Emissions (%)
1	4.3	0	0	0	0
2	22.43	-0.42	-0.36	-0.34	-0.34
3	29.04	-0.56	-0.45	-0.42	-0.43
4	19.49	-0.35	-0.26	-0.24	-0.24
5	19.51	-0.44	-0.32	-0.29	-0.29
6	4.68	-0.43	-0.34	-0.31	-0.31
7	0.53	-0.49	-0.39	-0.37	-0.37
8	0.02	-0.51	-0.43	-0.40	-0.41
National	**100**	**-0.43**	**-0.34**	**-0.32**	**-0.32**

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
No Cost Impact

Workgroup Recommendation

RED1-202-22

Proponents: Robert Schwarz, representing BUILDTank, Inc. (robby@btankinc.com)

2024 International Energy Conservation Code [RE Project]

Add new definition as follows:

FULL SLAB INSULATION.. Continuous Insulation installed under the entire area of the slab-on-grade floor except at structural column locations and service penetrations in addition to installed insulation up the perimeter slab edge.

PERIMETER SLAB EDGE INSULATION. . Continuous insulation applied only at the perimeter of a slab on grade floor that fully covers the slab height and either extends vertically at the perimeter from top of slab or stem wall to a specified depth or horizontally inward or outward from the slab edge, or a combination of both.

Revise as follows:

TABLE R402.1.2 MAXIMUM ASSEMBLY U-FACTORS[a] AND FENESTRATION REQUIREMENTS

Portions of table not shown remain unchanged.

CLIMATE ZONE	0	1	2	3	4 except Marine	5 and Marine 4	6	7 and 8
FENESTRATION U-FACTOR	0.50	0.50	0.40	0.30	0.30	0.28[e]	0.28[e]	0.27[e]
SKYLIGHT[d] *U*-FACTOR	0.60	0.60	0.60	0.53	0.53	0.50	0.50	0.50
GLAZED FENESTRATION SHGC[d]	0.25	0.25	0.25	0.25	0.40	NR	NR	NR
CEILING *U*-FACTOR[f]	0.035	0.035	0.030	0.030	0.026	0.026	0.026	0.026
WOOD FRAME WALL *U*-FACTOR	0.084	0.084	0.084	0.060	0.045	0.045	0.045	0.045
MASS WALL U-FACTOR[b]	0.197	0.197	0.165	0.098	0.098	0.082	0.060	0.057
FLOOR *U*-FACTOR	0.064	0.064	0.064	0.047	0.047	0.033	0.033	0.028
BASEMENT WALL *U*-FACTOR	0.360	0.360	0.360	0.091[c]	0.059	0.050	0.050	0.050
UNHEATED SLAB PERIMETER F-FACTOR	0.73	0.73	0.73	0.54	0.54	0.54	0.48	0.48
HEATED FULL SLAB F-FACTOR[g]	1.03	1.03	1.03	0.77	0.68	0.68	0.68	0.68
CRAWL SPACE *U*-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 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 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 0.28.

e. 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*.

f. Roofs with insulation entirely above deck shall comply with Section C402.2.1 and the Group R U-factors of Table C402.1.2.

g. F-factors for heated slabs correspond to the configuration described by footnote (d) of Table R402.1.3

TABLE R402.1.3 INSULATION MINIMUM R-VALUES AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	0	1	2	3	4 except Marine	5 and Marine 4	6	
FENESTRATION U-FACTOR[b, i]	0.50	0.50	0.40	0.30	0.30	0.28 [h]	0.28 [h]	
SKYLIGHT[b] *U*-FACTOR	0.60	0.60	0.60	0.53	0.53	0.50	0.50	
GLAZED FENESTRATION SHGC[b, e]	0.25	0.25	0.25	0.25	0.40	NR	NR	
CEILING *R*-VALUE[i]	30	30	38	38	49	49	49	
WOOD FRAME WALL R-VALUE[g]	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 c 13&1
MASS WALL R-VALUE[h]	3/4	3/4	4/6	8/13	8/13	13/17	15/20	
FLOOR *R*-VALUE[h, j]	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 o
BASEMENT[c, g] WALL *R*-VALUE	0	0	0	5ci or 13[f]	10ci or 13	15ci or 19 or 13&5ci	15ci or 19 or 13&5ci	15ci
UNHEATED SLAB PERIMETER R-VALUE & DEPTH [d]	0	0	0	10ci, 2 ft	10ci, 4 ft	10ci, 4 ft	10ci, 4 ft	10ci, 4
HEATED FULL SLAB R-VALUE & Depth [e]	R-5ci Perimeter edge and R-5ci full slab	R5ci Perimeter edge and R5ci full slab	R5ci Perimeter edge and R5ci full slab	R-10ci Perimeter edge 2ft and R-5ci full slab	R-10ci Perimeter edge 3ft and R-5ci fullslab	R-10ci Perimeter edge 3ft and R-5ci fullslab	R-10ci Perimeter edge 4ft and R-5ci full slab	R-10ci P 4ft and slab
CRAWL SPACE[c, g] WALL R-VALUE	0	0	0	5ci or 13[f]	10ci or 13	15ci or 19 or 13&5ci	15ci or 19 or 13&5ci	15ci o

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. 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 0.28.

c. “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.

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

f. 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.

g. 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.

h. 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

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

i. Roofs with insulation entirely above deck shall comply with Section C402.2.1 and the Group R R-values of Table C402.1.2.

j. "30 or 19+7.5ci or 20ci" means R30 cavity insulation alone or R19 cavity insulation with R7.5 continuous insulation or R20 continuous insulation alone.

R402.2.10 Slab-on-grade floors. Slab-on-grade floors, in contact with the ground, with a floor surface within 24 inches (600 mm) above or below grade shall be insulated in accordance with 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.

Revise as follows:

R402.2.10.1 Slab-on-grade floor insulation installation. Slab on grade floor insulation shall comply with the following:

1. When *perimeter slab edge insulation* is installed on slab on grade floors it shall be continuous and installed to separate conditioned from unconditioned spaces including but not limited to adjacent garages, entries, and porches slabs.
2. Where *perimeter slab edge insulation* is installed, it 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 extend past the footing depth in accordance with Section R403.1.4 of the International Residential Code. *Perimeter slab edge insulation* shall not be required to extend below the bottom of the slab when *full slab insulation* is in contact and continuous alignment with the *Perimeter slab edge insulation* or insulation extends horizontally away from the building 4 feet and is protected by pavement or by not less than 10 inches (254 mm) of soil. Alternatively, horizontal insulation may extend under the slab from the *perimeter slab edge insulation* in ward 4 feet and be protected by the slab itself. The top edge of *perimeter slab edge 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.*
3. Where installed, under a heated or unheated slab *full slab insulation* shall be continuous under the entire area of the slab-on-grade floor, except at structural column locations and service penetrations. *Perimeter slab edge insulation* shall be installed in contact and continuous alignment with the *full slab insulation.*
4. Alternatively, a proposed design for slab insulation R-value and installation shall comply with either Table R402.1.2, Section R402.1.5, or Sections R405 or R406 and the slab on grade floor insulation installation requirements of Section R402.2.10.1.

~~Where installed, the insulation shall extend downward from the top of the slab on the outside or inside of the foundation wall. Insulation located below grade shall be extended the distance provided in Table R402.1.3 or the distance of the proposed design, as applicable, by any combination of vertical insulation, insulation extending 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.*~~

Reason: The terms Full slab and perimeter slab edge insulation have been introduced to the IECC from ASHRAE 90.1 Appendix A as Table R402.1.2 and R402.1.3 now recognize F-factor developed in the ASHRAE 90.1 Appendix. There was an assumption users of the code understood the new terminology when in reality it was not understood. For example, it was not understood that “Full Slab insulation” meant insulation under the slab on grade and included slab edge perimeter insulation. These terms have been defined to ensure common understanding of the terms and application.
This proposal addresses confusion regarding the installation of both under slab and slab edge insulation now that tables R402.1.2 and R402.1.3 specifically call out full slab insulation and perimeter slab edge insulation.

Insulation installation requirements in Section R402.2.10.1 have been broken out to demonstrate allowed alternative installations and tradeoffs. Most of the language has not been changed, rather is has be organized to make it more understandable for those charged with implementing the requirements.

Cost Impact: The code change proposal will increase the cost of construction.
This proposal does not change any of the requirements of this section. However it does make it clear that a thermal break does need to be installed between adjacent slabs. I believe this is required now but is not enforced and therefore I believe it will raise the cost of construction. This proposal

also makes it more clear that slab edge insulation can be traded off which could reduce the cost of construction when using a performance compliance option.

Bibliography: See attached PDF documentation

Workgroup Recommendation

Proposal # 1328

RED1-203-22

Proponents: Jeremy Wright, representing J Wright Building Company (jeremy@jwrightbuildingcompany.com); Maston Stafford, representing US-EcoLogic, Inc. (maston.stafford@texenergy.org); Aaron Gary, representing Tempo, Inc. (aaron.gary@texenergy.org); Gayathri Vijayakumar, representing Steven Winter Associates, Inc. (gvijayakumar@swinter.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

TABLE R402.1.2 MAXIMUM ASSEMBLY U-FACTORS[a] AND FENESTRATION REQUIREMENTS

Portions of table not shown remain unchanged.

CLIMATE ZONE	0	1	2	3	4 except Marine	5 and Marine 4	6	7 and 8
UNHEATED SLAB F-FACTOR[h]	0.73	0.73	0.73	0.54	0.54	0.54	0.48	0.48

For SI: 1 foot = 304.8 mm.

h. A maximum *F*-factor of 0.73 shall apply in jurisdictions designated by the *code official* as having a very heavy termite infestation.

TABLE R402.1.3 INSULATION MINIMUM R-VALUES AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

Portions of table not shown remain unchanged.

CLIMATE ZONE	**0**	**1**	**2**	**3**	**4 except Marine**	**5 and Marine 4**	**6**	**7 and 8**
SLAB[d], [e] R-VALUE & DEPTH	0	0	0	10ci, 2 ft	10ci, 4 ft	10ci, 4 ft	10ci, 4 ft	10ci, 4 ft

For SI: 1 foot = 304.8 mm.

NR = Not Required.
ci = continuous insulation.

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

Reason: This proposal adds a new footnote to Table R402.1.2 and Table R402.1.3 to coordinate with existing Section R402.2.10 addressing slab-edge insulation in areas with very heavy termite infestation.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
The change coordinates the table with the prescriptive provisions for slab insulation. The improved clarity may lead to cost savings.

Workgroup Recommendation

Proposal # 998

RED1-204-22

Proponents: Greg Johnson, representing National Multifamily Housing Council (gjohnsonconsulting@gmail.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

TABLE R402.1.2 MAXIMUM ASSEMBLY U-FACTORS[a] AND FENESTRATION REQUIREMENTS

Portions of table not shown remain unchanged.

CLIMATE ZONE	0	1	2	3	4 except Marine	5 and Marine 4	6	7 and 8
FENESTRATION U-FACTOR	0.50	0.50	0.40	0.30	0.30	0.28[e]	0.28[e]	0.27[e]
SKYLIGHT[d] *U*-FACTOR	0.60	0.60	0.60	0.53	0.53	0.50	0.50	0.50
GLAZED FENESTRATION SHGC[d]	0.25	0.25	0.25	0.25	0.40	NR	NR	NR

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 fenestration *U*-factor ~~column~~ row excludes skylights other than skylights in Climate Zones 0 through 3 that have a SHGC of 0.28 or less. The SHGC ~~column~~ row 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 0.28~~.

e. 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*.

f. Roofs with insulation entirely above deck shall comply with Section C402.2.1 and the Group R U-factors of Table C402.1.2.

g. F-factors for heated slabs correspond to the configuration described by footnote (d) of Table R402.1.3

Reason: Footnotes should not contain requirements, they should be explanatory. Since there should be no requirements in footnotes there should be no exceptions. There are no columns for fenestration u-factors or SHGC; there are rows.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
No change in requirements.

Workgroup Recommendation

Proposal # 1083

RED1-205-22

Proponents: Greg Johnson, representing National Multifamily Housing Council (gjohnsonconsulting@gmail.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

TABLE R402.1.3 INSULATION MINIMUM R-VALUES AND FENESTRATION REQUIREMENTS BY COMPONENT[a]
Portions of table not shown remain unchanged.

CLIMATE ZONE	0	1	2	3	4 except Marine	5 and Marine 4	6	7 and 8
FLOOR *R*-VALUE[h, j]	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~~

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. 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 0.28.

c. “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.
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. Basement wall insulation is not required in Warm Humid locations as defined by Figure R301.1 and Table R301.1.
f. 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.
g. 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.
h. 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
   2. In windborne debris regions where protection of openings is required by Section R301.2.1.2 of the *International Residential Code*.
i. Roofs with insulation entirely above deck shall comply with Section C402.2.1 and the Group R R-values of Table C402.1.2.
j. "30 or 19+7.5ci or 20ci" means R30 cavity insulation alone or R19 cavity insulation with R7.5 continuous insulation or R20 continuous insulation alone.

R402.2.8 Floors. Floor *insulation* shall comply with one 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.
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.
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 *R*-values of the cavity and continuous insulation components ~~or the R-value of continuous insulation only~~ shall equal the required insulation component *R*-values for floors. Cavity insulation shall extend from the bottom to the top of all perimeter floor framing members and the framing members shall be air sealed.

Reason: It's hard to imagine a better recipe for uncontrolled fire spread from the exterior to concealed spaces of a wood frame building than horizontally placed foam plastic insulation immediately below unfilled cavities between joists.
There needs to be more fully developed requirements for the protection of concealed floor spaces if the bottom surface of the assembly can be

foam plastic. The original proponent of 'ci only' should bring back the fire blocking, fire suppression, or thermal barriers that will permit this application to be fire safe.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
Alternative compliance methods are available that should not cost more.

Workgroup Recommendation

Proposal # 1084

RED1-206-22

Proponents: Greg Johnson, representing National Multifamily Housing Council (gjohnsonconsulting@gmail.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

TABLE R402.1.3 INSULATION MINIMUM R-VALUES AND FENESTRATION REQUIREMENTS BY COMPONENT[a]
Portions of table not shown remain unchanged.

CLIMATE ZONE	<u>0</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4 except Marine</u>	<u>5 and Marine 4</u>	<u>6</u>	<u>7 and 8</u>
FLOOR *R*-VALUE[h, j]	13 or 7+5ci or 10ci[k]	13 or 7+5ci or 10ci[k]	13 or 7+5ci or 10ci[k]	19 or 13+5ci or 15ci[k]	19 or 13+5ci or 15ci[k]	30 or 19+7.5ci or 20ci[k]	30 or 19+7.5ci or 20ci[k]	38 or 19+10ci or 25ci[k]

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. 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 0.28.

c. “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.

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

f. 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.

g. 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.

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

i. Roofs with insulation entirely above deck shall comply with Section C402.2.1 and the Group R R-values of Table C402.1.2.

j. "30 or 19+7.5ci or 20ci" means R30 cavity insulation alone or R19 cavity insulation with R7.5 continuous insulation or R20 continuous insulation alone.

<u>k. Thermal barriers are required for foam plastic continuous insulation by Section R316.3.2 of the *International Residential Code* and Section 306.4 of the *International Building Code*, as applicable.</u>

Reason: A layer of foam plastic on the exterior of a building is required to separated from the interior by a thermal barrier. Table R4092.1.3 should not imply otherwise, particularly for floors with concealed joist spaces; this is a critical fire-safety requirement.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This merely a pointer to other required measures; no new requirement is proposed.

Workgroup Recommendation

RED1-207-22

Proponents: Robert Schwarz, representing BUILDTank, Inc. (robby@btankinc.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

TABLE R402.1.2 MAXIMUM ASSEMBLY U-FACTORS[a] AND FENESTRATION REQUIREMENTS

CLIMATE ZONE	0	1	2	3	4 except Marine	5 and Marine 4	6	7 and 8
FENESTRATION U-FACTOR	0.50	0.50	0.40	0.30	0.30	0.28[e]	0.28[e]	0.27[e]
SKYLIGHT[d] *U*-FACTOR	0.60	0.60	0.60	0.53	0.53	0.50	0.50	0.50
GLAZED FENESTRATION SHGC[d]	0.25	0.25	0.25	0.25	0.40	NR	NR	NR
CEILING *U*-FACTOR[f]	0.035	0.035	0.030	0.030	0.026	0.026	0.026	0.026
WOOD FRAME WALL *U*-FACTOR [h]	0.084	0.084	0.084	0.060	0.045	0.045	0.045	0.045
MASS WALL U-FACTOR[b]	0.197	0.197	0.165	0.098	0.098	0.082	0.060	0.057
FLOOR *U*-FACTOR	0.064	0.064	0.064	0.047	0.047	0.033	0.033	0.028
BASEMENT WALL *U*-FACTOR	0.360	0.360	0.360	0.091[c]	0.059	0.050	0.050	0.050
UNHEATED SLAB F-FACTOR	0.73	0.73	0.73	0.54	0.54	0.54	0.48	0.48
HEATED SLAB F-FACTOR[g]	1.03	1.03	1.03	0.77	0.68	0.68	0.68	0.68
CRAWL SPACE *U*-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 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 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 0.28.

e. 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*.

f. Roofs with insulation entirely above deck shall comply with Section C402.2.1 and the Group R U-factors of Table C402.1.2.

g. F-factors for heated slabs correspond to the configuration described by footnote (d) of Table R402.1.3

h. The stated U-factor requirements applies to all above grade wood framed walls that provide a boundary between conditioned space and unconditioned space, including attic knee walls, walls between the house and garage, etc.

TABLE R402.1.3 INSULATION MINIMUM R-VALUES AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	0	1	2	3	4 except Marine	5 and Marine 4	6	7 and 8
FENESTRATION U-FACTOR[b, i]	0.50	0.50	0.40	0.30	0.30	0.28 [h]	0.28 [h]	0.27 [h]
SKYLIGHT[b] *U*-FACTOR	0.60	0.60	0.60	0.53	0.53	0.50	0.50	0.50
GLAZED FENESTRATION SHGC[b, e]	0.25	0.25	0.25	0.25	0.40	NR	NR	NR
CEILING *R*-VALUE[i]	30	30	38	38	49	49	49	49
WOOD FRAME WALL R-VALUE[g]	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[h]	3/4	3/4	4/6	8/13	8/13	13/17	15/20	19/21
FLOOR *R*-VALUE[h, j]	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[c, g] WALL *R*-VALUE	0	0	0	5ci or 13[f]	10ci or 13	15ci or 19 or 13&5ci	15ci or 19 or 13&5ci	15ci or 19 or 13& 5ci
SLAB[d] R-VALUE & DEPTH	0	0	0	10ci, 2 ft	10ci, 4 ft	10ci, 4 ft	10ci, 4 ft	10ci, 4 ft
CRAWL SPACE[c, g] WALL R-VALUE	0	0	0	5ci or 13[f]	10ci or 13	15ci or 19 or 13&5ci	15ci or 19 or 13&5ci	15ci or 19 or 13&5ci

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. 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 0.28.

c. "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.

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

f. 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.

g. 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. <u>The stated R-value requirements applies to all above grade wood framed walls that provide a boundary between conditioned space and unconditioned space, including attic knee walls, walls between the house and garage, etc.</u>

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

i. Roofs with insulation entirely above deck shall comply with Section C402.2.1 and the Group R R-values of Table C402.1.2.

j. "30 or 19+7.5ci or 20ci" means R30 cavity insulation alone or R19 cavity insulation with R7.5 continuous insulation or R20 continuous insulation alone.

Reason: In the field we often see knee walls, wall separating conditioned space from garages and other exterior above grade wood framed wall assemblies not insulated in the same manner as the bulk of the exterior above grade wood framed wall. This small footnote helps to clarify that the wood framed wall U-factor and R-value are establishing for all exterior above grade wood framed walls not

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
The clarity created by this proposed footnote does not increase the cost of construction as the requirements have not changed. Rather implementation in the field and inspection enforcement will improve.

Workgroup Recommendation

Proposal # 1008

RED1-208-22

Proponents: Maston Stafford, representing US-EcoLogic, Inc. (maston.stafford@texenergy.org); Aaron Gary, representing Tempo, Inc. (aaron.gary@texenergy.org); Gayathri Vijayakumar, representing Steven Winter Associates, Inc. (gvijayakumar@swinter.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R402.1.5 Component performance alternative. Where the proposed total *building thermal envelope* thermal conductance TC is less than or equal to the required total *building thermal envelope* thermal conductance TC using factors in Table R402.1.2 the *building* shall be considered to be in compliance with Table R402.1.2. The total thermal conductance shall be determined in accordance with Equation 4-1. Proposed *U*-factors and slab-on-grade *F*-factors shall be taken from 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. In addition to total thermal conductance TC compliance, the SHGC requirements of Table R402.1.2 and the maximum fenestration *U*-factors of Section R402.6 shall be met.

Equation 4-1

$$(\mathrm{Up\ A} + \mathrm{Fp\ P}) \leq (\mathrm{Ur\ A} + \mathrm{Fr\ P})$$

Up A = the sum of proposed *U*-factors times the assembly areas in the proposed building.
Fp P = the sum of proposed *F*-factors times the slab-on-grade perimeter lengths in the proposed building.
Ur A = the sum of *U*-factors in Table R402.1.2 times the same assembly areas as in the proposed building.
Fr P = the sum of *F*-factors in Table R402.1.2 times the same slab-on-grade perimeter lengths as in the proposed building.

R405.2 Simulated performance compliance. Compliance based on total building performance requires that a *proposed design* meets all of the following:

1. The requirements of the sections indicated within Table R405.2.
2. The proposed total *building thermal envelope* thermal conductance TC~~UA, which is the sum of the U-factor times assembly area,~~ shall be less than or equal to the required total *building thermal envelope* thermal conductance TC~~UA~~ 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.

   For Climate Zones 0-2: TC~~UA~~ $_{\text{Proposed Design}}$ ≤ 1.08 × TC~~UA~~ $_{\text{Prescriptive reference design}}$ **(Equation 4-2)**
   For Climate Zones 3-8: TC~~UA~~ $_{\text{Proposed Design}}$ ≤ 1.15 × TC~~UA~~ $_{\text{Prescriptive reference design}}$

3. For buildings without a fuel burning appliance for space heating or water heating, the annual energy cost of the proposed design that is less than or equal to 85 percent of the annual energy cost of the *standard reference design*. For buildings with a fuel burning appliance for space heating or water heating, the annual energy cost of the proposed design that is less than or equal to 80 percent of the annual energy cost of the standard reference design. For dwelling units with greater than 5,000 square feet (465 m^2) of living space floor area located above grade plane, the annual energy cost of the proposed design shall be reduced by an additional 5 percent of annual energy cost of the standard reference design. Energy prices shall be taken from a source *approved* by the *code official*, such as the Department of Energy, 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 multipliers for all energy sources shall be obtained from ASHRAE Standard 105 (Tables K2, K4, or K8) or from another data source approved by the *code official*.
   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 for an all-electric building with on-site renewable energy installed.

R405.4.2 Residence specifications. The *standard reference design* and *proposed design* 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 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.

TABLE R405.4.2(1) SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS
Portions of table not shown remain unchanged.

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Foundations	Type: same as proposed.	As proposed
	Foundation wall area above and below grade and soil characteristics and slab-on-grade exposed perimeter lengths: same as proposed.	As proposed
	Foundation wall *U*-factor and slab-on-grade *F*-factor: as specified in Table R402.1.2.[l]	As proposed

For SI: 1 square foot = 0.93 m^2, 1 British thermal unit = 1055 J, 1 pound per square foot = 4.88 kg/m^2, 1 gallon (US) = 3.785 L, °C = (°F-32)/1.8, 1 degree = 0.79 rad.

l. A maximum *F*-factor of 0.73 shall apply in jurisdictions designated by the *code official* as having a very heavy termite infestation.

R406.3 Building thermal envelope. The proposed total *building thermal envelope* thermal conductance TC~~UA, which is sum of *U*-factor times assembly area,~~ shall be less than or equal to the required total *building thermal envelope* thermal conductance TC~~UA~~ 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 Climates Zones 3 through 8, in accordance with Equation 4-3 and Section R402.1.5. The area-weighted maximum fenestration SHGC permitted in Climate Zones 0 through 3 shall be 0.30.

For Climate Zones 0-2: $TC\cancel{UA}_{\text{Proposed design}} \le 1.08 \times TC\cancel{UA}_{\text{Prescriptive reference design}}$ **(Equation 4-3)**
For Climate Zones 3-8: $TC\cancel{UA}_{\text{Proposed design}} \le 1.15 \times TC\cancel{UA}_{\text{Prescriptive reference design}}$

Reason: Section R402.1.5 has changed from the UA alternative to a component performance alternative which includes the *F*-factor of a slab-on-grade foundation. This change to the prescriptive compliance path should also be included to sections R405 and R406 envelope requirements. With the inclusion of *F*-factors to slab-on-grade foundations in Table R402.1.2, then the foundation section of Table R405.4.2(1) needs to include these changes for the standard reference design. An interpretation could be made that because Table R405.4.2(1) does not specify slab-edge insulation for slab-on-grade foundation types, then the standard reference design will equal the proposed design slab-edge insulation or lack thereof. Hypothetically a building using the Simulated Building Performance compliance path in climate zones 3 through 8 built without slab-edge insulation would never have to compensate for the increased energy costs by lowering the U-factor of other assemblies because the simulation software would run both the proposed design and the standard reference design with no slab-edge insulation. Making this change to Table R405.4.2(1) and the changes we have made to Equation 4-2 of Section R405.2, this hypothetical becomes impossible.

A footnote was added to Table R405.4.2(1) to coordinate with existing Section R402.2.10 addressing slab-edge insulation in areas with very heavy termite infestation.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
These suggested changes only incorporate changes made in section R402.1.5 to other sections. There is no cost impact.

Workgroup Recommendation

Proposal # 1307

RED1-209-22

Proponents: Jay Crandell, representing Foam Sheathing Committee of the American Chemistry Council (jcrandell@aresconsulting.biz)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R402.2.10 Slab-on-grade floors. Slab-on-grade floors, in contact with the ground, with a floor surface within 24 inches (600 mm) above or below grade shall be insulated in accordance with Table R402.1.3. Where the slab is greater than 12 inches (305 mm) above grade, the insulation R-value requirement in Table R402.1.3 for the slab edge shall be increased to R-15ci for Climate Zones 4 through 8.

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

Reason: This proposal clarifies slab insulation requirements for the case where the slab edge extends more than 12 inches above grade which was the baseline used to determine the R-value requirements for slab edges. Slabs edges with greater height above grade will experience greater energy loss and also colder slab surface temperatures. The increase to R-15ci from R-10ci for Climate Zones 4-8 is less stringent than the requirement for above grade frame walls (e.g., R-0 + R-20ci) and is reasonably consistent on average with R-value requirements for above-grade mass walls in CZ 4-8.
In most cases, slabs that are more than 12-inches above grade will not be thickened edge monolithic slabs with perimeter footings (grade beams). Instead, they are more commonly and efficiently constructed with independent stem walls allowing the insulation to be placed vertically on the interior side of the stem wall to avoid complications with exterior above-grade wall detailing or other interfaces (such as at door thresholds). Because the code already allows the top of the interior vertical slab edge insulation to be cut at a 45deg taper it will also not interfere with the interface of the slab surface with the interior side of the above grade wall or interior floor perimeter.

Cost Impact: The code change proposal will increase the cost of construction.
There is no cost impact for typical slabs-on-grade that are located 8 inches to 12 inches above exterior finish grade. For those that exceed this limit which is the basis of the current R-value requirements for slab edge insulation, there will be an increase in cost but it will result in thermal performance more consistent with that intended by the code for slabs that meet the baseline requirement of 12 inches above grade that the code was based on.

Workgroup Recommendation

Proposal # 1332

RED1-210-22

Proponents: Shane Hoeper, representing myself (shoeper@cityofdubuque.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R402.2.10 Slab-on-grade floors. Slab-on-grade floors~~, in contact with the ground,~~ with a floor surface within 24 inches (600 mm) above or below grade shall be insulated in accordance with 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.

Reason: Slab on grade is by definition "in contact with the ground". The phrase is unnecessary.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
Grammar correction only.

Workgroup Recommendation

Proposal # 1139

RED1-211-22

Proponents: Jay Crandell, representing Foam Sheathing Committee of the American Chemistry Council (jcrandell@aresconsulting.biz)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R402.2.11.1 Crawl space wall insulation installation~~s~~. Where installed, c~~C~~rawl space wall insulation ~~shall comply with the following:~~

~~1.~~ ~~Where exterior crawl space wall insulation is installed, it~~ shall be secured ~~permanently attached~~ to the wall and extend downward from the sill plate to not less than the top ~~base~~ of the foundation wall footing.

~~2.~~ **Exception:** Where ~~interior~~ the crawl space wall insulation is installed on the interior side of the wall and the crawl space floor is more than 24 inches below the exterior grade, the crawl space wall insulation ~~it~~ shall be permitted to ~~permanently attached to the foundation wall and~~ 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 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.

Reason: This proposal is a clean-up of formatting and clarification of crawl space wall insulation installation requirements. These revisions also align better with the basis of the R-value requirements for crawl space walls. It also removes the word "permanently attached" and replaces it with "secured" to avoid situations where insulation is installed to be removable, such as done in accordance with some local requirements to allow for termite inspections.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This proposal is a clarification and does not change requirements in a way that should have any negative impact on construction cost. In fact, it may allow some flexibility through the clarifications that could reduce construction cost such as by the exception provided or by way of requiring insulation to be "secured" rather than "permanently attached".

Workgroup Recommendation

Proposal # 1335

RED1-212-22

Proponents: Greg Johnson, representing National Multifamily Housing Council (gjohnsonconsulting@gmail.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R402.2.3 Attic knee wall. Wood attic knee ~~Attic knee~~wall assemblies that separate conditioned space from unconditioned attic spaces shall comply with Table R402.1.3 for wood frame walls. ~~meet the same insulation requirements as above-grade 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 ~~Truss~~ 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 ~~meet the same insulation requirements as the~~ comply with Table R402.1.3 for wood frame walls ~~above-grade walls~~. Steel frame vertical roof truss framing members used to separate conditioned space and unconditioned space shall comply with Section R402.2.7.

Reason: These sections are imprecise and do not differentiate between wood and steel framing. The title of R402.2.3.1 is changed to differentiate between roof trusses and floor trusses.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
Mainly an editorial change.

Workgroup Recommendation

Proposal # 1090

RED1-213-22

Proponents: Alex Smith, representing NAHB (asmith@nahb.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R402.2.3 Attic knee wall. Attic knee wall assemblies that separate conditioned space from unconditioned attic spaces shall meet the same insulation requirements as above-grade walls. Such knee walls shall have an air barrier between conditioned an unconditioned space. <u>Where one added credit is obtained in addition to the minimum number of credits required in Section R408, the attic knee wall assembly minimum insulation requirements shall be R-13 in Climate Zones 0-3 and R-15 in Climate Zones 3-8.</u>

Reason: This proposal adds design flexibility. Constructing a knee wall assembly insulated to R20+5 or R-20 in the attic will be impractical for many attic design configurations. To offset the limited benefit of the added insulation in the attic buffer space, a requirement for one additional credit in Section R408 is included.

Cost Impact: The code change proposal will decrease the cost of construction.
The proposed code change would allow for selecting optimized design options.

Workgroup Recommendation

Proposal # 1128

RED1-214-22

Proponents: Michele DeFrance, representing City of Portland Maine (mdefrance@portlandmaine.gov)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

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^2).

   2.4. The perimeter of the hatch edge shall be weatherstripped.

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

Reason: This is language change (at the bottom, below the exceptions) to conform to the new section title for R402.1.5, previously called Total UA alternative, and now called component performance alternative.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This is a language change, with no cost, to provide conformance.

Workgroup Recommendation

Proposal # 1030

RED1-215-22

Proponents: Jay Crandell, representing Foam Sheathing Committee of the American Chemistry Council (jcrandell@aresconsulting.biz)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R402.2.7 Steel-frame ceilings, walls and floors. Steel-frame ceilings, walls, and floors shall comply with the *U*-factor requirements of Table R402.1.2. The calculation of the *U*-factor for a steel-framed ceilings and walls in an envelope assembly shall be permitted to be determined in accordance with AISI S250 ~~as modified herein~~. For wall assemblies, the application of AISI S250 shall comply with the following:

3.~~1.~~ Where ~~the steel-framed wall contains no cavity insulation, and uses~~ only the R-value of the continuous insulation component is used to ~~satisfy~~ determine the U-factor of a steel-framed wall in accordance with AISI S250, ~~maximum, the steel-framed wall member spacing is permitted to be installed at~~ any framing factor or on center spacing of framing members shall be permitted.

2. Where the steel-framed wall contains framing in addition to top and bottom tracks and studs at a specified spacing, ~~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 to determine the U-factor in accordance with ~~when calculating using~~ AISI S250 shall be based on the framing factor of the wall assembly as follows:~~.~~

   2.1 Framing factor of 0.12 or less, use 24 inches (610 mm) on center.

   2.2 Framing factor of 0.16 or less, use 16 inches (400 mm) on center.

   2.3 Framing factor of 0.20 or less, use 12 inches (305 mm) on center.

   2.4 Framing factor of 0.30 or less, use 6 inches (152 mm) on center.

   The framing factor shall be determined based on the surface area of steel framing members parallel to the exterior plane of the frame wall divided by the surface area of the opaque wall, excluding fenestration and door areas.

1. ~~3.~~ Where the steel-framed wall contains only top and bottom tracks and studs spaced at 24 inches (610 mm), 16 inches (400 mm), 12 inches (305 mm), or 6 inches (152 mm) on center, the specified framing member spacing shall be used to determine the U-factor for the wall in accordance with AISI S250. ~~less than 23 percent framing factors the AISI S250 shall be used without any modifications.~~

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

Reason: This proposal was also submitted to the IECC commercial committee as CED1-109-22 and is provided to the residential committee for similar purposes and coordination.
The AISI S250 standard addresses only "clear wall" framing with cold-formed steel studs and top and bottom tracks. The current modifications to AISI S250 in Section R402.2.7 (item 2) in relation to associating framing member spacing to a "framing factor" are needed, but also are not accurate and can lead to significant under-estimate (non-conservative) of U-factors for assemblies as built vs. as analyzed per AISI S250. In effect, additional wall framing members beyond just the layout studs at a specified on-center spacing are not properly or sufficiently accounted for with the current association of framing factors with stud spacing. This will result, for example, in a steel frame wall assembly with up to a 23% actual framing factor being assigned a U-factor determined using AISI S250 based on a "clear wall" assembly with 24"oc stud spacing with a framing factor of about 10% (overlooking the affect of much of the thermal bridging). This is essentially the reverse of how framing factors are used to conservatively define U-factors for wood framing where a 23% framing factor is actually used to determine the U-factor for the assembly. If the framing factor for steel framing was actually near 23 or 25 percent, then the adjustment needed to AISI S250 would be much greater than achieved by the current modification of using the next lower frame spacing.

This proposal addresses the above problems by the following revisions and improvements:

1. First, the list of "modifications" are really conditions or directions for appropriate application of the AISI S250 standard for only steel frame wall assemblies. So, the charging language for the list of "modifications" is revised accordingly.

2. The list is re-ordered to follow a more logical sequence and revised as follows:

a. Item #1 (previous #3) introduces the framing conditions that are applicable to U-factors determined in accordance with AISI S250 without requiring modification of the frame spacing input values.

b. Item #2 is revised to address framing conditions that do not apply to the "clear wall" scope of AISI S250 (addressed in Item #1) and provides directions for use of a framing member spacing input to more accurately determine a U-factor per AISI S250 (using its clear wall framing member spacing inputs) based on the actual framing factor of a wall assembly. This provides ability to account for additional framing members that often are present in wall assemblies which include openings for windows and doors and other conditions requiring additional framing beyond a "clear wall" with just top and bottom tracks and studs at a specified on-center spacing. Item #2 also includes direction on how to determine the framing factor for consistency and transparency in application.

c. Item #3 (previous #1) then provides direction for assemblies where continuous insulation is solely relied on to determine the U-factor per AISI S250 and in such case the frame spacing or framing factor does not have an impact on the determined U-factor. The language is revised to allow cavity insulation to be present as often is the case when addressing sound control, even if U-factor compliance is achieved by only the continuous insulation component.

d. Item #4 is unchanged.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
The intent of this proposal is to clarify modifications needed for proper application of the new AISI S250 standard reference for determining "clear wall" U-factors for steel-framed wall assemblies. Since the AISI S250 standard is a new reference this is not considered to have a cost impact in determining how to properly apply it to determine U-factors with reasonable accuracy relative to actual framing conditions.

Workgroup Recommendation

Proposal # 1238

RED1-216-22

Proponents: Robert Schwarz, representing BUILDTank, Inc. (robby@btankinc.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

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~~ Table R402.1.3 and ~~applicable provisions of~~ Sections ~~R402.2 and R402.2.8.~~ R402.2.7
2. There are no uninsulated duct, domestic hot water, 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 weatherstripped in accordance with Section R402.5.
6. The building thermal envelope separating the basement from adjacent conditioned spaces complies with Section R402.5.

R402.2.9.1 Basement wall insulation installation. Where *basement walls* enclosing conditioned basements 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.~~ comply with the following:

1. Where exterior basement wall insulation is installed, it shall be permanently attached to the wall and extend downward from the sill plate to not less than the footing or 10 feet, whichever is less.

2. Where interior basement wall insulation is installed, it shall extend downward from the sill plate at the top of the foundation wall to the finished floor below.

Reason: Modifications have been made to section R402.2.8.1 per guidance from the envelope subcommittee to align the basement insulation installation requirements with the crawl space wall insulation installation that was approved by the subcommittee unanimously.
In section R402.2.9 Basement Walls the exception defines an unconditioned basement and refers to a section of code that is actually a table and then should point directly to floor insulation installation to separate the unconditioned basement from the conditioned living space above. The proposal fixes this confusion.

Foundation walls that define a basement can and often are insulated from the exterior. The language has been changed in this proposal to provide requirements for installation for not only interior application but also exterior insulation installation. Both installs require full coverage from the sill plate downward as was done with the stricken language to ensure full coverage.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This proposal does not impact the cost of construction. Instead, it provides greater flexibility in how basement assemblies can be insulated. It also better defines unconditioned basements and how to insulate from the interior or exterior.

Workgroup Recommendation

Proposal # 1006

RED1-217-22

Proponents: Alex Smith, representing NAHB (asmith@nahb.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

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<u>, or in accordance with the proposed design, as applicable</u>.

TABLE R405.2 REQUIREMENTS FOR SIMULATED BUILDING PERFORMANCE

Portions of table not shown remain unchanged.

SECTION[a]	TITLE
General	
R401.2.5	Additional energy efficiency
R401.3	Certificate
Building Thermal Envelope	
~~R402.2.9~~	~~Basement walls~~

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

TABLE R406.2 REQUIREMENTS FOR ENERGY RATING INDEX

Portions of table not shown remain unchanged.

SECTION[a]	TITLE
General	
R401.3	Certificate
Building Thermal Envelope	
R402.1.1	Vapor retarder
R402.2.4	Eave baffle
R402.2.5.1	Access hatches and doors
~~R402.2.9~~	~~Basement walls~~

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

Reason: The proposal clarifies the relationship between the prescriptive path and both performance paths. The performance paths are intended to provide design flexibility in achieving target energy performance. Only installation provisions should be listed in this table because the amount of insulation should be tradable. The insulation height on basement walls should be tradable as well.

Cost Impact: The code change proposal will decrease the cost of construction.
The added design flexibility may lead to cost improved cost-effectiveness.

Workgroup Recommendation

Proposal # 1016

RED1-218-22

Proponents: Greg Johnson, representing National Multifamily Housing Council (gjohnsonconsulting@gmail.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R402.3 Radiant barriers. Where installed~~ to reduce thermal radiation~~, radiant barriers shall be installed in accordance with ASTM C1743.

Reason: The reason to install a radiant barrier is commentary and should not be in a requirement.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
Essentially editorial.

Workgroup Recommendation

Proposal # 1091

RED1-219-22

Proponents: Robert Schwarz, representing BUILDTank, Inc. (robby@btankinc.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

Table R402.4.1.1
AIR BARRIER, AIR SEALING AND INSULATION INSTALATION a,b
.

COMPONENT	AIR BARRIER AND AIR SEALING CRITERIA	INSULATION INSTALLATION CRITERIA
General requirements	A continuous air barrier shall be installed in the building Thermal envelope that is in alignment with the insulation. All penetrations, ~~B~~breaksor joints in the air barrier assembly shall be air sealed.	Air-permeable insulation shall not be used as an air sealing material. Air- permeable insulation shall be enclosed inside an air barrier assembly [b]. Verification or certification of insulation installation shall be in accordance with section R303

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.

Reason: Air barrier and air sealing criteria section:

- This code change proposal is intended to offer clarification to this section of table R402.4.1.1 for those in the field that use it to build homes that are compliant with the air testing requirements of the IECC. In the 2018 IECC definitions section, air barriers and building thermal envelope were changed to recognize that the air barrier and building thermal envelope are an assembly of things that create a boundary condition between conditioned and unconditioned space. This section of the proposal takes the definition to application to help ensure better energy performance from required installations of air barriers, air sealing, and insulation in the assembly.
- Current Definitions
  - **AIR BARRIER.** One or more materials joined together in a continuous manner to restrict or prevent the passage of air through the *building thermal envelope* and its assemblies.
  - **BUILDING THERMAL ENVELOPE.** The *basement walls, exterior walls*, floors, ceiling, roofs and any other *building* element assemblies that enclose *conditioned space* or provide a boundary between *conditioned space* and exempt or unconditioned space.
- Air sealing measures are now called out in the Tables name and should be incorporate into the requirements as such.

Insulation Installation Criteria:

- Manufactures of air permeable insulation have recognize that their installation literature must incorporate language and pictures showing that air permeable insulation must be enclosed inside of air barrier assembly. This table promotes this installation instruction in location such as behind tubs, on attic knee walls, etc. Therefore, the general section should begin with an overarching statement that states how air permeable insulation shall be installed.

Section R303 of the IECC requires that certification of the R-value installed be provided by the insulation sub-contractor. This general section now also requires that certification.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
The proposed language does not increase the cost of construction but rather offers clarity of existing requirements that are in alignment with manufacturer installation instructions.

Workgroup Recommendation

RED1-220-22

Proponents: Michele DeFrance, representing City of Portland Maine (mdefrance@portlandmaine.gov)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R402.4.3 Glazed fenestration exemption. Not greater than 15 square feet (1.4 m^2) 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 <u>component performance</u> ~~Total UA~~ alternative in Section R402.1.5.

Reason: This is language change to conform to the new section title for R402.1.5, previously called Total UA alternative, and now called component performance alternative.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This is a language change, with no cost, to provide conformance.

Workgroup Recommendation

Proposal # 1028

RED1-221-22

Proponents: Michele DeFrance, representing City of Portland Maine (mdefrance@portlandmaine.gov)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

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

Reason: This is language change to conform to the new section title for R402.1.5, previously called Total UA alternative, and now called component performance alternative.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This is a language change, with no cost, to provide conformance.

Workgroup Recommendation

Proposal # 1029

RED1-222-22

Proponents: Gayathri Vijayakumar, representing Steven Winter Associates, Inc. (gvijayakumar@swinter.com)

2024 International Energy Conservation Code [RE Project]

CHAPTER 4 [RE]
RESIDENTIAL ENERGY EFFICIENCY

SECTION R402
BUILDING THERMAL ENVELOPE

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 throughR402.5.6.

Revise as follows:

R402.5.1 Building thermal envelope. The *building thermal envelope* shall comply with Sections R402.5.1.1 through R402.5.1. 4~~3~~. The sealing methods between dissimilar materials shall allow for differential expansion and contraction.

R402.5.1.2 Testing. The *building* or each *dwelling unit* in the buildingshall be tested for air leakage. ~~The maximum air leakage rate for any *building* or *dwelling unit* under any compliance path shall not exceed 4.0 air changes per hour or 0.22 cfm/ft^2(1.1 L/s x m^2) of building or dwelling unit enclosure area.~~ Testing shall be conducted in accordance with ANSI/RESNET/ICC 380, ASTM E779, ASTM E1827 or ASTM E3158 and reported at a pressure differential of 0.2 inch water gauge (50 Pa). Where testing individual attached *dwelling units*, *dwelling units* shall be tested without simultaneously testing adjacent *dwelling units*. 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.
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:

~~1. When testing individual dwelling units, an air leakage rate not exceeding 0.27 cubic feet per minute per square foot [1.35 L/s x m^2)] 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:~~

~~1.1 Attached single and multiple family building dwelling units.~~

~~1.2 Buildings or dwelling units that are 1,500 square feet (139.4 m^2) or smaller.~~

1. 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.
2. Where tested in accordance with R402.5.1.2.1~~4~~, testing of each *dwelling unit* is not required.

~~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.~~

~~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.~~

Add new text as follows:

R402.5.1.2.1 Dwelling unit sampling. For buildings with eight or more *dwelling units*, the greater of seven or 20 percent of the *dwelling units* in the building shall be tested. Tested units shall include a top floor unit, a ground floor unit, a middle floor unit, and the *dwelling unit* with the largest *dwelling unit enclosure area*. Where the air leakage rate of a tested unit is greater than the maximum permitted air leakage rate, corrective actions shall be made to the unit and the unit shall be re-tested. For each tested unit that has a greater air leakage rate than the maximum permitted air leakage rate, an additional three units, including the corrected unit, shall be tested. Where buildings have fewer than eight dwelling units, each dwelling unit shall be tested.

Revise as follows:

R402.5.1.3 Prescriptive air leakage rate. When complying with Section R401.2.1, where the building is tested for air leakage, ~~or each dwelling unit in the building shall have an~~ the air leakage rate shall not exceed~~ing~~ 4.0 air changes per hour or 0.22 cfm/ft^2 (1.1 L/s x m^2) of the *building thermal envelope* area in Climate Zones 0, 1 and 2, 3.0 air changes per hour or 0.16 cfm/ft^2 (0.8 L/s x m^2) of the *building thermal envelope* area in Climate Zones 3 through 5, and 2.5 air changes per hour or 0.14 cfm/ft^2 (0.7 L/s x m^2) of the *building thermal envelope* area in Climate Zones 6 through 8~~when tested in accordance with Section R402.5.1.2.~~ Where attached *dwelling units* are tested for air leakage, the air leakage rate of the *dwelling unit* shall not exceed 0.25 cfm/ft^2 (1.25 L/s x m^2) of the *dwelling unit enclosure area* in all climate zones.

> Exception: For detached one-family dwellings that are 1,500 ft^2 (139.4 m^2) or smaller, an air leakage rate not exceeding 0.25 cfm/ft^2 (1.25 L/s x m^2) of the *dwelling unit enclosure area* shall be permitted in all climate zones.

R402.5.1.4 Performance air leakage rate ~~Dwelling unit sampling~~. ~~For buildings with eight or more dwelling units, the greater of seven or 20 percent of the dwelling units in the building shall be tested. Tested units shall include a top floor unit, a ground floor unit, a middle floor unit, and the dwelling unit with the largest dwelling unit enclosure area. Where the air leakage rate of a tested unit is greater than the maximum permitted air leakage rate, corrective actions shall be made to the unit and the unit re-tested. For each tested unit that has a greater air leakage rate than the maximum permitted air leakage rate, an additional three units, including the corrected unit, shall be tested. Where buildings have fewer than eight dwelling units, each dwelling unit shall be tested.~~ When complying with Section R401.2.2 or R401.2.3, where the building is tested for air leakage, the air leakage rate shall not exceed 4.0 air changes per hour or 0.22 cfm/ft^2 (1.1 L/s x m^2) of the *building thermal envelope* area. Where attached *dwelling units* are tested for air leakage, the air leakage rate of the *dwelling unit* shall not exceed 0.27 cfm/ft^2 (1.35 L/s x m^2) of the *dwelling unit enclosure area*

> Exception: For detached one-family dwellings that are 1,500 ft^2 (139.4 m^2) or smaller, an air leakage rate not exceeding 0.27 cfm/ft^2 (1.35 L/s x m^2) of the *dwelling unit enclosure area* shall be permitted.

R403.6 Mechanical ventilation. ~~The~~ *Residential buildings* and *dwelling units* ~~complying with Section R402.5.1~~ shall be provided with mechanical *ventilation* that complies with the requirements of Section M1505 of the *International Residential Code* or *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.

SECTION R405
SIMULATED BUILDING PERFORMANCE

Revise as follows:

TABLE R405.2 REQUIREMENTS FOR SIMULATED BUILDING PERFORMANCE

Portions of table not shown remain unchanged.

SECTION[a]	TITLE
Building Thermal Envelope	
R402.1.1	Vapor retarder
R402.2.3	Attic knee or pony wall
R402.2.4	Eave baffle
R402.2.5.1	Access hatches and doors
R402.2.9	Basement walls
R402.2.9.1	Basement wall insulation installation
R402.2.10.1	Slab-on-grade floor insulation installation
R402.2.11.1	Crawl space wall insulation installations
R402.5.1.1	Installation
R402.5.1.2	Testing
<u>R402.5.1.4</u>	<u>Performance air leakage rate</u>
R402.5.2	Fireplaces
R402.5.3	Fenestration air leakage
R402.5.4	Room containing fuel burning appli~~e~~ances
R402.5.5	Recessed lighting
R402.5.6	Air-sealed electrical and communication outlet boxes
R402.6	Maximum fenestration *U*-factor and SHGC

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

SECTION R406
ENERGY RATING INDEX COMPLIANCE ALTERNATIVE

Revise as follows:

TABLE R406.2 REQUIREMENTS FOR ENERGY RATING INDEX

Portions of table not shown remain unchanged.

SECTION[a]	TITLE
Building Thermal Envelope	
R402.1.1	Vapor retarder
R402.2.4	Eave baffle
R402.2.5.1	Access hatches and doors
R402.2.9	Basement walls
R402.2.9.1	Basement wall insulation installation
R402.2.10.1	Slab-on-grade floor insulation installation
R402.2.11.1	Crawl space wall insulation installation
R402.5.1.1	Installation
R402.5.1.2	Testing
R402.5.1.4	Performance air leakage rate
R402.5.2	Fireplaces
R402.5.3	Fenestration air leakage
R402.5.4	Rooms containing fuel burning appliances
R402.5.5	Recessed lighting
R402.5.6	Air-sealed electrical and communication outlet boxes(air sealed boxes)
R406.3	Building thermal envelope

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

Reason: This Public Comment does the following:

- Improves the organization of Section R402.5.1.2 by separating testing procedures from testing thresholds and re-ordering the test steps and exceptions
- Clarifies the testing thresholds by compliance path
- Establishes a cfm/ft2 metric alternative to ACH50 when choosing the Prescriptive Compliance Option.
- Clarifies the whole-building test threshold vs the dwelling unit test threshold.
- Corrects the spelling of "appliances" in Table R405.2 and adds the reference to the new Performance air leakage rate section

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
None

Bibliography: None

Workgroup Recommendation

Proposal # 1165

RED1-223-22 Part I

Proponents: Paul Demers, representing **Region VI code development team** (paul.a.demers@maine.gov)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R402.5.1.3 Prescriptive air leakage rate. When complying with Section R401.2.1, the building or each dwelling unit in the building shall have an air leakage rate not exceeding 5.0 air changes per hour in Climate Zones 0, 1 and 2, 3.0 air changes per hour in Climate Zones 3 through 8~~5, and 2.5 air changes per hour in Climate Zones 6 through 8,~~ when tested in accordance with Section R402.5.1.2.

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 sensible recovery efficiency (SRE) of no less than 65 percent at 32°F (0°C) at 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.

Reason: Comment: The language lowers the maximum of 2.5 changes per hour for all climate zones 6 and higher, removing the possibility of natural ventilation, and requires the use of ducted systems and ERVs for ventilation for all dwellings in these climate zones.

Point 1: This section (R402.5.1.3) applies to all residences in climate zones 6-8 across the board, with no exceptions, and lowers the air changes per hour below the threshold that requires dwellings to have ducted ventilation, increasing the cost of construction.

Point 2:

This section (R403.6.1) goes further, and requires all residences in climate zones 6-8 across the board, with no exceptions, to have ERV units. ERV units are not commonly used in residences, and would require calculations be done by either a design professional or engineer, increasing the cost of construction.

Point 3:

As most builders would have to use new or alternative means and methods to achieve the further reduced air changes per hour, this will also increase the cost of construction.

Recommendation:

In order to allow for natural ventilation and alternative types of ventilation, these sections, including IRC, Table N1105.4.2(1)[R405.4.2(1)] should be revised to read:

R402.5.1.3

Prescriptive air leakage rate. When complying with Section R401.2.1, the building or each dwelling unit in the building 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 ~~5~~8, ~~and 2.5 air changes per hour in Climate Zones 6 through 8,~~ when tested in accordance with Section R402.5.1.2.

R403.6.1

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 where a ducted system is provided. The system shall be a balanced ventilation system with a minimum sensible heat recovery efficiency (SRE) of no 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.

Cost Impact: The code change proposal will increase the cost of construction.
The addition of specialized equipment to handle ventilation below 3 ACH increases cost to construction. Current code provides more alternative to such specialized equipment required in the proposal.

Workgroup Recommendation

Proposal # 1481

RED1-223-22 Part II

Proponents: Paul Demers, representing **Region VI code development team** (paul.a.demers@maine.gov)

2024 ENERGY Chapter11

Revise as follows:

N1102.5.1.3 Prescriptive air leakage rate. Where complying with Section N1101.13.1, the building or each *dwelling unit* in the building shall have an air leakage rate not exceeding 5.0 air changes per hour in Climate Zones 0, 1 and 2, 3.0 air changes per hour in Climate Zones 3 through 8 ~~5~~, ~~and 2.5 air changes per hour in Climate Zones 6 through 8~~, when tested in accordance with Section N1102.5.1.2.

N1103.6.1 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 sensible recovery efficiency (SRE) of no less than 65 percent at 32°F (0°C) at 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.

Reason:
Prescriptive Air Leakage Rate

IRC Chapter 11, N1102.5.1.3

Prescriptive air leakage rate. When complying with Section N1101.2.1, the building or each dwelling unit in the building 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 58, and 2.5 air changes per hour in Climate Zones 6 through 8, when tested in accordance with Section R402.5.1.2.

IRC Chapter 11, N1103.6.1

N1103.6.1 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 no 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.

IRC Chapter 11, Table N1105.4.2(1_

Comment: The language lowers the maximum of 2.5 changes per hour for all climate zones 6 and higher, removing the possibility of natural ventilation, and requires the use of ducted systems and ERVs for ventilation for all dwellings in these climate zones.

Point 1: This section (**N1102.5.1.3**) applies to all residences in climate zones 6-8 across the board, with no exceptions, and lowers the air changes per hour below the threshold that requires dwellings to have ducted ventilation, increasing the cost of construction.

Point 2:

This section (**N1103.6.1**) goes further, and requires all residences in climate zones 6-8 across the board, with no exceptions, to have ERV units. ERV units are not commonly used in residences, and would require calculations be done by either a design professional or engineer, increasing the cost of construction.

Point 3:

As most builders would have to use new or alternative means and methods to achieve the further reduced air changes per hour, this will also increase the cost of construction.

Recommendation:

In order to allow for natural ventilation and alternative types of ventilation, these sections, including IRC, Table N1105.4.2(1) should be revised to read:

N1102.5.1.3

Prescriptive air leakage rate. When complying with Section N1101.13.1, the building or each dwelling unit in the building 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 ~~5~~8, ~~and 2.5 air changes per hour in Climate Zones 6 through 8,~~ when tested in accordance with Section N1102.5.1.2.

N1103.6.1 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 where a ducted system is provided. The system shall be a balanced ventilation system with a minimum sensible heat recovery efficiency (SRE) of no 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.

Cost Impact: The code change proposal will increase the cost of construction.
The current proposal targets an Air Change Rate below 3 for climate zones 5-8 down to 2.5 ACH which then requires specialized ventilation equipment that reduces the options for other types of equipment that could comply if the ACH is maintained at 3.0

This is more costly to these areas while eliminating accepted means of natural and mechanical ventilation.

Workgroup Recommendation

Proposal # 1482

RED1-224-22 Part I

Proponents: Theresa Weston, representing ABAA (Air Barrier Association of America) (holtweston88@gmail.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R402.5.1 Building thermal envelope. The *building thermal envelope* shall comply with Sections R402.5.1.1 through R402.5.1.~~3~~ 5 The sealing methods between dissimilar materials shall allow for differential expansion and contraction.

R402.5.1.2 Air Leakage Testing. The *building* or each *dwelling unit* in the buildingshall be tested for air leakage. ~~The maximum air leakage rate for any *building* or *dwelling unit* under any compliance path shall not exceed 4.0 air changes per hour or 0.22 cfm/ft^2(1.1 L/s x m^2) of building or dwelling unit enclosure area.~~ Testing shall be conducted in accordance with ANSI/RESNET/ICC 380, ASTM E779, ASTM E1827 or ASTM E3158 and reported at a pressure differential of 0.2 inch water gauge (50 Pa). 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.

Exceptions:

~~1.~~ ~~When testing individual dwelling units, an air leakage rate not exceeding 0.27 cubic feet per minute per square foot [1.35 L/s x m^2)] 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:~~

~~1.1 Attached single and multiple family building dwelling units.~~

~~1.2 Buildings or dwelling units that are 1,500 square feet (139.4 m^2) or smaller.~~

~~2.~~ 1. 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.

~~3.~~ 2. Where tested in accordance with R402.5.1.~~4~~ 5, testing of each dwelling unit is not required.

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.

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.

Add new text as follows:

R402.5.1.3 Mandatory Air Leakage. The maximum air leakage rate for any *building* or *dwelling unit* under any compliance path shall not exceed 4.0 air changes per hour or 0.22 cfm/ft^2(1.1 L/s x m^2) of building or dwelling unit enclosure area.
Exception: When testing individual dwelling units, an air leakage rate not exceeding 0.27 cubic feet per minute per square foot [1.35 L/s x m^2)] of the dwelling unit enclosure area 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.

2. Buildings or dwelling units that are 1,500 square feet (139.4 m^2) or smaller.

Revise as follows:

R402.5.1.~~3~~ 4 Prescriptive air leakage rate. When complying with Section R401.2.1, the building or each dwelling unit in the building shall have an air leakage rate not exceeding 5.0 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, when tested in accordance with Section R402.5.1.2.

R402.5.1.~~4~~ 5 Dwelling unit sampling. For buildings with eight or more dwelling units, the greater of seven or 20 percent of the dwelling units in the building shall be tested. Tested units shall include a top floor unit, a ground floor unit, a middle floor unit, and the dwelling unit with the largest dwelling unit enclosure area. Where the air leakage rate of a tested unit is greater than the maximum permitted air leakage rate, corrective actions shall be made to the unit and the unit re-tested. For each tested unit that has a greater air leakage rate than the maximum permitted air leakage rate, an additional three units, including the corrected unit, shall be tested. Where buildings have fewer than eight dwelling units, each dwelling unit shall be tested.

Reason: This proposals seeks a more logical organization of the code. It only updates the organization of the code and does not change technical requirements. More specifically, it separates the mandatory maximum air leakage rate (required across all compliance pathways) from the test method section by moving the existing language into a separate section identified as mandatory. This is intended to improve the code readability and the ease of understanding the code.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This proposal does not change requirements but only reorganizes the code for readability and clarity.

Workgroup Recommendation

Proposal # 1286

RED1-224-22 Part II

Proponents: Theresa Weston, representing ABAA (Air Barrier Association of America) (holtweston88@gmail.com)

2024 ENERGY Chapter11

Revise as follows:

N1102.5.1 Building thermal envelope. The *building thermal envelope* shall comply with Sections N1102.5.1.1 through N1102.5.1.~~3~~ 4. The sealing methods between dissimilar materials shall allow for differential expansion and contraction.

N1102.5.1.2 Air leakageTesting ~~and maximum air leakage rate~~. The *building* or each *dwelling 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 4.0 air changes per hour or 0.22 cfm/ft^2 (1.1 L/s x m^2) of building or dwelling unit enclosure area.~~ Testing shall be conducted in accordance with ANSI/RESNET/ICC 380, ASTM E779, ASTM E1827 or ASTM E3158 and reported at a pressure differential of 0.2 inch water gauge (50 Pa). 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.

Exceptions:

~~1.~~ ~~When testing individual dwelling units, an air leakage rate not exceeding 0.27 cubic feet per minute per square foot [1.35 L/s x m^2] 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 water gauge (50 Pa), shall be permitted in all climate zones for:~~

~~1.1 Attached single and multiple family building dwelling units.~~

~~1.2 Buildings or dwelling units that are 1,500 square feet (139.4 m^2) or smaller.~~

~~2.~~ 1. 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 N1102.5.1.1, 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 conditioned spaces in accordance with Sections N1102.2.13 and N1102.4.5, as applicable.

~~3.~~ 2. Where tested in accordance with N1102.5.1.2, testing of each dwelling unit is not required.

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.

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

Add new text as follows:

N1102.5.1.3 Mandatory Air Leakage. The maximum air leakage rate for any *building* or *dwelling unit* under any compliance path shall not exceed 4.0 air changes per hour or 0.22 cfm/ft^2 (1.1 L/s x m^2) of building or dwelling unit enclosure area.
Exception: When testing individual dwelling units, an air leakage rate not exceeding 0.27 cubic feet per minute per square foot [1.35 L/s x m^2] of the dwelling unit enclosure area,reported at a pressure of 0.2 inch water gauge (50 Pa), shall be permitted in all climate zones for:

1. Attached single and multiple family building dwelling units.

2. Buildings or dwelling units that are 1,500 square feet (139.4 m^2) or smaller.

Revise as follows:

N1102.5.1.~~3~~ 4 Prescriptive air leakage rate. Where complying with Section N1101.13.1, the building or each *dwelling unit* in the building shall have an air leakage rate not exceeding 5.0 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, when tested in accordance with Section N1102.5.1.2.

Reason: This proposals seeks a more logical organization of the code. It only updates the organization of the code and does not change technical requirements. More specifically, it separates the mandatory maximum air leakage rate (required across all compliance pathways) from the test method section by moving the existing language into a separate section identified as mandatory. This is intended to improve the code readability and the ease of understanding the code.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This proposal does not change requirements but only reorganizes the code for readability and clarity.

Workgroup Recommendation

Proposal # 1316

RED1-225-22

Proponents: Robert Schwarz, representing BUILDTank, Inc. (robby@btankinc.com)

2024 International Energy Conservation Code [RE Project]

Add new text as follows:

R402.2.12 Rim joist and sill plate requirements. . Where a rim joist rests upon a sill plate on top of a foundation wall that separates conditioned from unconditioned space, the junction of the sill plate to the foundation shall be sealed. Capillary break materials installed between the sill plate and the foundation shall not be used as air sealing materials unless specifically designed for such use. For all rim joists separating conditioned from unconditioned space, the rim joist to the sill plate, and the rim joist to subfloor connections shall be air sealed. Rim joists which are part of the thermal envelope assembly shall be insulated to at least the same R-value as the above grade exterior wall and shall be enclosed on six sides. Enclosure may be accomplished by installing a finished surface on the underside of the floor system.

Revise as follows:

TABLE R402.5.1.1 AIR BARRIER, AIR SEALING AND INSULATION INSTALLATION[a]

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
General requirements	A continuous air barrier shall be installed in the building envelope. Breaks or joints in the air barrier shall be sealed.	Air-permeable insulation shall not be used as a sealing material.
Ceiling/attic	A sealed air barrier shall be installed in any dropped ceiling or soffit to separate it from unconditioned space. Access openings, drop down stairs or knee wall doors to unconditioned attic spaces shall be air 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. Access hatches and doors shall be installed and insulated in accordance with Section R402.2.5 Eave Baffles shall be installed in accordance with Section R402.2.4
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 thermal envelope insulation for framed walls shall be installed in substantial contact and continuous alignment with the air barrier.
Windows, skylights and doors	The space between framing and skylights, and the jambs of windows and doors, shall be sealed.	Framing cavities around windows, skylights and doors shall be completely filled with insulation or insulated per window manufacturer's instructions.
Rim joists	Rim joists shall include an air barrier. The junctions of the rim board to the sill plate and the rim board and the subfloor shall be air sealed.	Rim joist shall be insulated per Section R402.2.11 ~~Rim joists shall be insulated so that the insulation maintains permanent contact with the exterior rim board.[b]~~
Floors, including cantilevered floors and floors above garages	The air barrier shall be installed at any exposed edge of insulation.	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.
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 *International Residential Code*.	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 R402.2.11.
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 Section R402.5.5.	Recessed light fixtures installed in the building thermal envelope shall be airtight and IC rated, and shall be buried 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.

Showers, tubs, and fireplaces adjacent to the building thermal envelope	An air barrier shall separate insulation in the *building thermal envelope* from the shower, tub, and fireplace assemblies.	Exterior framed walls adjacent to showers, tubs and fireplaces shall be insulated.
Electrical,communication, and other equipment boxes, housings, and enclosures	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. The continuity of the air barrier shall be maintained around boxes, housings, and enclosures that penetrate the air barrier. Alternatively, air-sealed boxes shall be installed in accordance with R402.5.6.	Boxes, housing, and enclosures shall be burried 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 in the building's thermal envelope shall be buried and 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	Air sealing materials recognized in a listed fire-resistance rated common wall or double wall design and installed in accordance with the listing, or air sealing materials recognized in an approved design, shall be used. Common walls or double walls shall be considered an exterior wall for the purposes of air barrier and air sealing application of this Table.	Insulation materials recognized in the listed common wall or double-wall design and installed in accordance with the listing, or insulation materials recognized in the approved design, shall be used.

a. Inspection of log walls shall be in accordance with the provisions of ICC 400.

b. Insulation full enclosure is not required in unconditioned/ventilated attic spaces ~~and at rim joists~~.

Reason: Rim joist at foundations and between floor are notoriously leaky and difficult to insulate. They are one of the first areas of the Building Thermal Envelope that are addresses when seeking to build a more airtight house, yet the IECC continues not to address them well or call them out specifically in the installation sections or R402. A specific requirement section is needed to address them. This proposal deals with the air leakage issues and the insulation issues. For too long fibrous insulation has been allowed to be installed in locations without complete enclosure. Fibrous air permeable insulation in any cavity must be enclosed on six sides. This cavity is not tall, but convection through the material occurs because it is open to large volume spaces, the greater volume of the basement or crawl space. Building durability is often associated with this location and lack of enclosure when warm moist air migrates through air permeable insulation and condenses on the rim joist surface.
This proposal addresses enclosure but also allows the finished material installed on the underside of the floor system, such a drywalled ceiling, to count for the enclosure of the insulation.

Some believe that the above grade wall definition should be enough to ensure that the rim joist is insulated to the same R-value as the above grade wall. However, it is common to see the Rim Joist insulated with less R-value and different insulation material than used in the above grade wall. This section just makes it clear that the minimum requirement for R-value is the same for the above grade walls and the rim joist as they are both unique and separate building envelope assemblies.

Cost Impact: The code change proposal will increase the cost of construction.
This will impact the first cost of construction as it is a new code requirement to enclose the fibrous insulation installed in the rim/band joist. However,

performance will improve, and operational cost and comfort will be impacted positively.

Workgroup Recommendation

Proposal # 1005

RED1-226-22

Proponents: Alex Smith, representing NAHB (asmith@nahb.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

TABLE R402.5.1.1 AIR BARRIER, AIR SEALING AND INSULATION INSTALLATION

Portions of table not shown remain unchanged.

COMPONENT	AIR BARRIER CRITERIA
Ceiling/attic	An ~~sealed~~ air barrier shall be installed in any dropped ceiling or soffit to separate it from unconditioned space. Access openings, drop down stairs or knee wall doors to unconditioned attic spaces shall be air sealed with gasketing materials that allow for repeated entrance over time.

Reason: This proposal removes the redundant term "sealed." It is already required that breaks and joints in the air barrier are sealed. The term “sealed air barrier” can be interpreted as a new term different from “air barrier” with sealed joints. Therefore, it will lead to issues in the field with interpretation of the code. It’s not the air barrier that gets sealed, it’s the joints that get sealed.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This change is editorial and will not effect the cost of construction.

Workgroup Recommendation

Proposal # 1035

RED1-227-22

Proponents: Theresa Weston, representing ABAA (Air Barrier Association of America) (holtweston88@gmail.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

TABLE R402.5.1.1 AIR BARRIER, AIR SEALING AND INSULATION INSTALLATION[a]

Portions of table not shown remain unchanged.

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
Windows, skylights and doors	The space between framing and skylights, and the jambs of windows and doors, shall be sealed.	Framing cavities around windows, skylights and doors shall be insulated. ~~completely filled with insulation or insulated per~~ and Insulation installation shall be in accordance with window manufacturer's instructions , where available.

a. Inspection of log walls shall be in accordance with the provisions of ICC 400.

b. Insulation full enclosure is not required in unconditioned/ventilated attic spaces and at rim joists.

Reason: This proposal edits the text to better represent what information is available in window installation instructions. Insulating the framing cavities around windows is important to energy performance. However, the way in which these areas are insulated also affects the water management (drainage) of the installed window. Window manufacturers may also provide information on the compatibility of specific types of insulation with their window product. That being said, not all window manufacturer instructions contain information on insulation. For example, storefront/curtain wall instructions typically cover the anchoring method (spacing / shimming space) around the frame but not the insulation installation.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This proposal does not change the requirements and therefore does not effect the cost of construction. It only seeks better coordination with typical construction practice.

Workgroup Recommendation

Proposal # 1277

RED1-228-22

Proponents: Robert Schwarz, representing BUILDTank, Inc. (robby@btankinc.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

TABLE R402.5.1.1 AIR BARRIER, AIR SEALING AND INSULATION INSTALLATION[a]

COMPONENT	AIR BARRIER/SEAL CRITERIA	INSULATION INSTALLATION CRITERIA
General requirements	A continuous air barrier shall be installed in the building envelope. Breaks or joints in the air barrier shall be sealed.	Air-permeable insulation shall not be used as a sealing material.
Ceiling/attic	A sealed air barrier shall be installed in any dropped ceiling or soffit to separate it from unconditioned space. Access openings, drop down stairs or knee wall doors to unconditioned attic spaces shall be air 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. Access hatches and doors shall be installed and insulated in accordance with Section R402.2.5 Eave Baffles shall be installed in accordance with Section R402.2.4
Above Grade Walls	The junction of the foundation and sill plate shall be air sealed. The junction of ~~the~~ top plates and drywall adjacent to unconditioned space shall be air sealed. ~~the top of exterior walls shall be sealed.~~ The junction of the bottom plate to the subfloor on exterior walls separating conditioned space from unconditioned space shall be air sealed. ~~Knee walls shall be sealed.~~	Air permeable insulation installed in wall cavities shall be enclosed on six sides. Building thermal envelope insulation for framed walls shall be installed in substantial contact and continuous alignment with the air barrier. ~~Cavities within~~ Corners in exterior ~~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. Headers on exterior walls in Climate zones 3-8, shall be insulated with material having a thermal resistance, R-value, of not less than R-5. ~~Exterior thermal envelope insulation for framed walls shall be installed in substantial contact and continuous alignment with the air barrier.~~
Windows, skylights and doors	The space between framing and skylights, and the jambs of windows and doors, shall be sealed.	Framing cavities around windows, skylights and doors shall be completely filled with insulation or insulated per window manufacturer's instructions.
Rim joists	Rim joists shall include an air barrier. 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.[b]
Floors, including cantilevered floors and floors above garages	The air barrier shall be installed at any exposed edge of insulation.	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.
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 *International Residential Code.*	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 R402.2.11.
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.
	Air sealing shall be provided between the garage	Insulated portions of the garage separation assembly shall be installed

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 Section R402.5.5.	Recessed light fixtures installed in the building thermal envelope shall be airtight and IC rated, and shall be buried 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.
Showers, tubs, and fireplaces adjacent to the building thermal envelope	An air barrier shall separate insulation in the *building thermal envelope* from the shower, tub, and fireplace assemblies.	Exterior framed walls adjacent to showers, tubs and fireplaces shall be insulated.
Electrical,communication, and other equipment boxes, housings, and enclosures	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. The continuity of the air barrier shall be maintained around boxes, housings, and enclosures that penetrate the air barrier. Alternatively, air-sealed boxes shall be installed in accordance with R402.5.6.	Boxes, housing, and enclosures shall be burried 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 in the building's thermal envelope shall be buried and 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	Air sealing materials recognized in a listed fire-resistance rated common wall or double wall design and installed in accordance with the listing, or air sealing materials recognized in an approved design, shall be used. Common walls or double walls shall be considered an exterior wall for the purposes of air barrier and air sealing application of this Table.	Insulation materials recognized in the listed common wall or double-wall design and installed in accordance with the listing, or insulation materials recognized in the approved design, shall be used.

a. Inspection of log walls shall be in accordance with the provisions of ICC 400.

b. Insulation full enclosure is not required in unconditioned/ventilated attic spaces and at rim joists.

Reason: Above Grade wall is a defined term Walls is not so the component name should be changed as proposed.
The objective of table R402.4.1.1 is to offer guidance for how to create an airtight well insulated home that meets the air leakage requirements of the IECC. Air barrier and insulation installation are part of the equation to be able to accomplish this goal, but air sealing is another part of it that has been missing from the title. The tables name now accurately reflects the air sealing goal.

Air barrier and air sealing criteria section:

Clarification of the language requiring drywall to be sealed to the top plate is needed to make it clear that all wall top plates that are adjacent to unconditioned space must be sealed. Believe it or not, in the field there is confusion regarding what exterior means. In a square house for example, does it mean four exterior walls, or does it mean top plates that are adjacent to unconditioned space, which would include interior walls that are adjacent to unconditioned space. The gained clarity of this air sealing activity addresses one of the largest air leakage sources on the high side of the home. NAIMA recently released “Five Priority Air Sealing Locations” from an Owens Corning study and listed the junction of the top plate and drywall adjacent to unconditioned spaces above as number one. They estimate that over 300 lineal feet of leakage is present. Multiply 300 feet by an 1/8” gap, and you get an almost 6060 window-sized hole to the outside at this location. Our field experience shows that the current language in this section of the code causes confusion because it says, “seal the junction of the top plate and exterior wall.” Many incorrectly assume that this means the top plate of the 4 exterior walls and not all top plates connected to the exterior or unconditioned space in a square house for example. This code change clearly breaks up the many requirements in this section into bite-size bits of understandable code language that those in the field that are applying the code need. For example, insulated corners and headers were jumbled together in one long sentence. Now, they are separated and clarified so the requirement is clear and understandable. The junction of the bottom plate to the subfloor on exterior walls has not been addressed by the IECC as one of the larges sources of air leakage in homes and therefore I have added this low hanging air sealing opportunity to the table.

Insulation Installation Criteria:

Air permeable insulation must be enclosed in an air barrier to trap pockets of air that are required to resist the flow of energy. This new language proposed for the table is in alignment with manufacture installation instruction and quickly expresses what is required to executedproperly in the field. Corners and headers are significantly different assemblies to insulate. Headers, in particulate may not have a true cavity to insulate and may be better suited to insulate with foam board. This proposal breaks the two assemblies into separately addressed assemblies. This also makes these two existing requirements stand out for better understanding and enforcement. Adding the defined term Building Thermal Envelop ensures clarity Knee walls, or pony walls and many call them, are a unique assembly which need to be addressed on their own in this table but at least a new R402 section has been established to address them. They have been removed from this section in favor of offering a separate knee or pony wall proposal to the 2024 IECC development committee.

Cost Impact: The code change proposal will increase the cost of construction.
The proposed language will only **minimally** impact the cost of construction, but the increased clarity of existing requirements far outweighs any increase in cost. Only two new requirements have really been added by this proposal.

1. Sealing the bottom plate to the subfloor. This could add material and labor cost, however in order to meet the current level or air tightness is probably being done. In those areas that areas that are struggling to meet the air leakage requirement this low hanging fruit needs to be made clear.

2. The proposed requirement for headers to be insulated to R-5 will in cost neutral because insulated headers are already required but adds greater flexibility for implementation. In addition there is now an allowance to not insulated headers in climates zones 0-2. When three ply header is replaced with a two-ply header the 1.5” space is often insulated with a material that has an R-value of 3 per inch. On the other hand, when half inch spacers are replaced with R2.5 1/2” foam board the material can achieve R5 but is not an r3 per inch.

Bibliography: This proposal aligns with ENERGY STAR requirements that are the basis of the creation of this table and have been adopted by the IECC in the past.
ENERGY STAR Requirements:

https://www.energystar.gov/sites/default/files/Rater%20F%20v104%202018-07 10_Clean_fillable.pdf

2. Fully-Aligned Air Barriers 6 At each insulated location below, a complete air barrier is provided that is fully aligned as follows:

Walls: At exterior vertical surface of wall insulation in all climate zones; also at interior vertical surface of wall insulation in Climate Zones 4-8 8

2.2 Walls behind showers, tubs, staircases, and fireplaces

2.3 Attic knee walls and skylight shaft walls

2.4 Walls adjoining porch roofs or garages

2.5 Double-walls and all other exterior walls

Footnote 8

All insulated vertical surfaces are considered walls (e.g., above and below grade exterior walls, knee walls) and must meet the air barrier

requirements for walls.

4. Air Sealing (Unless otherwise noted below, “sealed” indicates the use of caulk, foam, or equivalent material)

4.3 Above-grade sill plates adjacent to conditioned space sealed to foundation or sub-floor. Gasket also placed beneath above-grade sill plate if resting atop concrete / masonry & adjacent to cond. space

4.4 Continuous top plate or blocking is at top of walls adjoining unconditioned space, and sealed

4.5 Drywall sealed to top plate at all unconditioned attic / wall interfaces using caulk, foam, drywall adhesive (but not other construction adhesives), or equivalent material. Either apply sealant directly between drywall and top plate or to the seam between the two from the attic above.

Workgroup Recommendation

Proposal # 1007

RED1-229-22

Proponents: Alex Smith, representing NAHB (asmith@nahb.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

TABLE R402.5.1.1 AIR BARRIER, AIR SEALING AND INSULATION INSTALLATION[a]

Portions of table not shown remain unchanged.

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
Common walls or double walls separating attached single-family dwellings or townhouses	~~Air sealing materials recognized in a listed fire-resistance rated common wall or double wall design and installed in accordance with the listing, or air sealing materials recognized in an approved design, shall be used.~~ ~~Common walls or double walls shall be considered an exterior wall for the purposes of air barrier and air sealing application of this Table.~~ An air barrier shall be provided. Air sealing at the intersection of common walls or double walls and building thermal envelope shall be provided. Where air sealing materials are installed within a fire resistance-rated wall assembly, such materials shall meet one of the following: 1. be in accordance with an approved design for the fire resistance-rated assembly. 2. be materials approved for use as fireblocking or be approved for use in a fire resistant joint system or in a perimeter fire containment system; and be installed only at the perimeter of the fire-rated assembly and at joints with other assemblies.	Insulation materials recognized in the approved ~~listed~~ common wall or double-wall design and installed in accordance with the ~~listing, or insulation materials recognized in 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. Insulation full enclosure is not required in unconditioned/ventilated attic spaces and at rim joists.

Reason: The proposal resolves several issues with the current language:
1. The revised language clearly identifies that the provisions are intended to apply to townhomes. The terms "double wall" and "common wall" were originally adopted from IRC Section R302.2 Townhomes. However, both terms can apply to other uses such exterior double walls.

2. The revised language requires that an air barrier be provided without limiting the designer's choice on the type of fire-rated assembly or imposing overly prescriptive provisions.

3. The revised language requires that the boundary of the fire rated assembly be sealed to the exterior wall (air barrier materials installed on the outside of the assembly do not impact the fire rating).

4. The revised language removes the highly problematic language that the common wall shall be considered an exterior wall. These walls are not exterior walls. The energy code cannot require that the shaft liner panels be sealed at the H-channel. There are no listed assemblies that allow that. In addition, Section R402.5 Air Leakage or Table R402.5.1.1 do not use the term "exterior wall" in this manner elsewhere. This language is replaced by the sentence requiring that the air barrier be provided at these wall assemblies.

5. The proposal also adds a compliance option for using are sealing materials that are approved for use in similar fire rated systems. The installation of air sealing is limited only to the perimeter of the assembly and intersections with other assemblies.

6. The revised language also clarifies that it is not a requirement to insulate common walls. These walls do not represent exterior building boundary. The current language may lead the code user to an interpretation that common walls must be insulated to the same level as exterior walls.

During testimony it was stated that these provisions can be met by installation of proprietary foam products in the gap between the liner panels and framing. However, the same gap can be filled with strips of the same liner panels and complemented with other air sealing strategies. In addition, the area separation wall system is not the only strategy for achieving the required fire rating. The current language limits other wall options.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
The proposed language is intended to provide clarity and allow options for achieving air sealing of fire rated assemblies. It may or may not impact cost.

Workgroup Recommendation

Proposal # 1041

RED1-230-22

Proponents: Robert Schwarz, representing BUILDTank, Inc. (robby@btankinc.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

TABLE R402.5.1.1 AIR BARRIER, AIR SEALING AND INSULATION INSTALLATION[a].

COMPONENT	AIR BARRIER AND AIR SEALING CRITERIA	INSULATION INSTALLATION CRITERIA
Floors, including cantilevered floors and floors above garages	The air barrier shall be installed, and air sealed to maintain its continuity at ~~any~~ exposed edge s of ~~insulation~~ the insulated floor cavity.	Floor framing cavity insulation shall be installed in accordance with the requirements of Section R402.2.7. ~~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 shall extend from the bottom to the top of all perimeter floor framing members.~~

Reason: Table R402.4.1.1 has continued to evolve to recognize other component installation requirements that have been defined in Sections R402.2.1 through R402.2.13. Floor insulation installation requirements specifically, in Section R402.2.7 of the 2021 IECC, have changed and the Component section of Floors in Table R402.4.1.1 has not changed in the same way causing inconsistency between the two sections of code. The proposal has been simplified in the public comment and uses now common language in the table to refer the user to Section R402.2.7 as a reference.

Component Criteria: No Changes proposed.

Air barrier and air sealing criteria section:

- Floor cavities are wall cavities laid down, therefore, air permeable insulation installed inside the cavity also needs to be enclosed by the air barrier assembly. As the IECC now allows three insulation techniques for insulating floors as seen in Section R402.2.7 it becomes more important to ensure that the rim joist of the insulated floor not only get insulated but is airtight because the insulation is no longer required to be installed adjacent to the subfloor decking. The proposed language brings this to light for builders and trades that are executing the code requirements.

Insulation Installation Criteria:

- The insulation installation criteria outlined in Section R402.2.7 clearly describes how insulation in floor systems must be installed. There is no need to further explain it in this table,

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
The proposed language does not increase the cost of construction but rather offers clarity of existing requirements for inspection and installation of insulation.

Workgroup Recommendation

RED1-231-22

Proponents: Alex Smith, representing NAHB (asmith@nahb.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

TABLE R402.5.1.1 AIR BARRIER, AIR SEALING AND INSULATION INSTALLATION[a]

COMPONENT	AIR BARRIER CRITERIA
Electrical,communication, and other equipment boxes, housings, and enclosures	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. ~~The continuity of the air barrier shall be maintained around boxes, housings, and enclosures that penetrate the air barrier.~~ Alternatively, air-sealed boxes shall be installed in accordance with R402.5.6.

a. Inspection of log walls shall be in accordance with the provisions of ICC 400.

b. Insulation full enclosure is not required in unconditioned/ventilated attic spaces and at rim joists.

Reason: This proposal removes duplicative and unnecessary language. The requirements for air barrier around boxes, housings and enclosures is already addressed by the first sentence in this cell, which states that boxes, housing and enclosures shall be sealed to the air barrier. This requirement will ensure the continuity of the air barrier. The third sentence is recommended for deletion because it effectively re-states the same requirement and does not provide new information. Duplicative requirements can lead to issues in the field with interpreting the intent of the code and should be removed.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This change is editorial and will have no effect on the cost of construction.

Workgroup Recommendation

Proposal # 1040

RED1-232-22

Proponents: Craig Drumheller, representing WDMA (cdrumheller@wdma.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

TABLE R402.5.1.1 AIR BARRIER, AIR SEALING AND INSULATION INSTALLATION[a]

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
General requirements	A continuous air barrier shall be installed in the building envelope. Breaks or joints in the air barrier shall be sealed.	Air-permeable insulation shall not be used as a sealing material.
Ceiling/attic	A sealed air barrier shall be installed in any dropped ceiling or soffit to separate it from unconditioned space. Access openings, drop down stairs or knee wall doors to unconditioned attic spaces shall be air 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. Access hatches and doors shall be installed and insulated in accordance with Section R402.2.5 Eave Baffles shall be installed in accordance with Section R402.2.4
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 thermal envelope insulation for framed walls shall be installed in substantial contact and continuous alignment with the air barrier.
Windows, skylights and doors	The space between framing and skylights, and the jambs of windows and doors, shall be sealed.	Framing cavities around windows, skylights and doors shall contain a continuous perimeter of ~~be completely filled with~~ insulation or be installed ~~insulated~~ per the fenestration ~~window~~ manufacturer's instructions.
Rim joists	Rim joists shall include an air barrier. 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.[b]
Floors, including cantilevered floors and floors above garages	The air barrier shall be installed at any exposed edge of insulation.	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.
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 *International Residential Code*.	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 R402.2.11.
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 Section R402.5.5.	Recessed light fixtures installed in the building thermal envelope shall be airtight and IC rated, and shall be buried 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.

Showers, tubs, and fireplaces adjacent to the building thermal envelope	An air barrier shall separate insulation in the *building thermal envelope* from the shower , tub , and fireplace assemblies.	Exterior framed walls adjacent to showers , tubs and fireplaces shall be insulated.
Electrical,communication, and other equipment boxes, housings, and enclosures	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. The continuity of the air barrier shall be maintained around boxes, housings, and enclosures that penetrate the air barrier. Alternatively, air-sealed boxes shall be installed in accordance with R402.5.6.	Boxes, housing, and enclosures shall be burried 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 in the building's thermal envelope shall be buried and 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	Air sealing materials recognized in a listed fire-resistance rated common wall or double wall design and installed in accordance with the listing, or air sealing materials recognized in an approved design, shall be used. Common walls or double walls shall be considered an exterior wall for the purposes of air barrier and air sealing application of this Table.	Insulation materials recognized in the listed common wall or double-wall design and installed in accordance with the listing, or insulation materials recognized in the approved design, shall be used.

a. Inspection of log walls shall be in accordance with the provisions of ICC 400.

b. Insulation full enclosure is not required in unconditioned/ventilated attic spaces and at rim joists.

Reason: Completely filling the cavity between the rough opening and the window/door/skylight has historically caused operational and durability problems. In response, manufacturers have incorporated warnings or explicit instructions to **not** fill the cavity into their installation instructions. With imperfect installations or extreme weather conditions, moisture may find a way to get inside the rough opening; completely filling the cavity will prevent drying and cause problems such as mold and rot.

Also, filling, or inadvertently overfilling the cavity can cause operational problems preventing windows from opening and doors from closing.

Direct extractions from fenestration manufacturer’s installation instructions:

Manufacturer #1:

DO NOT fill the entire depth of the rough opening cavity.

Manufacturer #2:

DO NOT overpack batt insulation or overfill with foam.

Manufacturer #3:

An air space should remain between the nail fin/exterior sealant joint and the interior air seal.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
No change in cost. Expected to reduce callbacks and increase durability.

Workgroup Recommendation

Proposal # 1403

RED1-233-22

Proponents: Shannon Corcoran, representing American Gas Association

2024 International Energy Conservation Code [RE Project]

Revise as follows:

TABLE R402.5.1.1 AIR BARRIER, AIR SEALING AND INSULATION INSTALLATION[a]

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
General requirements	A continuous air barrier shall be installed in the building envelope. Breaks or joints in the air barrier shall be sealed.	Air-permeable insulation shall not be used as a sealing material.
Ceiling/attic	A sealed air barrier shall be installed in any dropped ceiling or soffit to separate it from unconditioned space. Access openings, drop down stairs or knee wall doors to unconditioned attic spaces shall be air 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. Access hatches and doors shall be installed and insulated in accordance with Section R402.2.5 Eave Baffles shall be installed in accordance with Section R402.2.4
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 thermal envelope insulation for framed walls shall be installed in substantial contact and continuous alignment with the air barrier.
Windows, skylights and doors	The space between framing and skylights, and the jambs of windows and doors, shall be sealed.	Framing cavities around windows, skylights and doors shall be completely filled with insulation or insulated per window manufacturer's instructions.
Rim joists	Rim joists shall include an air barrier. 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.[b]
Floors, including cantilevered floors and floors above garages	The air barrier shall be installed at any exposed edge of insulation.	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.
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 *International Residential Code*.	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 R402.2.11.
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 Section R402.5.5.	Recessed light fixtures installed in the building thermal envelope shall be airtight and IC rated, and shall be buried 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.
Showers, tubs, and	An air barrier shall separate insulation in the	

Showers, tubs, and fireplaces adjacent to the building thermal envelope	An air barrier shall separate insulation in the *building thermal envelope* from the shower , tub , ~~and~~ or fireplace assemblies.	Exterior framed walls adjacent to showers , tubs and fireplaces shall be insulated.
Electrical,communication, and other equipment boxes, housings, and enclosures	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. The continuity of the air barrier shall be maintained around boxes, housings, and enclosures that penetrate the air barrier. Alternatively, air-sealed boxes shall be installed in accordance with R402.5.6.	Boxes, housing, and enclosures shall be burried 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 in the building's thermal envelope shall be buried and 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	Air sealing materials recognized in a listed fire-resistance rated common wall or double wall design and installed in accordance with the listing, or air sealing materials recognized in an approved design, shall be used. Common walls or double walls shall be considered an exterior wall for the purposes of air barrier and air sealing application of this Table.	Insulation materials recognized in the listed common wall or double-wall design and installed in accordance with the listing, or insulation materials recognized in the approved design, shall be used.

a. Inspection of log walls shall be in accordance with the provisions of ICC 400.

b. Insulation full enclosure is not required in unconditioned/ventilated attic spaces and at rim joists.

Reason: As currently written, the tub and fireplace assemblies are one item. I believe the intent is to provide a barrier for any one of those installations.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This as an editorial change that should not affect the cost of construction.

Workgroup Recommendation

Proposal # 1275

RED1-234-22

Proponents: Jay Crandell, representing Foam Sheathing Committee of the American Chemistry Council (jcrandell@aresconsulting.biz)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

TABLE R402.5.1.1 AIR BARRIER, AIR SEALING AND INSULATION INSTALLATION[a]

Portions of table not shown remain unchanged.

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
Windows, skylights and doors	The gap~~space~~ between rough opening framing and the frames of skylights, ~~and the jambs of~~ windows and doors, shall be sealed.	The gap between rough opening framing and the frames of ~~Framing cavities around~~ windows, skylights and doors shall not be required to be ~~completely filled with insulation or~~ insulated ~~per window manufacturer's instructions~~.

Reason: This proposal clarifies that the rough opening gap around windows and doors and skylights is only required to be air sealed and should not be required to be filled with insulation. Filling a fenestration rough opening gap with insulation can create obstructions to drainage for windows installed with drainage pans in the rough opening, including rough opening jamb and head flashings if used. Also, many of the sealants used may have R-value properties (like insulation) but are not intended to be used as an insulation material and should not be used to fill a fenestration rough opening gap. Many manufacturer's instruction specify only air sealing to be applied around the inside perimeter of the rough opening gap for a shallow depth. Filling the gap entirely with certain types of sealants (that may be considered as insulation) can cause problems. If the concern is with narrow wall framing cavities that may occur in the vicinity of a fenestration product and in the process of framing a rough opening, then that matter is addressed further down in Table R402.5.1.1 as "narrow cavities".

Cost Impact: The code change proposal will decrease the cost of construction.
This proposal should decrease the cost of construction (although small) by not requiring fenestration rough opening gaps to be completely filled with insulation. More importantly, it will ensure proper installation and performance.

Workgroup Recommendation

Proposal # 1338

RED1-235-22

Proponents: Robert Schwarz, representing BUILDTank, Inc. (robby@btankinc.com)

2024 International Energy Conservation Code [RE Project]

Add new text as follows:

TABLE R402.5.1.1 AIR BARRIER, AIR SEALING AND INSULATION INSTALLATION[a].

Component	**Air Barrier, Air Sealing Criteria**	**Insulation Installation Criteria**
Knee wall	Knee walls shall have a sealed air barrier on the unconditioned side of the assembly to separate conditioned from unconditioned space.	Insulation installed in a knee wall assembly shall be installed in accordance with Section R402.2.3

Reason: Attic knee walls, in the field, are a unique assembly that have been overlooked by the IECC up until the 2024 IECC code development cycle when Section R402.2.3 Attic Knee Wall as well as a definition for knee wall, has been incorporated into the body of the code.
Now that knee walls are defined and Section R402.2.3 has been established it is important to incorporate Knee walls into Table R402.4.1.1 in the same way that other distinct assembly components have been incorporated.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
Since Knee walls are now defined in the IECC and have been called out specifically and separately in Section R402.2.3 adding additional Air barrier, Air Sealing, and insulation installation requirements and clarification will not increase the cost of construction.

Workgroup Recommendation

Proposal # 1009

RED1-236-22

Proponents: Robert Salcido, representing DOE (victor.salcido@pnnl.gov)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R402.5.1.2 Testing. The *building* or each *dwelling unit* in the buildingshall be tested for air leakage. ~~The maximum air leakage rate for any *building* or *dwelling unit* under any compliance path shall not exceed 4.0 air changes per hour or 0.22 cfm/ft^2(1.1 L/s x m^2) of building or dwelling unit enclosure area.~~ Testing shall be conducted in accordance with ANSI/RESNET/ICC 380, ASTM E779, ASTM E1827 or ASTM E3158 and reported at a pressure differential of 0.2 inch water gauge (50 Pa). 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.

Exceptions:

1. When testing individual dwelling units, an air leakage rate not exceeding 0.27 cubic feet per minute per square foot [1.35 L/s x m^2)] 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:

   1.1 Attached single and multiple family building dwelling units.

   1.2 Buildings or dwelling units that are 1,500 square feet (139.4 m^2) or smaller.
2. 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.
3. Where tested in accordance with R402.5.1.4, testing of each dwelling unit is not required.

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.

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.

R402.5.1.3 Prescriptive air leakage rate. <u>The maximum air leakage rate for any building or dwelling unit complying with Section R401.2.2 or R401.2.3 shall not exceed 4.0 air changes per hour or 0.22 cfm/ ft2(1.1 L/s x m2) of building or dwelling unit enclosure area.</u> When complying with Section R401.2.1, the building or each dwelling unit in the building shall have an air leakage rate not exceeding 5.0 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, when tested in accordance with Section R402.5.1.2.

Reason: The air leakage in Section R402.5.1.2 is in conflict with R402.5.1.3 for prescriptive air leakage. The language makes it sound like ANY compliance path needs to have a maximum of 4.0 ACH50. However, for prescriptive leakage, CZ 0-2 can have 5.0 ACH50 leakage. Based on potential confusion with air leakage requirements, the proposed language changes are being submitted to help clarify the intent of the air leakage requirements based on compliance path. As part of this comment is a broader call to the envelope subcommittee to look over the air leakage requirements language overall to clarify and/or simplify the air leakage language for clarity

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
No Cost Impact

Workgroup Recommendation

Proposal # 1193

RED1-237-22

Proponents: Hendrik Shank, representing New York State, Department of State (hendrikus.shank@dos.ny.gov); Daniel Carroll, representing Division of Building Standards & Codes (daniel.carroll@dos.ny.gov)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R402.5.1.2 Testing. The *building* or each *dwelling unit* in the buildingshall be tested for air leakage. The maximum air leakage rate for any *building* or *dwelling unit* under any compliance path shall not exceed 4.0 air changes per hour or 0.22 cfm/ft^2(1.1 L/s x m^2) of building or ~~dwelling unit enclosure area~~ *dwelling unit enclosure area*. Testing shall be conducted in accordance with ANSI/RESNET/ICC 380, ASTM E779, ASTM E1827 or ASTM E3158 and reported at a pressure differential of 0.2 inch water gauge (50 Pa). 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.

Exceptions:

1. When testing individual ~~dwelling units~~ *dwelling units*, an air leakage rate not exceeding 0.27 cubic feet per minute per square foot [1.35 L/s x m^2)] of the ~~dwelling unit enclosure area~~ *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.~~ water gauge (50 Pa), shall be permitted in all ~~climate zones~~ *climate zones* for:

   1.1 Attached single and multiple family building dwelling units.

   1.2 Buildings or dwelling units that are 1,500 square feet (139.4 m^2) or smaller.

2. 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.
3. Where tested in accordance with R402.5.1.4, testing of each dwelling unit is not required.

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.

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.

Reason: The intention of the editorial code change relating to water gauge is to keep the units consistent with other units in this code section and the units used in the fenestration air leakage provisions identified in Section R402.5.3 of the Draft 2024 IECC. The purpose of changing “dwelling unit enclosure area” to italic font is to inform the user that “dwelling unit enclosure area” is a defined term in Chapter 2.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This code change proposal is editorial so there is no cost impact associated with it.

Workgroup Recommendation

RED1-238-22

Proponents: Theresa Weston, representing ABAA (Air Barrier Association of America) (holtweston88@gmail.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R402.5.1.2 Testing. The *building* or each *dwelling unit* in the buildingshall be tested for air leakage. The maximum air leakage rate for any *building* or *dwelling unit* under any compliance path shall not exceed 4.0 air changes per hour or 0.22 cfm/ft^2(1.1 L/s x m^2) of building or dwelling unit enclosure area. Testing shall be conducted in accordance with ANSI/RESNET/ICC 380, ASTM E779, ASTM E1827 or ASTM E3158 and reported at a pressure differential of 0.2 inch water gauge (50 Pa). 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.

Exceptions:

1. When testing individual dwelling units, an air leakage rate not exceeding 0.27 cubic feet per minute per square foot [1.35 L/s x m^2)] 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:

   1.1 Attached single and multiple family building dwelling units.

   1.2 Buildings or dwelling units that are 1,500 square feet (139.4 m^2) or smaller.

2. 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.
3. ~~Where tested in accordance with R402.5.1.4, testing of each dwelling unit is not required.~~ <u>Attached dwelling units tested in accordance with C402.6.2.2</u>

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.

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.

~~**R402.5.1.4 Dwelling unit sampling.** For buildings with eight or more dwelling units, the greater of seven or 20 percent of the dwelling units in the building shall be tested. Tested units shall include a top floor unit, a ground floor unit, a middle floor unit, and the dwelling unit with the largest dwelling unit enclosure area. Where the air leakage rate of a tested unit is greater than the maximum permitted air leakage rate, corrective actions shall be made to the unit and the unit re-tested. For each tested unit that has a greater air leakage rate than the maximum permitted air leakage rate, an additional three units, including the corrected unit, shall be tested. Where buildings have fewer than eight dwelling units, each dwelling unit shall be tested.~~

Reason: This proposal coordinates the sampling protocol for multi-unit buildings between the residential and commercial parts of the IECC. This will allow smoother transition between those working on buildings or projects that are at the interface of the two codes. The two sampling protocols for the two sections are currently (in current drafts for 2024) very close as shown in the table below. It is best practice to have any development in only one part of the code and have the other part incorporate by reference. This reduces the chance for future misalignment between the residential and commercial codes.

	R402.5.1.4	C402.6.2.2
# units to allow sampling	8 or more dwelling units	8 or more dwelling units
Units tested	must include a top floor unit, a ground floor unit, a middle floor unit and the dwell unit with the largest unit enclosure area	must include a top floor unit, a ground floor unit, a middle floor unit and the dwell unit with the largest unit enclosure area
Corrective action	if the air leakage rate of a tested unit is greater than maximum air leakage rate, three additional units and original unit retested.	if the air leakage rate of a tested unit is greater than maximum air leakage rate, three additional units (including a mixture of testing unit types and locations) retested.
common spaces	not stated	testing required if greater than 1500 sq ft.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This proposal coordinates between the residential and commercial portions of the code. Current provisions are very similar and there should not be an effect on the cost of construction.

Workgroup Recommendation

Proposal # 1305

RED1-239-22

Proponents: Anjana Agarwal, representing The Ad Hoc Group (anjana@theadhocgroup.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R402.5.1.2 Testing. The *building* or each *dwelling unit* in the buildingshall be tested for air leakage. The maximum air leakage rate for any *building* or *dwelling unit* under any compliance path shall not exceed ~~4.0~~ 3.0 air changes per hour or 0.22 cfm/ft^2(1.1 L/s x m^2) of building or dwelling unit enclosure area. Testing shall be conducted in accordance with ANSI/RESNET/ICC 380, ASTM E779, ASTM E1827 or ASTM E3158 and reported at a pressure differential of 0.2 inch water gauge (50 Pa). 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.

Exceptions:

1. When testing individual dwelling units, an air leakage rate not exceeding 0.27 cubic feet per minute per square foot [1.35 L/s x m^2)] 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:

   1.1 Attached single and multiple family building dwelling units.

   1.2 Buildings or dwelling units that are 1,500 square feet (139.4 m^2) or smaller.

2. 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.
3. Where tested in accordance with R402.5.1.4, testing of each dwelling unit is not required.
4. Where technology providers or vendors are able to certify reduction in leakage in accordance with the above mentioned approved methods, no additional independent third party testing will be required.

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.

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.

R402.5.1.3 Prescriptive air leakage rate. When complying with Section R401.2.1, the building or each dwelling unit in the building shall have an air leakage rate not exceeding ~~5.0~~ 3.0 air changes per hour in Climate Zones 0, 1 and 2, and ~~3.0~~ 2.5 air changes per hour in Climate Zones 3 through ~~5~~ 8, ~~and 2.5 air changes per hour in Climate Zones 6 through 8,~~ when tested in accordance with Section R402.5.1.2.

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 Table R402.1.2.	As proposed
	Solar absorptance = 0.75.	As proposed
	Emittance = 0.90.	As proposed
Basement and crawl space walls	Type: same as proposed.	As proposed
	Gross area: same as proposed.	As proposed
	U-factor: as specified in Table R402.1.2, with the insulation layer on the interior side of the walls.	As proposed
Above-grade floors	Type: wood frame.	As proposed
	Gross area: same as proposed.	As proposed
	U-factor: as specified in Table R402.1.2.	As proposed
Ceilings	Type: wood frame.	As proposed
	Gross area: same as proposed.	As proposed
	U-factor: as specified in Table R402.1.2.	As proposed
Roofs	Type: composition shingle on wood sheathing.	As proposed
	Gross area: same as proposed.	As proposed
	Solar absorptance = 0.75.	As proposed
	Emittance = 0.90.	As proposed
Attics	Type: vented with an aperture of 1 ft^2 per 300 ft^2 of ceiling area.	As proposed
Foundations	Type: same as proposed.	As proposed
	Foundation wall area above and below grade and soil characteristics: same as proposed.	As proposed
Opaque doors	Area: 40 ft^2.	As proposed
	Orientation: North.	As proposed
	U-factor: same as fenestration as specified in Table R402.1.2.	As proposed
Vertical fenestration other than opaque doors	Total area[h] = (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 Table R402.1.2.	As proposed
	SHGC: as specified in Table R402.1.2 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 × SHGC for the standard reference design).	Interior shade fraction: 0.92 – (0.21 × SHGC as proposed)
	External shading: none	As proposed
Skylights	None	As proposed
Thermally isolated sunrooms	None	As proposed
	The air leakage rate at a pressure of 0.2 inch w.g. (50 Pa) shall be Climate Zones 0 through 2: ~~5.0~~ 3.0 air changes per hour. Climate Zones 3 ~~, 4, and 5: 3.0 air changes per hour. Climate Zones 6~~ through 8: 2.5 air changes per hour.	The measured air exchange rate.[a]
	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 B x M where:	

Air exchange rate	where: B = 0.01 × CFA + 7.5 × (Nbr + 1), cfm. M = 1.0 where the measured air exchange rate is > = 3.0 air changes per hour at 50 Pascals, and otherwise, M = minimum (1.7, Q/B) Q = the proposed mechanical ventilation rate, cfm. CFA = conditioned floor area, ft2. Nbr = number of bedrooms. 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 Section R403.6.1. Heat recovery or energy recovery shall not be modeled for mechanical ventilation where not required by Section R403.6.1.	The mechanical ventilation rate[b], Q, shall be in addition to the air leakage rate and shall be as proposed.
Mechanical ventilation	Where mechanical ventilation is not specified in the proposed design: None Where mechanical ventilation is specified in the proposed design, the annual vent fan energy use, in units of kWh/yr, shall equal (8.76 × B × M)/ef where: B and M are determined in accordance with the Air Exchange Rate row of this table. e_f = the minimum fan efficacy, as specified in Table 403.6.2, corresponding to the system type at a flow rate of B × M. *CFA* = conditioned floor area, ft^2. N_{br} = number of bedrooms.	As proposed
Internal gains	IGain, in units of Btu/day per dwelling unit, shall equal 17,900 + 23.8 ×*CFA* + 4,104 × N_{br} where: *CFA* = conditioned floor area, ft^2. N_{br} = number of bedrooms.	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[c] but not integral to the building 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 Table R402.1.3, 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[d, e, j, k]	For other than electric heating without a heat pump: as proposed. 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 Section R403.7.	
	Fuel Type/Capacity: Same as proposed design	As proposed
	Product class: Same as proposed design	As proposed
	Efficiencies:	As proposed
	Heat pump: Complying with 10 CFR §430.32	As proposed
	Non-electric furnaces: Complying with 10 CFR §430.32	As proposed
	Non-electric boilers: Complying with 10 CFR §430.32	As proposed
Cooling systems[d, f, k]	As proposed. Capacity: sized in accordance with Section R403.7.	
	Fuel Type: Electric Capacity: Same as proposed design	As proposed
	Efficiencies: Complying with 10 CFR §430.32	As proposed
		As proposed Use, in units of gal/day = 25.5 + (8.5 × N_{br}) × (1 − *HWDS*)

<table>
<tr><td rowspan="6">Service water heating[d, g, k]</td><td>As proposed.
Use, in units of gal/day = 25.5 + (8.5 × N_{br})
where: N_{br} = number of bedrooms.</td><td>(1 − HWDS)
where:
N_{br} = number of bedrooms.
HWDS = factor for the compactness of the hot water distribution system.
<table><tr><th colspan="2">Compactness ratio[i] factor</th><th>HWDS</th></tr><tr><td>1 story</td><td>2 or more stories</td><td></td></tr><tr><td>> 60%</td><td>> 30%</td><td>0</td></tr><tr><td>> 30% to ≤ 60%</td><td>> 15% to ≤ 30%</td><td>0.05</td></tr><tr><td>> 15% to ≤ 30%</td><td>> 7.5% to ≤ 15%</td><td>0.10</td></tr><tr><td>< 15%</td><td>< 7.5%</td><td>0.15</td></tr></table></td></tr>
<tr><td>Fuel Type: Same as proposed design</td><td>As proposed</td></tr>
<tr><td>Rated Storage Volume: Same as proposed design</td><td>As proposed</td></tr>
<tr><td>Draw Pattern: Same as proposed design</td><td>As proposed</td></tr>
<tr><td>Efficiencies: Uniform Energy Factor complying with 10 CFR §430.32</td><td>As proposed</td></tr>
<tr><td>Tank Temperature: 120° F (48.9° C)</td><td>Same as standard reference design</td></tr>
<tr><td rowspan="4">Thermal distribution systems</td><td>Duct location:
<table><tr><td>Foundation Type</td><td>Slab on grade</td><td>Unconditioned crawl space</td><td>Basement or conditioned crawl space</td></tr><tr><td>Duct location (supply and return)</td><td>One-story building: 100% in unconditioned attic

All other: 75% in unconditioned attic and 25% inside conditioned space</td><td>One-story building: 100% in unconditioned crawlspace

All other: 75% in unconditioned crawlspace and 25% inside conditioned space</td><td>50% inside conditioned space

50% unconditioned attic</td></tr></table></td><td>Duct location: as proposed.</td></tr>
<tr><td>Duct insulation: in accordance with Section R403.3.1.</td><td>Duct insulation: as proposed.</td></tr>
<tr><td>Duct system leakage to outside:
For duct systems serving > 1,000ft2 of conditioned floor area, the duct leakage to outside rate shall be 4 cfm (113.3 L/min) per 100 ft2 (9.29 m2) of conditioned floor area.
For duct systems serving ≤ 1,000ft2 of conditioned floor area, the duct leakage to outside rate shall be 40 cfm (1132.7 L/min).</td><td>Duct System Leakage to Outside: The measure total duct system leakage rate shall be entered into the software as the duct system leakage to outside rate.
Exceptions:
<table><tr><td>1.</td><td>When duct system leakage to outside is tested in accordance ANSI/ RESNET/ICC 380 or ASTM E1554, the measured value shall be permitted to be entered.</td></tr><tr><td>2.</td><td>When total duct system leakage is measured without the air handler installed, the simulation value shall be 4 cfm (113.3 L/min) per 100 ft^2 (9.29 m^2) of conditioned floor area.</td></tr></table></td></tr>
<tr><td>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.</td><td>For hydronic systems and ductless systems, DSE shall be as specified in Table R405.4.2(2).</td></tr>
<tr><td>Thermostat</td><td>Type: Manual, cooling temperature setpoint = 75°F;
Heating temperature setpoint = 72°F.</td><td>Same as standard reference design.</td></tr>
<tr><td>Dehumidistat</td><td>Where a mechanical ventilation system with latent heat recovery is not specified in the proposed design: None. Where the proposed design utilizes a mechanical ventilation system with latent heat recovery:
Dehumidistat type: manual, setpoint = 60% relative humidity.
Dehumidifier: whole-dwelling with integrated energy factor = 1.77 liters/kWh.</td><td>Same as standard reference design.</td></tr>
</table>

For SI: 1 square foot = 0.93 m^2, 1 British thermal unit = 1055 J, 1 pound per square foot = 4.88 kg/m^2, 1 gallon (US) = 3.785 L, °C = (°F-32)/1.8, 1 degree = 0.79 rad.

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.

g. For a proposed design the following assumptions shall be made for both the proposed design and standard reference design.

   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 §130.32

h. For residences with conditioned basements, R-2 and R-4 residences, and for townhouse units, 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.

i. 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 Table R405.4.2(1), the standard reference design shall be the same as proposed design.

Reason: Air leakage can cause huge energy losses, accounting for up to a third of a home's energy use. Additionally, air leakage can significantly reduce indoor air quality and comfort levels. Compared to individual components of a building or equipment, a building's envelope has a much longer life-span and requiring lower levels of air leakage can result in long-term energy benefits.
Certain technology providers, such as Aeroseal and AeroBarrier, measure envelope leakage pre- and post-delivery of their service for every project. As part of each project, they deliver an instantly verifiable envelope sealing report which eliminates the need for additional third party testing. By eliminating the need for additional testing in such cases, the barriers and cost to deploying additional efficiency measures are reduced.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
Any increase in cost will be marginal and will be offset by long-term gains.

Workgroup Recommendation

Proposal # 1379

RED1-240-22

Proponents: Robert Schwarz, representing BUILDTank, Inc. (robby@btankinc.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R402.5.1.2 Testing. The *building* or each *dwelling unit* in the buildingshall be tested for air leakage. The maximum air leakage rate for any *building* or *dwelling unit* under any compliance path shall not exceed 3.0 ~~4.0~~ air changes per hour or 0.22 cfm/ft^2(1.1 L/s x m^2) of building or dwelling unit enclosure area regardless of the compliance option used. Testing shall be conducted in accordance with ANSI/RESNET/ICC 380, ASTM E779, ASTM E1827 or ASTM E3158 and reported at a pressure differential of 0.2 inch water gauge (50 Pa). 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.

Exceptions:

1. When testing individual dwelling units, an air leakage rate not exceeding 0.27 cubic feet per minute per square foot [1.35 L/s x m^2)] 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:

   1.1 Attached single and multiple family building dwelling units.

   1.2 Buildings or dwelling units that are 1,500 square feet (139.4 m^2) or smaller.

2. 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.
3. Where tested in accordance with R402.5.1.4, testing of each dwelling unit is not required.

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.

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.

~~**R402.5.1.3 Prescriptive air leakage rate.** When complying with Section R401.2.1, the building or each dwelling unit in the building shall have an air leakage rate not exceeding 5.0 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, when tested in accordance with Section R402.5.1.2.~~

Reason: Building to an air leakage rate of 3.0 ACH50 is not airtight enough to have solid control and predictability of air flow through the building thermal envelope for energy efficiency or building durability. Building science dictates tight home regardless of the climate zone. Climate zones 3 through 8 have demonstrated that achieving 3 ACH50 is not difficult or costly. It is time to concentrate on bringing all climate zones to a single achievable air leakage rate rather than push for reduced air leakage rates per climate zone. Builders are pushing forward with tighter homes on their own in climate zones 3-8 because they have seen that it is not difficult or costly to achieve. The IECC is doing a disservice to climate zones 0-2 by not also pushing them to adopt sound building science and achievable minimum standards that opens their building market up to innovation and better performance.

Cost Impact: The code change proposal will increase the cost of construction.
Yes only in climate zones 0-2. however they will quickly learn from their colleagues in climate zones 3-8 how to build to 3 ACH50, how to use Table R402.4.1.1 air barriers, air sealing, and insulation installation, and how to properly ventilate the house in more humid climates as already required by

the code. Ensuring the code continues to promote sound building science across the county is more important that a incremental bump in first costs.

Workgroup Recommendation

Proposal # 1034

RED1-241-22

Proponents: Michele DeFrance, representing City of Portland Maine (mdefrance@portlandmaine.gov)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R402.5.1.3 Prescriptive air leakage rate. When complying with Section R401.2.1, the building or each dwelling unit in the building shall have an air leakage rate not exceeding 5.0 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, when tested in accordance with Section R402.5.1.2.

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 where a ducted system is provided. The system shall be a balanced ventilation system with a sensible recovery efficiency (SRE) of no less than 65 percent at 32°F (0°C) at 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.

2024 ENERGY Chapter11

TABLE N1105.4.2(1) SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS

For SI: 1 square foot = 0.93 m^2, 1 British thermal unit = 1055 J, 1 pound per square foot = 4.88 kg/m^2, 1 gallon (US) = 3.785 L, °C = (°F – 32)/1.8, 1 degree = 0.79 rad.

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.

g. For a proposed design the following assumptions shall be made for both the proposed design and standard reference design.

   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 §130.32

h. For residences with conditioned basements, R-2 and R-4 residences, and for townhouse units, 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.

i. 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 Table N1105.4.2(1), the standard reference design shall be the same as proposed design.

Reason: Comment: The language lowers the maximum of 2.5 changes per hour for all climate zones 6 and higher, removing the possibility of natural ventilation, and requires the use of ducted systems and ERVs for ventilation for all dwellings in these climate zones.

Point 1: This section (R402.5.1.3) applies to all residences in climate zones 6-8 across the board, with no exceptions, and lowers the air changes per hour below the threshold that requires dwellings to have ducted ventilation, increasing the cost of construction.

Point 2:

This section (R403.6.1) goes further, and requires all residences in climate zones 6-8 across the board, with no exceptions, to have ERV units. ERV units are not commonly used in residences, and would require calculations be done by either a design professional or engineer, increasing the cost of construction.

Point 3:

As most builders would have to use new or alternative means and methods to achieve the further reduced air changes per hour, this will also increase the cost of construction.

Recommendation:

In order to allow for natural ventilation and alternative types of ventilation, these sections, including IRC, Table N1105.4.2(1)[R405.4.2(1)] should be revised to reflect 3 air changes for climate zones 6 through 8.

Cost Impact: The code change proposal will decrease the cost of construction.
The change from 2.5 air changes per hour to 3 air changes per hour in climate zones 6 through 8 will reduce construction costs for residential buildings.

Workgroup Recommendation

Proposal # 1447

RED1-242-22

Proponents: Amy Boyce, representing Energy Efficient Codes Coalition (EECC) (amy.boyce@imt.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R402.5.1.3 Prescriptive air leakage rate. When complying with Section R401.2.1, the building or each dwelling unit in the building shall have an air leakage rate not exceeding 4.0 ~~5.0~~ 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 3 ~~6~~ through 8, when tested in accordance with Section R402.5.1.2.

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 Table R402.1.2.	As proposed
	Solar absorptance = 0.75.	As proposed
	Emittance = 0.90.	As proposed
Basement and crawl space walls	Type: same as proposed.	As proposed
	Gross area: same as proposed.	As proposed
	U-factor: as specified in Table R402.1.2, with the insulation layer on the interior side of the walls.	As proposed
Above-grade floors	Type: wood frame.	As proposed
	Gross area: same as proposed.	As proposed
	U-factor: as specified in Table R402.1.2.	As proposed
Ceilings	Type: wood frame.	As proposed
	Gross area: same as proposed.	As proposed
	U-factor: as specified in Table R402.1.2.	As proposed
Roofs	Type: composition shingle on wood sheathing.	As proposed
	Gross area: same as proposed.	As proposed
	Solar absorptance = 0.75.	As proposed
	Emittance = 0.90.	As proposed
Attics	Type: vented with an aperture of 1 ft^2 per 300 ft^2 of ceiling area.	As proposed
Foundations	Type: same as proposed.	As proposed
	Foundation wall area above and below grade and soil characteristics: same as proposed.	As proposed
Opaque doors	Area: 40 ft^2.	As proposed
	Orientation: North.	As proposed
	U-factor: same as fenestration as specified in Table R402.1.2.	As proposed
Vertical fenestration other than opaque doors	Total area[h] = (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 Table R402.1.2.	As proposed
	SHGC: as specified in Table R402.1.2 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 × SHGC for the standard reference design).	Interior shade fraction: 0.92 – (0.21 × SHGC as proposed)
	External shading: none	As proposed
Skylights	None	As proposed
Thermally isolated sunrooms	None	As proposed
	The air leakage rate at a pressure of 0.2 inch w.g. (50 Pa) shall be Climate Zones 0 through 2: 4.0 ~~5.0~~ air changes per hour. Climate Zones 3 ~~, 4, and 5: 3.0 air changes per hour. Climate Zones 6~~ through 8: 2.5 air changes per hour.	The measured air exchange rate.[a]
	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 B x M where:	

Air exchange rate	where: B = 0.01 × CFA + 7.5 × (Nbr + 1), cfm. M = 1.0 where the measured air exchange rate is > = 3.0 air changes per hour at 50 Pascals, and otherwise, M = minimum (1.7, Q/B) Q = the proposed mechanical ventilation rate, cfm. CFA = conditioned floor area, ft2. Nbr = number of bedrooms. 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 Section R403.6.1. Heat recovery or energy recovery shall not be modeled for mechanical ventilation where not required by Section R403.6.1.	The mechanical ventilation rate[b], Q, shall be in addition to the air leakage rate and shall be as proposed.
Mechanical ventilation	Where mechanical ventilation is not specified in the proposed design: None Where mechanical ventilation is specified in the proposed design, the annual vent fan energy use, in units of kWh/yr, shall equal (8.76 × B × M)/ef where: B and M are determined in accordance with the Air Exchange Rate row of this table. e_f = the minimum fan efficacy, as specified in Table 403.6.2, corresponding to the system type at a flow rate of B × M. *CFA* = conditioned floor area, ft^2. N_{br} = number of bedrooms.	As proposed
Internal gains	IGain, in units of Btu/day per dwelling unit, shall equal 17,900 + 23.8 ×*CFA* + 4,104 × N_{br} where: *CFA* = conditioned floor area, ft^2. N_{br} = number of bedrooms.	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[c] but not integral to the building 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 Table R402.1.3, 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[d, e, j, k]	For other than electric heating without a heat pump: as proposed. 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 Section R403.7.	
	Fuel Type/Capacity: Same as proposed design	As proposed
	Product class: Same as proposed design	As proposed
	Efficiencies:	As proposed
	Heat pump: Complying with 10 CFR §430.32	As proposed
	Non-electric furnaces: Complying with 10 CFR §430.32	As proposed
	Non-electric boilers: Complying with 10 CFR §430.32	As proposed
Cooling systems[d, f, k]	As proposed. Capacity: sized in accordance with Section R403.7.	
	Fuel Type: Electric Capacity: Same as proposed design	As proposed
	Efficiencies: Complying with 10 CFR §430.32	As proposed
		As proposed Use, in units of gal/day = 25.5 + (8.5 × N_{br}) × (1 – *HWDS*) where:

<table>
<tr>
<td rowspan="6">Service water heating[d, g, k]</td>
<td>As proposed.
Use, in units of gal/day = 25.5 + (8.5 × N_{br})
where: N_{br} = number of bedrooms.</td>
<td>where:
N_{br} = number of bedrooms.
HWDS = factor for the compactness of the hot water distribution system.
<table>
<tr><th colspan="2">Compactness ratio[i] factor</th><th>HWDS</th></tr>
<tr><td>1 story</td><td>2 or more stories</td><td></td></tr>
<tr><td>> 60%</td><td>> 30%</td><td>0</td></tr>
<tr><td>> 30% to ≤ 60%</td><td>> 15% to ≤ 30%</td><td>0.05</td></tr>
<tr><td>> 15% to ≤ 30%</td><td>> 7.5% to ≤ 15%</td><td>0.10</td></tr>
<tr><td>< 15%</td><td>< 7.5%</td><td>0.15</td></tr>
</table></td>
</tr>
<tr><td>Fuel Type: Same as proposed design</td><td>As proposed</td></tr>
<tr><td>Rated Storage Volume: Same as proposed design</td><td>As proposed</td></tr>
<tr><td>Draw Pattern: Same as proposed design</td><td>As proposed</td></tr>
<tr><td>Efficiencies: Uniform Energy Factor complying with 10 CFR §430.32</td><td>As proposed</td></tr>
<tr><td>Tank Temperature: 120° F (48.9° C)</td><td>Same as standard reference design</td></tr>
<tr>
<td rowspan="4">Thermal distribution systems</td>
<td>Duct location:
<table>
<tr><td>Foundation Type</td><td>Slab on grade</td><td>Unconditioned crawl space</td><td>Basement or conditioned crawl space</td></tr>
<tr><td>Duct location (supply and return)</td><td>One-story building: 100% in unconditioned attic

All other: 75% in unconditioned attic and 25% inside conditioned space</td><td>One-story building: 100% in unconditioned crawlspace

All other: 75% in unconditioned crawlspace and 25% inside conditioned space</td><td>50% inside conditioned space

50% unconditioned attic</td></tr>
</table></td>
<td>Duct location: as proposed.</td>
</tr>
<tr><td>Duct insulation: in accordance with Section R403.3.1.</td><td>Duct insulation: as proposed.</td></tr>
<tr>
<td>Duct system leakage to outside:
For duct systems serving > 1,000ft2 of conditioned floor area, the duct leakage to outside rate shall be 4 cfm (113.3 L/min) per 100 ft2 (9.29 m2) of conditioned floor area.
For duct systems serving ≤ 1,000ft2 of conditioned floor area, the duct leakage to outside rate shall be 40 cfm (1132.7 L/min).</td>
<td>Duct System Leakage to Outside: The measure total duct system leakage rate shall be entered into the software as the duct system leakage to outside rate.
Exceptions:
<table>
<tr><td>1.</td><td>When duct system leakage to outside is tested in accordance ANSI/ RESNET/ICC 380 or ASTM E1554, the measured value shall be permitted to be entered.</td></tr>
<tr><td>2.</td><td>When total duct system leakage is measured without the air handler installed, the simulation value shall be 4 cfm (113.3 L/min) per 100 ft^2 (9.29 m^2) of conditioned floor area.</td></tr>
</table></td>
</tr>
<tr><td>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.</td><td>For hydronic systems and ductless systems, DSE shall be as specified in Table R405.4.2(2).</td></tr>
<tr><td>Thermostat</td><td>Type: Manual, cooling temperature setpoint = 75°F;
Heating temperature setpoint = 72°F.</td><td>Same as standard reference design.</td></tr>
<tr><td>Dehumidistat</td><td>Where a mechanical ventilation system with latent heat recovery is not specified in the proposed design: None. Where the proposed design utilizes a mechanical ventilation system with latent heat recovery:
Dehumidistat type: manual, setpoint = 60% relative humidity.
Dehumidifier: whole-dwelling with integrated energy factor = 1.77 liters/kWh.</td><td>Same as standard reference design.</td></tr>
</table>

For SI: 1 square foot = 0.93 m^2, 1 British thermal unit = 1055 J, 1 pound per square foot = 4.88 kg/m^2, 1 gallon (US) = 3.785 L, °C = (°F-32)/1.8, 1 degree = 0.79 rad.

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.

g. For a proposed design the following assumptions shall be made for both the proposed design and standard reference design.

   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 §130.32

h. For residences with conditioned basements, R-2 and R-4 residences, and for townhouse units, 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.

i. 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 Table R405.4.2(1), the standard reference design shall be the same as proposed design.

Reason: This proposal improves the efficiency of the IECC by incorporating a moderate improvement in envelope air tightness. It also restores two proposals that were originally approved by the IECC-Residential Consensus Committee, but were negotiated away in a compromise among a subset of the IECC-Residential Committee during the balloting process.
Proposal REPI-64, which was approved by the Residential Consensus Committee, would have improved envelope air tightness to 2.0 ACH50 in climate zones 3-8. However, in the final negotiations among some Consensus Committee members, this proposal was inexplicably weakened to apply a smaller improvement to only climate zones 6-8. While we continue to believe there is support for 2.0 ACH50 across climate zones 3-8, and a considerable number of Consensus Committee members expressed support for this measure in the balloting process, in the interest of finding a reasonable compromise, this public comment proposes 2.5 ACH50 as the requirement across these climate zones. This level of envelope air tightness is achievable and cost-effective for these climate zones.

This comment would also restore the approved air tightness requirement in climate zones 0-2 that was approved 31-9 by the Residential Consensus Committee in REPI-63. To our knowledge, this proposal received only one negative ballot in Ballot #1, and the change to 4.0 ACH50 should have been included in the public comment redline and on cdpAccess. It would be inconsistent with ICC’s procedural rules to allow the Consensus Committee to modify a proposal that has received over 2/3 positive ballots through the first three rounds of balloting.

Cost Impact: The code change proposal will increase the cost of construction.
This proposal will increase the cost of construction. Although this will marginally increase the cost of construction, the improved air tightness is cost-effective to the homeowner and will create a more comfortable home. Using U.S. DOE’s methodology for analyzing code change proposals, an analysis of this improvement in climate zones 4 and 5 found the following life cycle cost-effectiveness and simple payback estimates:

				Simple Payback Analysis			Life Cycle Cost Analysis		
Climate Zone	ACH50	kWh/yr Savings	Therms/yr Savings	Marginal Upgrade Cost	Annual Energy Savings	Simple Payback (Years)	Present Value Costs	Present Value Benefits	Life Cycle Cost
CZ 4	2.5	68.9	5.9	$89	$17.50	5.1	$201	$944	-$743
CZ 5	2.5	109.8	2.8	$89	$18.40	4.8	$201	$992	-$790

The cost-effectiveness calculator developed by the IECC-Commercial Cost-Effectiveness Subcommittee also found a similar 4-5 year simple payback and positive life-cycle savings.

Workgroup Recommendation

RED1-243-22 Part I

Proponents: Theresa Weston, representing ABAA (Air Barrier Association of America) (holtweston88@gmail.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

~~**R402.5.4**~~ **R402.1.6** **Rooms containing fuel-burning appliances.** In Climate Zones 3 through 8, where open combustion air ducts provide combustion air to open combustion fuel-burning appliances, the appliances and combustion air opening shall be located outside the *building thermal envelope* or enclosed in a room that is isolated from inside the thermal envelope. Such rooms shall be sealed and insulated in accordance with the envelope requirements of Table R402.1.3, where the walls, floors and ceilings shall meet a minimum of the *basement wall R*-value requirement. The door into the room shall be fully gasketed and any water lines and ducts in the room insulated in accordance with Section R403. The combustion air duct shall be insulated where it passes through *conditioned space* to an *R*-value of not less than R-8.

Exceptions:

1. Direct vent appliances with both intake and exhaust pipes installed continuous to the outside.
2. Fireplaces and stoves complying with Section R402.5.2 and Section R1006 of the International Residential Code.

Reason: This moves the section on "Rooms containing fuel-burning appliances" to a more appropriate place in the code. Currently, it is buried in the air leakage section, but contains more general requirements rather than only air leakage requirements.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This proposal only reorganizes the code and makes no changes in requirements.

Workgroup Recommendation

Proposal # 1281

RED1-243-22 Part II

Proponents: Theresa Weston, representing ABAA (Air Barrier Association of America) (holtweston88@gmail.com)

2024 ENERGY Chapter11

Revise as follows:

~~**N1102.5.4**~~ **N1102.1.6** **Rooms containing fuel-burning appliances.** In Climate Zones 3 through 8, where opencombustion airducts provide combustion air to open combustion fuel-burning appliances, the appliances and combustion air opening shall be located outside the *building thermal envelope* or enclosed in a room that is isolated from inside the thermal envelope. Such rooms shall be sealed and insulated in accordance with the envelope requirements of Table N1102.1.3, where the walls, floors and ceilings shall meet a minimum of the *basement wall R*-value requirement. The door into the room shall be fully gasketed and any water lines and ducts in the room insulated in accordance with Section N1103. The combustion air duct shall be insulated where it passes through *conditioned space* to an *R*-value of not less than R-8.

Exceptions:

1. Direct vent appliances with both intake and exhaust pipes installed continuous to the outside.
2. Fireplaces and stoves complying with Sections N1102.5.2 and R1006.

Reason: This moves the section on "Rooms containing fuel-burning appliances" to a more appropriate place in the code. Currently, it is buried in the air leakage section, but contains more general requirements rather than only air leakage requirements.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This proposal only reorganizes the code and makes no changes in requirements.

Workgroup Recommendation

Proposal # 1310

RED1-244-22

Proponents: Robert Schwarz, representing BUILDTank, Inc. (robby@btankinc.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R402.5.6 Air-Sealed electrical and communication outlet boxes and other equipment boxes, housings, and enclosure. Air-sealed electrical and communication outlet boxes and other equipment boxes, housings, and enclosures that penetrate the air barrier of the building thermal envelope shall be caulked, taped, gasketed, or otherwise sealed to the air barrier element being penetrated and ~~. Air sealed boxes~~ shall be buried in or surrounded by insulation. Air-sealed **electrical and communication outlet** boxes shall be tested and marked in accordance with NEMA OS 4. Air-sealed electrical and communication outlet boxes and other equipment boxes, housings, and enclosures ~~boxes~~ shall be installed in accordance with the manufacturer's instructions .

Reason: It is important to have consistency in the language of the code. The air barrier air sealing and insulation installation table has language that is different than Section R402.5.6 and this proposal better ensures that the requirements align. The notion of other equipment boxes, housings, and enclosures now calls out fan housing, low voltage boxes, and audio speaker boxes, for example, that need to be sealed when installed within the building's thermal envelope. This level of air sealing better ensures the ability of a builder to achieve the air leakage requirements of the energy code and lets them know up front what needs to be addressed in order to be successful at achieving the requirement.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This proposal does not impact cost of construction but better ensure that the requirements for air sealing the home align in all sections of the code.

Workgroup Recommendation

Proposal # 1136

RED1-245-22

Proponents: Shane Hoeper, representing myself (shoeper@cityofdubuque.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R402.5.6 Air-Sealed electrical and communication outlet boxes. Air-sealed electrical and communication outlet boxes that penetrate the air barrier of the building thermal envelope shall be caulked, 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 shall be tested and marked in accordance with NEMA OS 4. Air-sealed boxes shall be installed in accordance with the manufacturer's instructions .

Reason: Insulation contact is not necessary to maintain air tightness. Depending on the envelope assembly, there may not even be insulation present.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
The code change proposal will not increase the cost of construction.

Workgroup Recommendation

Proposal # 1140

RED1-246-22

Proponents: Jacob Miller, representing Smart Surfaces Coalition (jmiller@smartsurfacescoalition.org); Jennifer Amann, representing ACEEE (jamann@aceee.org)

2024 International Energy Conservation Code [RE Project]

Add new text as follows:

R402.7 **Roof Solar Reflectance.** Roofs shall comply with the following three-year aged Solar Reflectance Index standards:

Revise as follows:

TABLE R402.7 MAXIMUM ROOF REFLECTANCE[a]

TYPE	ROOF SLOPE	THREE-YEAR AGED SOLAR REFLECTANCE INDEX[b,c]
All	Low-slope	85
Asphalt Shingle	Steep-slope	30
Metal	Steep-slope	60
Tile	Steep-slope	50

a. The use of area-weighted averages to comply with these requirements shall be permitted. Materials lacking 3-year-aged tested values for solar reflectance shall be assigned a 3-year-aged solar reflectance in accordance with Section R408.2.1.3.1.

b. Aged solar reflectance tested in accordance with ASTM C1549, ASTM E903 or ASTM E1918 or CRRC-S100.

c. Solar reflectance index (SRI) shall be determined in accordance with ASTM E1980 using a convection coefficient of 2.1 BTU/hr X ft^2 x °F ($12W/m^2$. Calculation of aged SRI shall be based on aged tested values of solar reflectance and thermal emittance.

Add new text as follows:

R402.7.1 Aged solar reflectance. Where an aged solar reflectance required by section 402.7 is not available, it shall be determined in accordance with Equation 4-4.

$R_{aged} = [0.2 + 0.7 (R_{intial} - 0.2)]$ **(Equation 4-4)**

where:

R_{aged} = Aged solar reflactance

$R_{initial}$ = Initial solar reflectance determined in accordance with CRRC-S1000

Exceptions:

1. Roofs in Climate Zones 6-8
2. Roofs where more than 75 percent of roof area complies with one or more of the exceptions below:
    1. Portions of the roof that are covered by the following
        1. Photovoltaic systems or components
        2. Solar air or water heating systems or components
        3. Vegetative roofs or landscaped roofs
        4. Above roof decks or walkways
        5. Skylights
        6. HVAC systems and components, and other opaque objects mounted above the roof
    2. Portions of roof shaded during the peak sun angle on the summer solstice by permanent features of the building or by permanent features of adjacent buildings
    3. Portions of roofs that are ballasted with a minimum stone ballast of 17 pounds per square foot ($74kg/m^2$) or 23 psf ($117kg/m^2$) pavers

Revise as follows:

TABLE R408.2 CREDITS FOR ADDITIONAL ENERGY EFFICIENCY

Measure Number	Measure Description	Credit Value								
		Climate Zone 0 & 1	Climate Zone 2	Climate Zone 3	Climate Zone 4	Climate Zone 4C	Climate Zone 5	Climate Zone 6	Climate Zone 7	Climate Zone 8
R408.2.1.1(1)	≥2.5% Reduction in total UA	0	0	0	1	1	1	1	1	1
R408.2.1.1(2)	≥5% reduction in total UA	0	1	1	2	2	3	3	3	3
R408.2.1.1(3)	>7.5% reduction in total UA	0	1	2	2	2	3	3	4	4
R408.2.1.2(1)	0.22 U-factor windows	1	2	2	3	3	4	4	4	5
R408.2.1.2(2)	U-factor and SHGC for windows per Table R408.2.1	1	1	1	0	0	0	0	1	2
~~R408.2.1.3~~	~~Cool Roof~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~0~~	~~0~~	~~0~~	~~0~~
R408.2.2(1)	High performance cooling system option 1	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(2)	High performance cooling system option 2	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(3)	High performance gas furnace option 1	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(4)	High performance gas furnace option 2	0	0	0	0	0	TBD	TBD	TBD	0
R408.2.2(5)	High performance gas furnace and cooling system option 2	TBD	TBD	TBD	TBD	TBD	0	0	0	TBD
R408.2.2(6)	High performance gas furnace and heat pump system option 1	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(7)	High performance gas furnace option 2	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(8)	High performance heat pump system option 1	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(9)	High performance heat pump system option 2	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(10)	High performance heat pump system option 3	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(11)	Ground source heat pump	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(12)	Ductless - Single zone	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(13)	Ductless - Multizone (Non-ducted indoor unit)	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(14)	Ductless – Multizone (Ducted or Mixed)	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.3(1)	Gas-fired storage water heaters	7	6	5	3	3	2	2	3	1
R408.2.3(2)	Gas-fired instantaneous water heaters	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.3(3)	Electric water heaters	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.3(4)	Electric water heaters	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.3(5)	Solar hot water heating system	4	5	6	6	6	6	5	5	4
R408.2.3(6)	Compact hot water distribution	2	2	2	2	2	2	2	2	2
R408.2.4(1)	More efficient distribution system	4	6	7	10	10	12	13	15	16
R408.2.4(2)	100% of ducts in conditioned space	4	6	8	12	12	15	17	19	20
R408.2.4(3)	Reduced total duct leakage	1	1	1	1	1	1	2	2	2
R408.2.5(1)	2 ACH50 air leakage rate with ERV or HRV installed	1	4	5	10	10	13	15	8	8
R408.2.5(2)	2 ACH50 air leakage rate with balanced ventilation	2	3	2	4	4	5	6	6	6

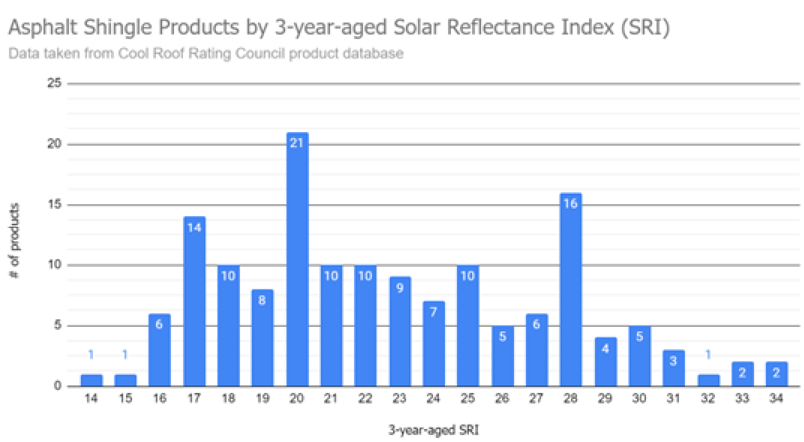
R408.2.5(3)	1.5 ACH50 air leakage rated with ERV or HRV installed	2	4	6	12	12	15	18	11	11
R408.2.5(4)	1 ACH50 air leakage rate with ERV or HRV installed	2	5	6	14	14	17	21	14	14
R408.2.6	Energy efficient appliances	9	8	8	7	7	5	5	5	4
R408.2.7	Renewable energy measures	17	16	17	11	11	9	8	7	4
R408.2.9	Demand responsive thermostat	1	1	1	1	1	1	1	1	1

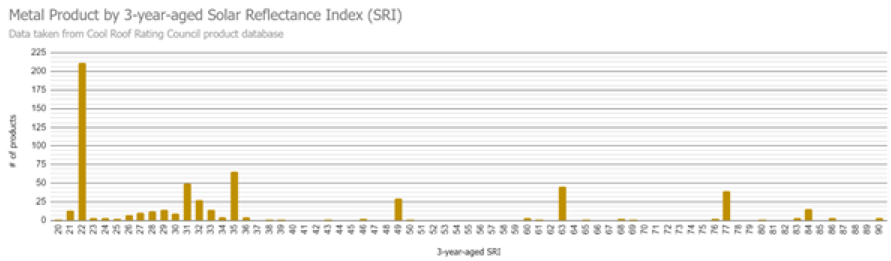
Delete without substitution:

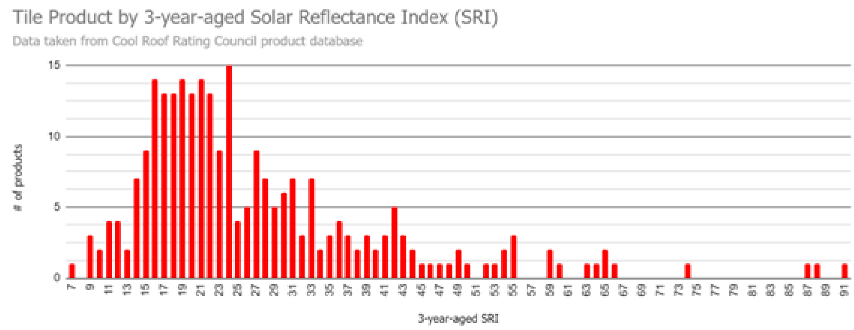
~~**R408.2.1.3 Roof reflectance.** Roofs shall comply with one or more of the options in Table R408.2.1.3.~~

Reason: The 2024 International Energy Conservation Code (IECC) should add a residential requirement, R402.7, to set steep-slope roof 3-year-aged Solar Reflectance Index (SRI) standards for asphalt shingle, metal, and tile roofs at or above 30, 60, and 50 respectively in Climate Zones 1-5, and low-slope roof 3-year-aged SRI standards at or above 85 in Climate Zones 1-5.

These SRI low-slope requirements were recently proposed and accepted for the California Energy Code (Title 24, Part 6) [1]. Additionally, the Cool Roof Rating Council directory lists more than 400 roofing products with 3-year-aged Solar Reflectance Index values ≥30 in the categories of asphalt shingle, tile, and metal – all products used for steep-slope residential buildings. Thirteen of these products are asphalt shingle, and these higher-SRI products are produced by national/international roofing material manufacturers such as CertainTeed, Malarkey, Tamko, ATAS International, Sherwin Williams, and Owens Corning. The recommended updates to the 2024 IECC Residential Code are feasible and necessary to address rising temperatures around the world, especially in metropolitan areas due to the Urban Heat Island effect.







The International Energy Conservation Code was created by the International Code Council in 2000, and its scope is overdue to be updated if it is going to effectively deliver on its initial purpose. The purpose of building codes is to protect the general health, safety, and welfare of the people that occupy the buildings [2].

Over the last few decades, scientific understanding of building impacts and climate change has evolved and broadened while understanding of risks to health, safety and welfare has also changed considerably. As the reality of climate change and the broad scope of its economic, environmental justice, and health impacts are becoming more accepted, codes must evolve to serve a broader set of societal interests, not a limited set of outdated interests. Therefore, this submission, from a broad coalition of leading health, policy, architecture, environmental design and other groups is advocating for two types of changes – **first**, that the scope of the code be updated to bring it into line with current understanding of science including the risks and impacts of climate on health, environmental justice, economic competitiveness, and urban viability, taking into account associated costs and benefits. Bringing code scope up to date will allow codes to deliver on their objectives and allow codes to address issues that have emerged in the last two decades such as urban heat deaths, city-wide heating or cooling from city-wide reflectivity from roof surfaces, and health, environmental justice and climate costs. Cities and other public jurisdictions rely on codes to incorporate rigorous and complete cost-benefit analysis – and codes today do not include a large range of costs and benefits, so today do not effectively serve their purpose and role. The Smart Surfaces Coalition and its many partners[1] ask that code be updated to effectively serve its purpose and role to reflect current understanding of climate change science, such as large city-wide heating, health, and risk impacts from roofing decisions. **Second,** codes provide a valuable role for cities and other jurisdictions to communicate efficiently to the roofing and services market their desire for improved products. This role has been strengthened by the greatly increased perception of climate risks, rising heat deaths, and related environmental justice issues. In order to provide those market signals, **the Smart Surfaces Coalition asks in Section 2 [below] that this code adoption include targets for the next cycle (IECC 2027) which would greatly increase target 3-year-aged SRI to reflect the reality of climate change and the emerging political consensus that governments must behave responsibly towards the threat of climate change**. For steep-slope roofs, the SSC recommends a standard 3-year-aged Solar Reflectance Index of ≥40, ≥75, and ≥70 for asphalt shingle, metal, and tile respectively and ≥90 for low-slope roofs in the 2027 IECC Residential Code. Today, there exist more than 65 metal roofing products with 3-year-aged Solar Reflectance Index of ≥75, four tile roofing products with 3-year-aged Solar Reflectance Index ≥70, and more than 375 low-slope roofing products with a 3-year-aged Solar Reflectance Index of ≥90 [3]. Lawrence Berkeley National Laboratory published a 2016 study of Next-Generation Asphalt Shingles, in which the team produced several materials for “faux shingles” (designed for reflectance study) [4]. These existing materials indicate a clear industry trajectory towards an ability to meet 2027 standards cost-effectively by 2027.

The Smart Surfaces Coalition[2] strongly supports the inclusion of Section R402.7 in the 2024 IECC. This proposal was developed jointly by the Smart Surfaces Coalition[3], the American Council for an Energy-Efficient Economy, and New Buildings Institute, and reflects the objectives and views of the Smart Surfaces Coalition[4], which is a coalition of 40+ industry-leading organizations including the American Institute of Architects, the National League of Cities, the Alliance to Save Energy, the American Public Health Association, the American Planning Association, the World Cement Association and Habitat for Humanity. Greg Kats (gkats@cap-e.com), CEO of Smart Surfaces Coalition, is an additional co-proponent of this proposal.

The only consistent opposition to the expansion of reflective roof requirements are dark roofing manufacturers and their industry groups. A 2016 roofing industry review discusses these “erroneous claims against cool roofs despite the science supporting their general benefits...the success of...cool roof technologies has created an anxiety among the manufacturers of ‘non-cool’ roofs. They have initiated a campaign through the ERA to discredit, or at least cast doubt, on the fundamental science behind cool roofing” [5].In Spring 2022, two roofing materials industry groups, the Asphalt Roofing Manufacturers Association (ARMA) and the EPDM Roofing Association (ERA), submitted a document to the Baltimore City Council opposing a new roof ordinance to increase roof reflectivity. These organizations sought to raise doubts about the legitimacy and benefit of increasing the use of reflective/cool surfaces in Baltimore. The objections made in Baltimore by these two groups, which have been persuasively rebutted by other roofing industry organizations, are discussed and dismissed again below.

A. Energy and Heat Reduction

Cool or reflective roofs reflect far more sunlight back into the atmosphere than a conventional, dark roof, which absorbs roughly 80 - 95% of incoming sunlight. Asphalt and EPDM-based materials are examples of these dark, lower-cost roofing options. These dark roofs heat buildings, worsen city-wide urban heat, increase air conditioning demand, aggravate smog and air pollution, and impose large economic and equity burdens. As a result of such costs, these types of dark roofs are increasingly being rejected by cities and by national and internationalIt should also be noted that homes in northern climates often have high levels of roof insulation. There is a common misconception that higher insulation levels reduce or negate the energy-saving impact of cool roofs. A study of black and white roof membranes over various levels of insulation by the Princeton Plasma Physics Lab showed that the relationship between roof reflectivity and insulation was not a tradeoff. This means that for a homeowner to have a roof that minimizes heat gain in the summer and heat loss in the winter, both insulation and reflectivity are necessary [7]. Given climate projections from the Intergovernmental Panel on Climate Change (IPCC), city-wide cooling strategies like reflective roofs are moving from optional to essential to protect city livability [8]. Over the last two decades, the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) has found that heating degree days have dropped 15% while cooling degree days have increased by about 15%. These findings were drawn from out-of-date data. Given accelerated global warming, the shift from heating to cooling degree days is substantially larger than the ASHRAE estimations indicate [9]. Given the reality of global warming and the decrease in heating degree days, reflective roofs are a strong and suitable solution across climate zones.

B. Health

Reflective roofs can reduce urban heat, smog, heat deaths, and costs, building a strong public health argument for their deployment in Climate Zones 1-5. Heat deaths typically occur on the top floor of a building as a direct result of the heating of dark roofs [10]. For example, a Chicago multi-day heat event in 1995 killed 793 people [11]. With the value of a statistical life at about $10 million, the deaths alone quantify this tragedy at $800 million [12]. This is without any attempt to quantify the cost of the larger number of people who suffered from, though survived, the heat event. Chicago is in Zone 5, illustrating the increased severity of heat events across Climate Zones.

More generally, reflective roofs can improve health outcomes with the health benefits that come with reducing indoor and outdoor extreme heat. The impacts of excess urban heat are large and complex including increased risk of chronic diseases, obesity, occupational accidents, and reduced work capacity [13]. Reflective roofs measurably reduce urban temperature, protecting the lives and health of populations.

C. Moisture

Cool roofs reduce energy demand, mitigate urban heat islands, and can be built without the presence of moisture. Moisture and condensation risks on cool roofs can be easily eliminated by using a variety of commercially available products or roof designs. In colder climates, warm, humid air travels upward in a building during the cold winter months and can infiltrate the roof assembly from the bottom. In a paper presented to the 2011 NRCA International Roofing Symposium, the Single Ply Roofing Industry (SPRI) reported on a field survey and modeling studies to verify whether cool roofs were susceptible to condensation buildup. SPRI found that though moisture was observed on the underside of the membrane on three roofs, researchers noted “no detrimental effects due to moisture in any of the roofs [14].” In all cases, the minimal moisture build-up detected in the winter months dried up by the summer.

The Smart Surfaces Coalition has worked with multiple cities to undertake city-wide cost-benefit analysis of Smart Surfaces including reflective residential roofs. For example, in 2021, the Smart Surfaces Coalition conducted a 248-page analysis with/for the city of Baltimore and a range of partners such as the American Institute of Architects, the National League of Cities, and the American Public Health Association that demonstrated how reflective roofs are both cost-effective (with a benefit-cost ratio greater than 9:1) and provide broad benefits including in the areas of health, employment, risk reduction, reduced energy bills and improved resilience [15]. The report quantified the benefits that reflective roofs deliver including reduced heat, better air quality, lower energy bills, reduced risk of summer heat deaths, and improved urban structural inequality, and large health benefits.

[1]

This does NOT include SSC partner Cool Roof Rating Council, which may not make such recommendations

[2] NOT INCLUDING SSC partner Cool Roof Rating Council

[3] NOT INCLUDING SSC partner Cool Roof Rating Council.

[4] NOT INCLUDING SSC partner Cool Roof Rating Council.

Section 2

*Recommending the levels proposed in Section 1 as an effective **first** step for introduction of a higher performance roofing requirement in the mandatory IECC-residential code. Future updates (2027 IECC-residential code) might, for example, include the following text. We consider these values to be conservative and are likely to recommend this performance level or higher:*

As a reference for the next adoption cycle, the Smart Surfaces Coalition recommends the following update to Table 402.7 for the 2027 IECC Residential code revision:

TABLE 402.7

MINIMUM ROOF REFLECTANCE[a]

TYPE	ROOF SLOPE	THREE-YEAR AGED SOLAR REFLECTANCE INDEX[b,c]
All	Low-slope	90
Asphalt Shingle	Steep-slope	40
Metal	Steep-slope	75
Tile	Steep-slope	70

a. The use of area-weighted averages to comply with these requirements shall be permitted. Materials lacking 3-year-aged tested values for solar reflectance shall be assigned a 3-year-aged solar reflectance in accordance with Section R408.2.1.3.1.

b. Aged solar reflectance tested in accordance with ASTM C1549, ASTM E903 or ASTM E1918 or CRRC-S100.

c. Solar reflectance index (SRI) shall be determined in accordance with ASTM E1980 using a convection coefficient of 2.1 Btu/h × ft ^2 × °F (12 W/m^2 × K). Calculation of aged SRI shall be based on aged tested values of solar reflectance and thermal emittance.

R402.7.1 Aged solar reflectance

Where an aged solar reflectance required by section 402.7 is not available, it shall be determined in accordance with Equation 4-4

(Equation 4-4)

R_aged= [0.2+0.7(R_initial-0.2)]

R_{aged} = Aged solar reflectance

$R_{initial}$ = Initial solar reflectance determined in accordance with CRRC-S100

Exceptions:

1. Roofs in Climate Zones 6-8
2. Roofs where more than 75 percent of roof area complies with one or more of the exceptions below:
   1. Portions of the roof that are covered by the following
      1. Photovoltaic systems or components
      2. Solar air or water heating systems or components
      3. Vegetative roofs or landscaped roofs
      4. Above roof decks or walkways
      5. Skylights
      6. HVAC systems and components, and other opaque objects mounted above the roof
   2. Portions of roof shaded during the peak sun angle on the summer solstice by permanent features of the building or by permanent features of adjacent buildings

Portions of roofs that are ballasted with a minimum stone ballast of 17 pounds per square foot (74kg/m^2) or 23 psf (117kg/m^2) pavers

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
SSC agrees with the broad roofing and building industry consensus on the cost-effectiveness of reflective roofs. The leading industry publication, Roofing Magazine, for example, asserts that “decades of real-world examples from the marketplace indicate that reflective roofs are an effective net energy (and money) saver even in our coldest cities” [16]. Reflective roof requirements would help remove the cost burden of dark roofs from home and property owners by guiding them to make the more cost-effective choice.

Given the broad availability of multiple commercial products (outlined in the Reason Statement) that meet or exceed the proposed 3-year-aged SRI performance levels, in many cases there will be no cost premium for selecting a higher performance product that meets the proposed code level. In cases where there is a price premium, expected payback period is a few years or less due to the large range of additional benefits from reflective roofs, including surface life extension, lower energy bills, lower city temperature, improved air quality, health and environmental justice benefits, etc [17]. According to the EPA, the cost premium for cool roofs versus conventional roofing materials ranges from zero to 5 or 10 cents per square foot for most products, while cool roofs can provide an average yearly net savings of almost 50 cents per square foot [18].

Energy Star estimates that the average Heating & Air Conditioning Costs for Homeowners in the U.S. is $1,000 per year. The U.S. Department of Energy states that substituting a cool roof for a conventional roof can reduce the annual air-conditioning energy use of a single-story building by up to 15% [19]. The U.S. Office of Energy Efficiency and Renewable Energy’s Federal Energy Management Program has calculated that the required ENERGY STAR-qualified cool roof product saves money if priced no more than $0.64/$ft^2$ (in 2020 dollars) above the less efficient model (e.g., $640 for a building with a 1,000 ft^2 roof) [20]. Analysis done for the city of Baltimore put cool roof cost-premium estimates at $0.10/$ft^2$ and $0.30/$ft^2$ for low- and steep-slope roofs respectively [21].

Additionally, with rapidly rising market demand and the desire to respond to climate change, roofing manufacturers are increasingly investing in more reflective roofing products. Reflective roofs not only reduce unwanted heat and cut pollution, energy bills, smog, and GHG emissions but also commonly command larger profit margins for roofing product companies. This dynamic makes cool roofs more desirable for both manufacturers and consumers in most cities.

The Smart Surfaces Coalition has worked with multiple cities to undertake city-wide cost-benefit analysis of Smart Surfaces including reflective residential roofs. For example, in 2021, the Smart Surfaces Coalition conducted a 248-page analysis with/for the city of Baltimore and a range of partners such as AIA, the National League of Cities, and the American Public Health Association demonstrating that reflective roofs are very cost-effective, with a benefit-cost ratio of over 10:1 [22].

Clearly, there is broad documentation and consensus – with the exception of dark roof companies and their industry groups – that reflective roofs are cost-effective and important design elements across the country including in climate zones 1-5. The case for extending reflective surface requirements to the residential code in the IECC is clear and compelling.

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Workgroup Recommendation

Proposal # 1207

RED1-247-22

Proponents: Craig Conner, representing self (craig.conner@mac.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R403.3.3 Ducts buried within ceiling insulation.

4.2 Where air-permeable insulation is used and installed at attic floor, air shall be supplied at a flow rate greater than or equal to 50 CFM (23.6 L/s) per 1,000 square feet (93 m) of ceiling. The air shall be supplied from ductwork providing supply air to the unvented attic space when the conditioning system is operating. Alternatively, the air shall be supplied by a supply fan when the conditioning system is operating.

Reason: Additional research done by the Department of Energy thru the Building America Program has shown that additional moisture removal should be provided when vapor diffusion ports are used in the configuration described, This is done by providing supply air.
Joseph Lstiburek (joe@buildingscience.com) representing Building Science Corporation, is the co-proponent of this proposal. Craig Conner is representing Building Quality.

Cost Impact: The code change proposal will increase the cost of construction.
The cost of this code change proposal is minor. It is the cost of providing one supply air duct to the attic.

Workgroup Recommendation

Proposal # 1337

RED1-248-22

Proponents: Craig Conner, representing self (craig.conner@mac.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

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

1. The supply and return ducts shall have an insulation *R*-value not less than R-8.
2. At all points along each duct, the sum of the ceiling insulation *R*-value against and above the top of the duct, and against and below the bottom of the duct, 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 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 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 when installed in an unvented attic with vapor diffusion port, the supply ducts shall be completely buried within ceiling insulation, 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 duct that are less than 3 feet (914 mm) from the supply outlet shall not be required to comply with these requirements.

   4.1 Air permeable insulation installed in unvented attics shall be in compliance with the requirements of Section R806.5.2 of the *International Residential Code*.

   <u>4.2 Where air-permeable insulation is used and installed at attic ceiling, air shall be supplied at a flow rate greater than or equal to 50 CFM (23.6 L/s) per 1,000 square feet (93 m) of ceiling. The air shall be supplied from ductwork providing supply air to the unvented attic space when the conditioning system is operating. Alternatively, the air shall be supplied by a supply fan when the conditioning system is operating</u>

Reason: Additional research done by the Department of Energy thru the Building America Program has shown that additional moisture removal should be provided when vapor diffusion ports are used in the configuration described, This is done by providing supply air.
Only Section 4.2 is new. Section 4.1 is existing code.

Joseph Lstiburek (joe@buildingscience.com) representing self and Building Science Corporation is the co-proponent of this proposal. Craig Conner is representing self and Building Quality.

Cost Impact: The code change proposal will increase the cost of construction.
The cost of this code change proposal is minor. It is the cost of providing one supply air duct to the attic

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Workgroup Recommendation

Proposal # 1340

RED1-249-22

Proponents: Gayathri Vijayakumar, representing Steven Winter Associates, Inc. (gvijayakumar@swinter.com)

2024 International Energy Conservation Code [RE Project]

SECTION R202
GENERAL DEFINITIONS

Revise as follows:

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

SECTION R405
SIMULATED BUILDING PERFORMANCE

Revise as follows:

R405.1 Scope. This section establishes criteria for compliance using 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 R401 through R404.

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

1. The requirements of the sections indicated within Table R405.2.
2. The proposed total building thermal envelope UA, which is the sum of the 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 1.08 in Climate Zones 0, 1, and 2, and 1.15 in Climate Zones 3 through 8 in accordance with Equation 4-2. The area-weighted maximum fenestration SHGC permitted in Climate Zones 0 through 3 shall be 0.30.

(Equation 4-2)

$$\text{For Climate Zones 0-2: } UA_{\text{Proposed design}} \leq 1.08 \times UA_{\text{Prescriptive reference design}}$$
$$\text{For Climate Zones 3-8: } UA_{\text{Proposed design}} \leq 1.15 \times UA_{\text{Prescriptive reference design}}$$

3. For each dwelling unit~~buildings~~ without a fuel burning appliance for space heating or water heating, the annual energy cost of the proposed design that is less than or equal to 85 percent of the annual energy cost of the *standard reference design*. For each dwelling unit~~buildings~~ with a fuel burning appliance for space heating or water heating, the annual energy cost of the dwelling unit~~proposed design~~ that is less than or equal to 80 percent of the annual energy cost of the standard reference design. For each dwelling unit~~s~~ with greater than 5,000 square feet (465 m^2) of living space floor area located above grade plane, the annual energy cost of the dwelling unit~~proposed design~~ shall be reduced by an additional 5 percent of annual energy cost of the *standard reference design*. Energy prices shall be taken from a source *approved* by the *code official*, such as the Department of Energy, 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 multipliers for all energy sources shall be obtained from ASHRAE Standard 105 (Tables K2, K4, or K8) or from another data source approved by the *code official*.
   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 for an all-electric dwelling unit~~building~~ with on-site renewable energy installed.
   3. For buildings with eight or more *dwelling units*, where the building components' energy specifications are the same in each *dwelling unit*, simulations shall be permitted on the greater of seven or 20 percent of the *dwelling units* in the building. Simulated *dwelling units* shall include a top floor unit, a ground floor unit, a middle floor unit, and the *dwelling unit* with the largest *dwelling unit enclosure area*

R405.3 Documentation. Documentation of the software used for the proposed design, as-built dwelling unit, and the parameters for the *standard reference design*~~baseline *building*~~ shall be in accordance with Sections R405.3.1 through R405.3.2.2.

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.*

Revise as follows:

R405.3.2 Compliance report. Compliance software tools shall generate a report that documents that the *proposed design* and as-built *dwelling unit* complies with Section R405. 2~~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 *c ode official* before a certificate of occupancy is issued. Compliance reports shall include information in accordance with Sections R405.3.2.1 and R405.3.2.2.

R405.3.2.1 Compliance report for permit application. A compliance report submitted 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 the software used to produce the results for the *standard reference design* and~~/or~~ the proposed design~~rated home~~.
5. A certificate indicating that the *proposed design* complies with Section R405. 2~~3~~. 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 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 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 dwelling unit~~home~~.

R405.3.2.2 Compliance report for certificate of occupancy. A compliance report submitted for obtaining the certificate of occupancy shall include the following:

1. Building street address, or other *building site* identification.
2. Declaration of the 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 R405.2~~3~~.
4. The name and version of the compliance software tool.
5. A site-specific energy analysis report that is in compliance with Section R405.4~~3~~ , 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~~confirmed rated design of the built home~~ complies with Section R405. 2~~3~~. The certificate shall report the energy features that were confirmed to be in the building~~home~~, including component-level insulation *R*-values or *U*-factors; results from any required duct system and building envelope air leakage testing; and the type and rated efficiencies of the heating, cooling, mechanical ventilation and service water-heating equipment installed.
7. When on-site renewable energy systems have been installed, the certificate shall report the type and production size of the installed system.

R405.4 Calculation procedure. Calculations ~~of the proposed design~~ shall be in accordance with Sections R405.4.1 and R405.4.2.

R405.4.1 General. Except as specified by this section, the *standard reference design*, ~~and~~ *proposed design*, and as-built *dwelling unit* shall be configured and analyzed using identical methods and techniques.

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.

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

Portions of table not shown remain unchanged.

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Air exchange rate	The air leakage rate at a pressure of 0.2 inch w.g. (50 Pa) shall be Climate Zones 0 through 2: 4.0 air changes per hour. Climate Zones 3 , 4, and 5: 3.0 air changes per hour. Climate Zones 6 through 8: 2.5 air changes per hour.	The measured[l] air leakage ~~exchange~~ rate.[a]
	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 B x M where: B = 0.01 × CFA + 7.5 × (Nbr + 1), cfm. M = 1.0 where the measured air leakage ~~exchange~~ rate is > = 3.0 air changes per hour at 50 Pascals, and otherwise, M = minimum (1.7, Q/B) Q = the proposed mechanical ventilation rate, cfm. CFA = conditioned floor area, ft2. Nbr = number of bedrooms. 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 Section R403.6.1. Heat recovery or energy recovery shall not be modeled for mechanical ventilation where not required by Section R403.6.1.	The measured[l] mechanical ventilation rate[b], Q, shall be in addition to the measured air leakage rat~~e and shall be as proposed~~.
Thermal distribution systems	Duct system leakage to outside: For duct systems serving > 1,000ft2 of conditioned floor area, the duct leakage to outside rate shall be 4 cfm (113.3 L/min) per 100 ft2 (9.29 m2) of conditioned floor area. For duct systems serving ≤ 1,000ft2 of conditioned floor area, the duct leakage to outside rate shall be 40 cfm (1132.7 L/min).	Duct System Leakage to Outside: The measured[l] total duct system leakage rate shall be entered into the software as the duct system leakage to outside rate. **Exceptions:** 1. When duct system leakage to outside is tested in accordance ANSI/ RESNET/ICC 380 or ASTM E1554, the measured value shall be permitted to be entered. 2. When total duct system leakage is measured without the air handler installed, the simulation value shall be 4 cfm (113.3 L/min) per 100 ft^2 (9.29 m^2) of conditioned floor area.

For SI: 1 square foot = 0.93 m^2, 1 British thermal unit = 1055 J, 1 pound per square foot = 4.88 kg/m^2, 1 gallon (US) = 3.785 L, °C = (°F-32)/1.8, 1 degree = 0.79 rad.

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.

g. For a proposed design the following assumptions shall be made for both the proposed design and standard reference design.

   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 §130.32

h. For residences with conditioned basements, R-2 and R-4 residences, and for townhouse units, 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.

i. 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 Table R405.4.2(1), the standard reference design shall be the same as proposed design.

l. For the *proposed design*, where measured values are not yet available, assumptions shall be permitted. These assumptions shall be replaced with measured values prior to obtaining the certificate of occupancy.

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 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. Calculations that account for the effects 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. Printed *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 2, AFUE, SEER 2 and UEF.

Reason: This public comment is submitted to accomplish the following:

1. Clarify that for Group R-2 buildings, simulations are performed on the dwelling unit, not the whole building. Common spaces, such as lobbies, stairwells, corridors and amenity spaces shall follow requirements in R401 through R404.
2. For Group R-2, rather than require repetitive modeling of dwelling units with identical features, specifies a list of unit types that must be simulated.
3. Makes more explicit the process prior to CO (i.e., proposed design MUST be updated with as-built information) and creates a footnote to clarify that assumptions for tested results may be used at Proposed Design for the sake of the permit application.
4. Corrected some incorrect section references
5. Updates references to SEER, EF and HSPF to more current ratings

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
N/A

Bibliography: None

Workgroup Recommendation

Proposal # 1143

RED1-250-22

Proponents: Greg Johnson, representing National Multifamily Housing Council (gjohnsonconsulting@gmail.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

TABLE R405.2 REQUIREMENTS FOR SIMULATED BUILDING PERFORMANCE

Portions of table not shown remain unchanged.

SECTION[a]	TITLE
Building Thermal Envelope	
~~R402.2.9~~	~~Basement walls~~
~~R402.2.9.1~~	~~Basement wall insulation installation~~
~~R402.2.10.1~~	~~Slab-on-grade floor insulation installation~~
~~R402.2.11.1~~	~~Crawl space wall insulation installations~~

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

TABLE R406.2 REQUIREMENTS FOR ENERGY RATING INDEX

Portions of table not shown remain unchanged.

SECTION[a]	TITLE
Building Thermal Envelope	
~~R402.2.9~~	~~Basement walls~~
~~R402.2.9.1~~	~~Basement wall insulation installation~~
~~R402.2.10.1~~	~~Slab-on-grade floor insulation installation~~
~~R402.2.11.1~~	~~Crawl space wall insulation installation~~

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

Reason: Each of the sections proposed to be deleted from Tables R405.2 and R406.2 are prescriptive installation requirements that mandate a certain area of insulation be installed (under a full slab per footnote d to Table R402.1.3; top of the basement wall to 10 ft below grade or to the basement floor; crawlspace insulation from sill to base of foundation or to interior floor of crawlspace).
Mandating installation of specific areas - volumes - of insulation defeats the purpose of the performance paths, which are intended to permit the flexibility of trading some amount or area of insulation for other energy saving measures like additional insulation in some other area of the building.

There is no reason that an owner/designer/contractor should not be able to trade away 1/2 of the insulation on a basement wall. Ditto for underslab insulation and crawlspace wall insulation provided the any loss of energy efficiency is fully mitigated by other efficiency measures .

Cost Impact: The code change proposal will decrease the cost of construction.
The proposal protects trade-off flexibility which permits owners to find the most cost effective approach to energy code compliance.

Workgroup Recommendation

Proposal # 1076

RED1-251-22

Proponents: Gayathri Vijayakumar, representing Steven Winter Associates, Inc. (gvijayakumar@swinter.com)

2024 International Energy Conservation Code [RE Project]

SECTION R405
SIMULATED BUILDING PERFORMANCE

Revise as follows:

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

Portions of table not shown remain unchanged.

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Air exchange rate	For detached one-family dwellings, t~~T~~he air leakage rate at a pressure of 0.2 inch water gauge ~~w.g.~~ (50 Pa) shall be Climate Zones 0 through 2: 4.0~~5.0~~ air changes per hour. Climate Zones 3 , 4, and 5: 3.0 air changes per hour. Climate Zones 6 through 8: 2.5 air changes per hour. For detached one-family dwellings that are 1,500 ft^2 (139.4 m^2) or smaller and attached *dwelling units*, the air leakage rate at a pressure of 0.2 inch water gauge (50 Pa) shall be 0.25 cfm/ft^2 of the *dwelling unit enclosure area.*	The measured air leakage~~exchange~~ rate.[a]
	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 B x M where: B = 0.01 × CFA + 7.5 × (Nbr + 1), cfm. M = 1.0 where the measured air leakage~~exchange~~ rate is > = 3.0 air changes per hour at 50 Pascals, and otherwise, M = minimum (1.7, Q/B) Q = the proposed mechanical ventilation rate, cfm. CFA = conditioned floor area, ft2. Nbr = number of bedrooms. ~~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 Section R403.6.1. Heat recovery or energy recovery shall not be modeled for mechanical ventilation where not required by Section R403.6.1.~~	The measured mechanical ventilation rate[b], Q, shall be in addition to the measured air leakage rate ~~and shall be as proposed~~.
Mechanical ventilation	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 Section R403.6.1. Heat recovery or energy recovery shall not be modeled for mechanical ventilation where not required by Section R403.6.1. Where mechanical ventilation is not specified in the proposed design: None Where mechanical ventilation is specified in the proposed design, the annual vent fan energy use, in units of kWh/yr, shall equal (8.76 × B × M)/ef where: B and M are determined in accordance with the Air Exchange Rate row of this table. e_f = the minimum fan efficacy, as specified in Table 403.6.2, corresponding to the system type at a flow rate of B × M. *CFA* = conditioned floor area, ft^2. N_{br} = number of bedrooms.	As proposed

For SI: 1 square foot = 0.93 m^2, 1 British thermal unit = 1055 J, 1 pound per square foot = 4.88 kg/m^2, 1 gallon (US) = 3.785 L, °C = (°F-32)/1.8, 1 degree = 0.79 rad.

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.

g. For a proposed design the following assumptions shall be made for both the proposed design and standard reference design.

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 §130.32

h. For residences with conditioned basements, R-2 and R-4 residences, and for townhouse units, 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.

i. 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 Table R405.4.2(1), the standard reference design shall be the same as proposed design.

Reason: Based on another public comment to add a 0.25 cfm50/ft2 metric for the air leakage threshold for attached units and smaller homes when using the Prescriptive Compliance option, this public comment adds those same metrics/thresholds to the Standard Reference Design (SRD). Additionally, given that air “exchange” rate is the combination of air “leakage” and mechanical ventilation, some revisions are made to phrasing to maintain that intent.

Also, the text related the ERV and HRVs in the SRD is better placed in the row called “Mechanical Ventilation” rather than “Air exchange rate”, so this PC proposes to move it.

Also, footnote a contains text redundant to R402.5.1.2, so is struck in this PC.

Finally, an Errata was submitted clarifying that the Committee previously voted to approve REPI-63, therefore the 5.0 ACH50 is revised to 4.0 ACH50, as approved previously by the Committee.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
None

Bibliography: None

Workgroup Recommendation

Proposal # 1164

RED1-252-22

Proponents: Aaron Phillips, representing Asphalt Roofing Manufacturers Association (aphillips@asphaltroofing.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

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 Table R402.1.2.	As proposed
	Solar reflectance~~absorptance~~ = 0.25~~0.75~~.	As proposed
	Emittance = 0.90.	As proposed
Basement and crawl space walls	Type: same as proposed.	As proposed
	Gross area: same as proposed.	As proposed
	U-factor: as specified in Table R402.1.2, with the insulation layer on the interior side of the walls.	As proposed
Above-grade floors	Type: wood frame.	As proposed
	Gross area: same as proposed.	As proposed
	U-factor: as specified in Table R402.1.2.	As proposed
Ceilings	Type: wood frame.	As proposed
	Gross area: same as proposed.	As proposed
	U-factor: as specified in Table R402.1.2.	As proposed
Roofs	Type: composition shingle on wood sheathing.	As proposed
	Gross area: same as proposed.	As proposed
	Solar reflectance~~absorptance~~ = 0.25~~0.75~~.	As proposed
	Emittance = 0.90.	As proposed
Attics	Type: vented with an aperture of 1 ft^2 per 300 ft^2 of ceiling area.	As proposed
Foundations	Type: same as proposed.	As proposed
	Foundation wall area above and below grade and soil characteristics: same as proposed.	As proposed
Opaque doors	Area: 40 ft^2.	As proposed
	Orientation: North.	As proposed
	U-factor: same as fenestration as specified in Table R402.1.2.	As proposed
Vertical fenestration other than opaque doors	Total area[h] = (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 Table R402.1.2.	As proposed
	SHGC: as specified in Table R402.1.2 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 × SHGC for the standard reference design).	Interior shade fraction: 0.92 – (0.21 × SHGC as proposed)
	External shading: none	As proposed
Skylights	None	As proposed
Thermally isolated sunrooms	None	As proposed
	The air leakage rate at a pressure of 0.2 inch w.g. (50 Pa) shall be Climate Zones 0 through 2: 5.0 air changes per hour. Climate Zones 3 , 4, and 5: 3.0 air changes per hour. Climate Zones 6 through 8: 2.5 air changes per hour.	The measured air exchange rate.[a]
	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 B x M where:	

Air exchange rate	where: B = 0.01 × CFA + 7.5 × (Nbr + 1), cfm. M = 1.0 where the measured air exchange rate is > = 3.0 air changes per hour at 50 Pascals, and otherwise, M = minimum (1.7, Q/B) Q = the proposed mechanical ventilation rate, cfm. CFA = conditioned floor area, ft2. Nbr = number of bedrooms. 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 Section R403.6.1. Heat recovery or energy recovery shall not be modeled for mechanical ventilation where not required by Section R403.6.1.	The mechanical ventilation rate[b], Q, shall be in addition to the air leakage rate and shall be as proposed.
Mechanical ventilation	Where mechanical ventilation is not specified in the proposed design: None Where mechanical ventilation is specified in the proposed design, the annual vent fan energy use, in units of kWh/yr, shall equal (8.76 × B × M)/ef where: B and M are determined in accordance with the Air Exchange Rate row of this table. e_f = the minimum fan efficacy, as specified in Table 403.6.2, corresponding to the system type at a flow rate of B × M. *CFA* = conditioned floor area, ft^2. N_{br} = number of bedrooms.	As proposed
Internal gains	IGain, in units of Btu/day per dwelling unit, shall equal 17,900 + 23.8 ×*CFA* + 4,104 × N_{br} where: *CFA* = conditioned floor area, ft^2. N_{br} = number of bedrooms.	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[c] but not integral to the building 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 Table R402.1.3, 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[d, e, j, k]	For other than electric heating without a heat pump: as proposed. 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 Section R403.7.	
	Fuel Type/Capacity: Same as proposed design	As proposed
	Product class: Same as proposed design	As proposed
	Efficiencies:	As proposed
	Heat pump: Complying with 10 CFR §430.32	As proposed
	Non-electric furnaces: Complying with 10 CFR §430.32	As proposed
	Non-electric boilers: Complying with 10 CFR §430.32	As proposed
Cooling systems[d, f, k]	As proposed. Capacity: sized in accordance with Section R403.7.	
	Fuel Type: Electric Capacity: Same as proposed design	As proposed
	Efficiencies: Complying with 10 CFR §430.32	As proposed
		As proposed Use, in units of gal/day = 25.5 + (8.5 × N_{br}) × (1 − *HWDS*)

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<tr><td rowspan="6">Service water heating[d, g, k]</td><td>As proposed.
Use, in units of gal/day = 25.5 + (8.5 × N_{br})
where: N_{br} = number of bedrooms.</td><td>(1 − HWDS)
where:
N_{br} = number of bedrooms.
HWDS = factor for the compactness of the hot water distribution system.
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<tr><td>> 30% to ≤ 60%</td><td>> 15% to ≤ 30%</td><td>0.05</td></tr>
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<tr><td>Fuel Type: Same as proposed design</td><td>As proposed</td></tr>
<tr><td>Rated Storage Volume: Same as proposed design</td><td>As proposed</td></tr>
<tr><td>Draw Pattern: Same as proposed design</td><td>As proposed</td></tr>
<tr><td>Efficiencies: Uniform Energy Factor complying with 10 CFR §430.32</td><td>As proposed</td></tr>
<tr><td>Tank Temperature: 120° F (48.9° C)</td><td>Same as standard reference design</td></tr>
<tr><td rowspan="4">Thermal distribution systems</td><td>Duct location:
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<tr><td>Foundation Type</td><td>Slab on grade</td><td>Unconditioned crawl space</td><td>Basement or conditioned crawl space</td></tr>
<tr><td>Duct location (supply and return)</td><td>One-story building: 100% in unconditioned attic

All other: 75% in unconditioned attic and 25% inside conditioned space</td><td>One-story building: 100% in unconditioned crawlspace

All other: 75% in unconditioned crawlspace and 25% inside conditioned space</td><td>50% inside conditioned space

50% unconditioned attic</td></tr>
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<tr><td>Duct insulation: in accordance with Section R403.3.1.</td><td>Duct insulation: as proposed.</td></tr>
<tr><td>Duct system leakage to outside:
For duct systems serving > 1,000ft2 of conditioned floor area, the duct leakage to outside rate shall be 4 cfm (113.3 L/min) per 100 ft2 (9.29 m2) of conditioned floor area.
For duct systems serving ≤ 1,000ft2 of conditioned floor area, the duct leakage to outside rate shall be 40 cfm (1132.7 L/min).</td><td>Duct System Leakage to Outside: The measure total duct system leakage rate shall be entered into the software as the duct system leakage to outside rate.
Exceptions:
<table>
<tr><td>1.</td><td>When duct system leakage to outside is tested in accordance ANSI/ RESNET/ICC 380 or ASTM E1554, the measured value shall be permitted to be entered.</td></tr>
<tr><td>2.</td><td>When total duct system leakage is measured without the air handler installed, the simulation value shall be 4 cfm (113.3 L/min) per 100 ft^2 (9.29 m^2) of conditioned floor area.</td></tr>
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<tr><td>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.</td><td>For hydronic systems and ductless systems, DSE shall be as specified in Table R405.4.2(2).</td></tr>
<tr><td>Thermostat</td><td>Type: Manual, cooling temperature setpoint = 75°F;
Heating temperature setpoint = 72°F.</td><td>Same as standard reference design.</td></tr>
<tr><td>Dehumidistat</td><td>Where a mechanical ventilation system with latent heat recovery is not specified in the proposed design: None. Where the proposed design utilizes a mechanical ventilation system with latent heat recovery:
Dehumidistat type: manual, setpoint = 60% relative humidity.
Dehumidifier: whole-dwelling with integrated energy factor = 1.77 liters/kWh.</td><td>Same as standard reference design.</td></tr>
</table>

For SI: 1 square foot = 0.93 m^2, 1 British thermal unit = 1055 J, 1 pound per square foot = 4.88 kg/m^2, 1 gallon (US) = 3.785 L, °C = (°F-32)/1.8, 1 degree = 0.79 rad.

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.

g. For a proposed design the following assumptions shall be made for both the proposed design and standard reference design.

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 §130.32

h. For residences with conditioned basements, R-2 and R-4 residences, and for townhouse units, 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.

i. 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 Table R405.4.2(1), the standard reference design shall be the same as proposed design.

2024 ENERGY Chapter11

Revise as follows:

TABLE N1105.4.2(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 Table N1102.1.2.	As proposed
	Solar reflectance~~absorptance~~ = 0.25~~0.75~~.	As proposed
	Emittance = 0.90.	As proposed
Basement and crawl space walls	Type: same as proposed.	As proposed
	Gross area: same as proposed.	As proposed
	U-factor: as specified in Table N1102.1.2, with the insulation layer on the interior side of the walls.	As proposed
Above-grade floors	Type: wood frame.	As proposed
	Gross area: same as proposed.	As proposed
	U-factor: as specified in Table N1102.1.2.	As proposed
Ceilings	Type: wood frame.	As proposed
	Gross area: same as proposed.	As proposed
	U-factor: as specified in Table N1102.1.2.	As proposed
Roofs	Type: composition shingle on wood sheathing.	As proposed
	Gross area: same as proposed.	As proposed
	Solar reflectance~~absorptance~~ = 0.25~~0.75~~.	As proposed
	Emittance = 0.90.	As proposed
Attics	Type: vented with an aperture of 1 ft^2 per 300 ft^2 of ceiling area.	As proposed
Foundations	Type: same as proposed.	As proposed
	Foundation wall area above and below grade and soil characteristics: same as proposed.	As proposed
Opaque doors	Area: 40 ft^2.	As proposed
	Orientation: North.	As proposed
	U-factor: same as fenestration as specified in Table N1102.1.2.	As proposed
Vertical fenestration other than opaque doors	Total area[h] = (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 Table N1102.1.2.	As proposed
	SHGC: as specified in Table N1102.1.2 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 × SHGC for the standard reference design).	Interior shade fraction: 0.92 – (0.21 × SHGC as proposed)
	External shading: none	As proposed
Skylights	None	As proposed
Thermally isolated sunrooms	None	As proposed
	The air leakage rate at a pressure of 0.2 inch w.g. (50 Pa) shall be Climate Zones 0 through 2: air changes per hour. Climate Zones 3 , 4, and 5: 3.0 air changes per hour. Climate Zones 6 through 8: 2.5 air changes per hour.	The measured air exchange rate.[a]

Air exchange rate	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 B x M where:B = 0.01 × CFA + 7.5 × (Nbr + 1), cfm. M = 1.0 where the measured air exchange rate is ≥ 3.0 air changes per hour at 50 Pascals, and otherwise, M = minimum (1.7, Q/B) Q = the proposed mechanical ventilation rate, cfm. CFA = conditioned floor area, ft2. Nbr = number of bedrooms.The mechanical ventilation system type shall be the same as in the proposed design. Heat recovery or energy recovery shall be modeled assumed for mechanical ventilation where required by Section N1103.6.1. Heat recovery or energy recovery shall not be modeled for mechanical ventilation where not required by Section N1103.6.1..	The mechanical ventilation rate[b] ,Q, shall be in addition to the air leakage rate and shall be as proposed.
Mechanical ventilation	Where mechanical ventilation is not specified in the proposed design: None Where mechanical ventilation is specified in the proposed design, the annual vent fan energy use, in units of kWh/yr, shall equal (8.76 x B x M)/ef where: e_f = the minimum fan efficacy, as specified in Table N1103.6.2, corresponding to the system type at a flow rate of B x M *CFA* = conditioned floor area, ft^2. N_{br} = number of bedrooms.	As proposed
Internal gains	IGain, in units of Btu/day per dwelling unit, shall equal 17,900 + 23.8 ×*CFA* + 4,104 × N_{br} where: *CFA* = conditioned floor area, ft^2. N_{br} = number of bedrooms.	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[c] but not integral to the building 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 Table N1102.1.3, 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[d, e, j, k]	For other than electric heating without a heat pump: as proposed. 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 Section N1103.7.	As proposed
	Fuel Type/Capacity: Same as proposed design	As proposed
	Product class: Same as proposed design	As proposed
	Efficiencies:	As proposed
	Heat pump: Complying with 10 CFR §430.32	As proposed
	Non-electric furnaces: Complying with 10 CFR §430.32	As proposed
	Non-electric boilers: Complying with 10 CFR §430.32	As proposed
Cooling systems[d, f, k]	As proposed. Capacity: sized in accordance with Section N1103.7.	
	Fuel Type: Electric Capacity: Same as proposed design	As proposed
	Efficiencies: Complying with 10 CFR §430.32	As proposed
		As proposed

<table>
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<td rowspan="6">Service water heating[d, g, k]</td>
<td>As proposed.
Use, in units of gal/day = $25.5 + (8.5 \times N_{br})$
where: N_{br} = number of bedrooms.</td>
<td>As proposed
Use, in units of gal/day = $25.5 + (8.5 \times N_{br}) \times (1 - HWDS)$
where:
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HWDS = factor for the compactness of the hot water distribution system.
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<tr><th colspan="2">Compactness ratio[i] factor</th><th>HWDS</th></tr>
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75% in unconditioned attic and 25% inside conditioned space</td><td>One-story building: 100% in unconditioned attic

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For SI: 1 square foot = 0.93 m^2, 1 British thermal unit = 1055 J, 1 pound per square foot = 4.88 kg/m^2, 1 gallon (US) = 3.785 L, °C = (°F – 32)/1.8, 1 degree = 0.79 rad.

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.

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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.

g. For a proposed design the following assumptions shall be made for both the proposed design and standard reference design.

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 §130.32

h. For residences with conditioned basements, R-2 and R-4 residences, and for townhouse units, 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.
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-	Common wall area is the area of walls shared with an adjoining dwelling unit.

i. 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 Table N1105.4.2(1), the standard reference design shall be the same as proposed design.

Reason: Within the IECC residential provisions and IRC Chapter 11 of the 1st Public Comment Draft, there are only two instances where "solar absorptance" is used. In contrast, there are multiple uses of "solar reflectance" in IECC Section R408.2.1.3 and IRC Section N1108.2.1.3. This comment changes those two instances of "solar absorptance," and the associated values, to make all uses consistent throughout the residential provisions. The intended result is less confusion in understanding roof radiative property requirements in different portions of the IECC and IRC. CED1-197-22 proposes the same changes in the commercial provisions.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
The changes proposed in this comment align language across sections of the code without making technical modifications. Therefore, there is no impact on cost of construction.

Workgroup Recommendation

Proposal # 981

RED1-253-22

Proponents: Greg Johnson, representing National Multifamily Housing Council (gjohnsonconsulting@gmail.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

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 roof surface complies with one of the options in Table C402.3 of the *International Energy Conservation Code*–Commercial Provisions 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 $^{1}/_{4}$ unit vertical in 12 units horizontal (21-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.

Reason: Section R101.5 clearly requires that residential buildings comply with the IECC-R rather than the IECC- commercial provisions.
The original proponent of this section should do the work of incorporating the actual requirements for the benefit of the code user instead of referencing a code that may not be adopted.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
There will be no cost impact if the original proponent does the work of incorporating the provisions they wish to see applied.

Workgroup Recommendation

Proposal # 1100

RED1-254-22

Proponents: Craig Drumheller, representing WDMA (cdrumheller@wdma.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

TABLE R408.2 CREDITS FOR ADDITIONAL ENERGY EFFICIENCY

Measure Number	Measure Description	Credit Value								
		Climate Zone 0 & 1	Climate Zone 2	Climate Zone 3	Climate Zone 4 except 4 Marine	Climate Zone 4C Marine	Climate Zone 5	Climate Zone 6	Climate Zone 7	Climate Zone 8
R408.2.1.1(1)	≥2.5% Reduction in total UA	0	0	0	1	1	1	1	1	1
R408.2.1.1(2)	≥5% reduction in total UA	0	1	1	2	2	3	3	3	3
R408.2.1.1(3)	>7.5% reduction in total UA	0	1	2	2	2	3	3	4	4
~~R408.2.1.2(1)~~	~~0.22 U-factor windows~~	~~1~~	~~2~~	~~2~~	~~3~~	~~3~~	~~4~~	~~4~~	~~4~~	~~5~~
R408.2.1.2(2)	U-factor and SHGC for ~~windows~~ vertical fenestration per Table R408.2.1	1	1	1	~~0~~ 2	~~0~~ 1	~~0~~ 1	~~0~~ 1	1	2
R408.2.1.3	Cool Roof	TBD	TBD	TBD	TBD	TBD	0	0	0	0
R408.2.2(1)	High performance cooling system option 1	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(2)	High performance cooling system option 2	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(3)	High performance gas furnace option 1	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(4)	High performance gas furnace option 2	0	0	0	0	0	TBD	TBD	TBD	0
R408.2.2(5)	High performance gas furnace and cooling system option 2	TBD	TBD	TBD	TBD	TBD	0	0	0	TBD
R408.2.2(6)	High performance gas furnace and heat pump system option 1	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(7)	High performance gas furnace option 2	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(8)	High performance heat pump system option 1	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(9)	High performance heat pump system option 2	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(10)	High performance heat pump system option 3	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(11)	Ground source heat pump	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(12)	Ductless - Single zone	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(13)	Ductless - Multizone (Non-ducted indoor unit)	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(14)	Ductless – Multizone (Ducted or Mixed)	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.3(1)	Gas-fired storage water heaters	7	6	5	3	3	2	2	3	1
R408.2.3(2)	Gas-fired instantaneous water heaters	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.3(3)	Electric water heaters	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.3(4)	Electric water heaters	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.3(5)	Solar hot water heating system	4	5	6	6	6	6	5	5	4
R408.2.3(6)	Compact hot water distribution	2	2	2	2	2	2	2	2	2
R408.2.4(1)	More efficient distribution system	4	6	7	10	10	12	13	15	16
R408.2.4(2)	100% of ducts in conditioned space	4	6	8	12	12	15	17	19	20
R408.2.4(3)	Reduced total duct leakage	1	1	1	1	1	1	2	2	2
R408.2.5(1)	2 ACH50 air leakage rate with ERV or HRV installed	1	4	5	10	10	13	15	8	8

R408.2.5(2)	2 ACH50 air leakage rate with balanced ventilation	2	3	2	4	4	5	6	6	6
R408.2.5(3)	1.5 ACH50 air leakage rated with ERV or HRV installed	2	4	6	12	12	15	18	11	11
R408.2.5(4)	1 ACH50 air leakage rate with ERV or HRV installed	2	5	6	14	14	17	21	14	14
R408.2.6	Energy efficient appliances	9	8	8	7	7	5	5	5	4
R408.2.7	Renewable energy measures	17	16	17	11	11	9	8	7	4
R408.2.9	Demand responsive thermostat	1	1	1	1	1	1	1	1	1

R408.2.1.2 Improved fenestration. The area weighted average of the vertical ~~Vertical~~ fenestration ~~shall meet one of the following:~~

~~1. U-factor equal to or less than 0.22~~

~~2~~. U-factor and SHGC shall be equal to or less than ~~that~~ values specified in Table R408.2.1.2

TABLE R408.2.1.2 IMPROVED FENESTRATION

Climate Zone	Fenestration U-factor	Fenestration SHGC
0	0.32	0.23
1	0.32	0.23
2	0.30	0.23
3	0.25	0.25
4 except 4 Marine	~~NA~~ 0.25	~~NA~~ 0.40
5 and 4 Marine	~~NA~~ 0.25	~~NA~~ NR
6	~~NA~~ 0.25	~~NA~~ NR
7 and 8	0.25	~~NA~~ NR

Reason: A number of changes are necessary in section R408 for fenestration in order to make the section more usable, improve the accuracy of credits allocated, and improve clarity and consistency.

- Climate Zone 4 has been modified to exclude Zone 4 Marine and Zone 4C changed to 4 Marine on order to make it consistent with the prescriptive tables.
- The 0.22 U-Factor measure has been removed. This is done because the associated points are only accurate with a 15% windows to floor area ratio that was used for the analysis. There are already multiple options to change the thermal performance of the building envelope which is a more accurate alternative that accounts for window area and better represents the savings associated with improving the building envelope.
- Section R408.2.1.2 has been rewritten for clarity and to insure that window U-factor and SHGC weighted averages are permitted to achieve the Improved Fenestration target values.
- Table R408.2.1.2 has been modified to include values for climate zones 4-6. It is believed that the overall energy savings is sufficient to earn 1 or 2 credits (needs to be verified by PNNL).
- NAs have been changed to NRs to be consistent with the terminology in the prescriptive tables.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
No change in cost.

Workgroup Recommendation

Proposal # 1408

RED1-255-22

Proponents: Aaron Phillips, representing Asphalt Roofing Manufacturers Association (aphillips@asphaltroofing.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R408.2.1.3 Roof reflectance. Roofs shall comply with one or more of the options in Table R408.2.1.3. The following roofs and portions of roofs are excluded from the roof reflectance credit:
1. Portions of the roof 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 of the roof shaded during the peak sun angle on the summer solstice by permanent features of the building or by permanent features of adjacent buildings.

3. Portions of roofs that are ballasted with a minimum stone ballast of 17 pounds per square foot (74 kg/m2) or 23 psf (117 kg/m2) pavers.

4. Roofs where not less than 75 percent of the roof area complies with one or more of the exceptions to this section.

TABLE R408.2 CREDITS FOR ADDITIONAL ENERGY EFFICIENCY

Measure Number	Measure Description	Credit Value								
		Climate Zone 0 & 1	Climate Zone 2	Climate Zone 3	Climate Zone 4	Climate Zone 4C	Climate Zone 5	Climate Zone 6	Climate Zone 7	Climate Zone 8
R408.2.1.1(1)	≥2.5% Reduction in total UA	0	0	0	1	1	1	1	1	1
R408.2.1.1(2)	≥5% reduction in total UA	0	1	1	2	2	3	3	3	3
R408.2.1.1(3)	>7.5% reduction in total UA	0	1	2	2	2	3	3	4	4
R408.2.1.2(1)	0.22 U-factor windows	1	2	2	3	3	4	4	4	5
R408.2.1.2(2)	U-factor and SHGC for windows per Table R408.2.1	1	1	1	0	0	0	0	1	2
R408.2.1.3	~~Cool Roof~~ Roof reflectance (roof is part of the *building thermal envelope* and directly above cooled, conditioned space)	TBD	TBD	TBD	TBD	TBD	0	0	0	0
R408.2.1.3	Roof reflectance (roof is above an unconditioned space that contains a duct system not compliant with R403.3.1)	TBD	TBD	TBD	TBD	TBD	0	0	0	0
R408.2.2(1)	High performance cooling system option 1	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(2)	High performance cooling system option 2	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(3)	High performance gas furnace option 1	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(4)	High performance gas furnace option 2	0	0	0	0	0	TBD	TBD	TBD	0
R408.2.2(5)	High performance gas furnace and cooling system option 2	TBD	TBD	TBD	TBD	TBD	0	0	0	TBD
R408.2.2(6)	High performance gas furnace and heat pump system option 1	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(7)	High performance gas furnace option 2	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(8)	High performance heat pump system option 1	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(9)	High performance heat pump system option 2	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(10)	High performance heat pump system option 3	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(11)	Ground source heat pump	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(12)	Ductless - Single zone	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(13)	Ductless - Multizone (Non-ducted indoor unit)	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(14)	Ductless – Multizone (Ducted or Mixed)	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.3(1)	Gas-fired storage water heaters	7	6	5	3	3	2	2	3	1
R408.2.3(2)	Gas-fired instantaneous water heaters	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.3(3)	Electric water heaters	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.3(4)	Electric water heaters	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.3(5)	Solar hot water heating system	4	5	6	6	6	6	5	5	4
R408.2.3(6)	Compact hot water distribution	2	2	2	2	2	2	2	2	2
R408.2.4(1)	More efficient distribution system	4	6	7	10	10	12	13	15	16
R408.2.4(2)	100% of ducts in conditioned space	4	6	8	12	12	15	17	19	20
R408.2.4(3)	Reduced total duct leakage	1	1	1	1	1	1	2	2	2
R408.2.5(1)	2 ACH50 air leakage rate with ERV or HRV installed	1	4	5	10	10	13	15	8	8
R408.2.5(2)	2 ACH50 air leakage rate with balanced ventilation	2	3	2	4	4	5	6	6	6
R408.2.5(3)	1.5 ACH50 air leakage rated with ERV or HRV installed	2	4	6	12	12	15	18	11	11
R408.2.5(4)	1 ACH50 air leakage rate with ERV or HRV installed	2	5	6	14	14	17	21	14	14
R408.2.6	Energy efficient appliances	9	8	8	7	7	5	5	5	4
R408.2.7	Renewable energy measures	17	16	17	11	11	9	8	7	4
R408.2.9	Demand responsive thermostat	1	1	1	1	1	1	1	1	1

2024 ENERGY Chapter11

Revise as follows:

N1108.2.1.3 Roof reflectance. Roofs shall comply with one or more of the options in Table N1108.2.1.3. The following roofs and portions of roofs are excluded from the roof reflectance credit:
1. Portions of the roof 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 of the roof shaded during the peak sun angle on the summer solstice by permanent features of the building or by permanent features of adjacent buildings.

3. Portions of roofs that are ballasted with a minimum stone ballast of 17 pounds per square foot (74 kg/m^2) or 23 psf (117 kg/m^2) pavers.

4. Roofs where not less than 75 percent of the roof area complies with one or more of the exceptions of this section.

TABLE N1108.2 CREDITS FOR ADDITIONAL ENERGY EFFICIENCY

Measure Number	Measure Description	Credit Value								
Climate Zone 0 & 1	Climate Zone 2	Climate Zone 3	Climate Zone 4	Climate Zone 4C	Climate Zone 5	Climate Zone 6	Climate Zone 7	Climate Zone 8		
N1108.2.1.1(1)	≥2.5% Reduction in total UA	0	0	0	1	1	1	1	1	1
N1108.2.1.1(2)	≥5% reduction in total UA	0	1	1	2	2	3	3	3	3
N1108.2.1.1(3)	>7.5% reduction in total UA	0	1	2	2	2	3	3	4	4
N1108.2.1.2(1)	0.22 U-factor windows	1	2	2	3	3	4	4	4	5
N1108.2.1.2(2)	U-factor and SHGC for windows per Table R408.2.1	1	1	1	0	0	0	0	1	2
N1108.2.1.3	~~Cool Roof~~ Roof reflectance (roof is part of the *building thermal envelope* and directly above cooled, conditioned space)	TBD	TBD	TBD	TBD	TBD	0	0	0	0
N1108.2.1.3	Roof reflectance (roof is above an unconditioned space that contains a duct system not compliant with N1103.3.2)	TBD	TBD	TBD	TBD	TBD	0	0	0	0
N1108.2.2(1)	High performance cooling system option 1	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
N1108.2.2(2)	High performance cooling system option 2	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
N1108.2.2(3)	High performance gas furnace option 1	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
N1108.2.2(4)	High performance gas furnace and cooling system option 1	0	0	0	0	0	TBD	TBD	TBD	0
N1108.2.2(5)	High performance gas furnace and cooling system option 2	TBD	TBD	TBD	TBD	TBD	0	0	0	TBD
N1108.2.2(6)	High performance gas furnace and heat pump system option 1	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
N1108.2.2(7)	High performance gas furnace option 2	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
N1108.2.2(8)	High performance heat pump system option 1	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
N1108.2.2(9)	High performance heat pump system option 2	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
N1108.2.2(10)	High performance heat pump system option 3	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
N1108.2.2(11)	Ground source heat pump	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
N1108.2.2(12)	Ductless - Single zone	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
N1108.2.2(13)	Ductless - Multizone (Non-ducted indoor unit)	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
N1108.2.2(14)	Ductless - Multizone (Ducted or Mixed)	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
N1108.2.3(1)	Gas-fired storage water heaters	7	6	5	3	3	2	2	3	1
N1108.2.3(2)	Gas-fired instantaneous water heaters	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
N1108.2.3(3)	Electric water heaters	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
N1108.2.3(4)	Electric water heaters	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
N1108.2.3(5)	Solar hot water heating system	4	5	6	6	6	6	5	5	4
N1108.2.3(6)	Compact hot water distribution	2	2	2	2	2	2	2	2	2
N1108.2.4(1)	More efficient distribution system	4	6	7	10	10	12	13	15	16
N1108.2.4(2)	100% of ducts in conditioned space	4	6	8	12	12	15	17	19	20
N1108.2.4(3)	Reduced total duct leakage	1	1	1	1	1	1	2	2	2
N1108.2.5(1)	2 ACH50 air leakage rate with ERV or HRV installed	1	4	5	10	10	13	15	8	8
N1108.2.5(2)	2 ACH50 air leakage rate with balanced ventilation	2	3	2	4	4	5	6	6	6
N1108.2.5(3)	1.5 ACH50 air leakage rated with ERV or HRV installed	2	4	6	12	12	15	18	11	11
N1108.2.5(4)	1 ACH50 air leakage rate with ERV or HRV installed	2	5	6	14	14	17	21	14	14
N1108.2.6	Energy efficient appliances	9	8	8	7	7	5	5	5	4
N1108.2.7	Renewable energy measures	17	16	17	11	11	9	8	7	4
N1108.2.9	Demand reponsive thermostat	1	1	1	1	1	1	1	1	1

Reason: Placing "cool roofs" in the additional efficiency requirements section permits design professionals to utilize reflective roofs to achieve an energy efficiency improvement when appropriate based on project specifics. However, as presently configured, selection of the cool roof credit may allow fulfillment of credit requirements without the intended improvement in energy efficiency. This comment modifies this section to ensure that, when a cool roof is selected, it can be expected to improve energy efficiency.

R408.2.1.3 (N1108.2.1.3). Under certain circumstances, installation of a reflective roof will not yield an improvement in energy efficiency. These limitations are already present in the IECC commercial provisions (C402.4 of the 1st Public Comment Draft). This comment incorporates those existing limits into the residential provisions. Doing so will prevent someone from asserting energy efficiency improvement via installation of a reflective roof when, for example, the roof is located beneath a photovoltaic array.

Table R408.2 (N1108.2). Replace the existing "cool roof" row in the table with two rows that recognize that energy efficiency improvement from a reflective roof is contingent on other conditions. One row acknowledges that energy efficiency gains may be available in certain climate zones when a reflective roof is part of the *building thermal envelope* and is above cooled, conditioned space. The other row recognizes the potential energy efficiency benefit in certain climate zones when a reflective roof is installed above an unconditioned space that contains ducts that are insufficiently insulated. By establishing separate rows in the table that recognize the interdependency of reflective roofing and other building elements, this comment supports analysis that assigns appropriate credits based on building construction details.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This comment clarifies the situations in which a reflective roof may offer energy efficiency benefits. This comment is not expected to affect cost of construction because it only adds guidance to ensure selection of an additional energy efficiency credit that saves energy.

Workgroup Recommendation

Proposal # 982

RED1-256-22

Proponents: Glen Clapper, representing National Roofing Contractors Association (gclapper@nrca.net)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R408.2.1.3 Roof reflectance. Roofs in Climate Zones 0-4 and 4C shall comply with one or more of the options in Table R408.2.1.3.

2024 ENERGY Chapter11

Revise as follows:

N1108.2.1.3 Roof reflectance. Roofs in Climate Zone 0-4 and 4C shall comply with one or more of the options in Table N1108.2.1.3.

Reason: This public comment code change proposal further clarifies that the roof reflectance criteria options are only required in these specific climate zones based upon the "TBD" credits in Table R408.2 (N1108.2).

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This public comment code change proposal will neither increase nor decrease the cost of construction.

Workgroup Recommendation

Proposal # 1430

RED1-257-22

Proponents: Aaron Phillips, representing Asphalt Roofing Manufacturers Association (aphillips@asphaltroofing.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

TABLE R408.2.1.3 MINIMUM ROOF REFLECTANCE[a]

ROOF SLOPE	THREE-YEAR AGED SOLAR REFLECTANCE INDEX[b]
Low-slope	75~~[b, c]~~
Steep-slope	16

a. The use of area-weighted averages to comply with these requirements shall be permitted. Materials lacking 3-year-aged tested values for solar reflectance shall be assigned a 3-year-aged solar reflectance in accordance with Section R408.2.1.3.1.

~~b. Aged solar reflectance tested in accordance with ASTM C1549, ASTM E903 or ASTM E1918 or CRRC-S100.~~

b.~~c.~~ Solar reflectance index (SRI) shall be determined in accordance with ASTM E1980 using a convection coefficient of 2.1 Btu/h × ft^2 × °F (12 W/m^2 × K). Calculation of aged SRI shall be based on aged tested values of solar reflectance tested in accordance with ASTM C1549, ASTM E903, ASTM E1918, or CRRC S100 and thermal emittance tested in accordance with ASTM C1371, ASTM E408, or CRRC S100.

R408.2.1.3.1 Aged solar reflectance. Where an aged solar reflectance ~~required by Section R402.6~~ is not available, it shall be determined in accordance with Equation 4-4

(Equation 4-4)

$$R_{aged} = [0.2+0.7(R_{initial}-0.2)]$$

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

2024 ENERGY Chapter11

Revise as follows:

TABLE N1108.2.1.3 MINIMUM ROOF REFLECTANCE[a]

ROOF SLOPE	THREE-YEAR AGED SOLAR REFLECTANCE INDEX[b]
Low-slope	75~~[b,c]~~
Steep-slope	16

a. The use of area-weighted averages to comply with these requirements shall be permitted. Materials lacking 3-year-aged tested values for solar reflectance shall be assigned a 3-year aged solar reflectance in accordance with Section N1108.2.1.3.1.

~~b. Aged solar reflectance tested in accordance with ASTM C1549, ASTM E903 or ASTM E1918 or CRRC-S100.~~

b.~~c.~~ Solar reflectance index (SRI) shall be determined in accordance with ASTM E1980 using a convection coefficient of 2.1 Btu/h x ft[2] x ºF (12 W/m[2] x K). Calculation of aged SRI shall be based on aged tested values of~~Aged~~ solar reflectance tested in accordance with ASTM C1549, ASTM E903 ,~~or~~ ASTM E1918 or CRRC-S100 and thermal emittance tested in accordance with ASTM C1371, ASTM E408, or CRRC S100.

N1108.2.1.3.1 Aged solar reflectance. Where an aged solar reflectance~~required by Section N1102.6~~ is not available, it shall be determined in accordance with Equation 11-8.

(Equation 11-8)

$$R_{aged} = [0.2+0.7(R_{initial}-0.2)]$$

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

2024 International Energy Conservation Code [RE Project]

Add new standard(s) as follows:

ASTM

ASTM International
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken, PA 19428-2959

C1371-15(2022)	Standard Test Method for Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers
E408-13(2019)	Standard Test Methods for Total Normal Emittance of Surfaces Using Inspection-Meter Techniques

Reason: This comment cleans up the roof reflectance provisions in Section R408 and Section N1108. Modifications are summarized as follows:
- Remove footnote b and place the necessary information into the final footnote, which is re-identified from "c" to "b".
- Delete footnote references "b" and "c" in the second row of Tables R408.2.1.3 and N1108.2.1.3.
- Add additional acceptable test methods C1371 and E408 for thermal emittance in the final footnote of Tables R408.2.1.3 and N1108.2.1.3. This coordinates with options present in the Commercial 1st Public Comment Draft.
- Align content of the final footnote of Table N1108.2.1.3 with the content of the Table R408.2.1.3 footnote. For some reason, these do not match in the 1st Public Comment Draft.
- Add alternative solar reflectance test methods in the "$R_{initial}$" term description to coordinate with options already offered in footnotes to the Tables.
- Remove from R408.2.1.3.1 the reference to section R402.6, which is no longer accurate.
- Remove from N1108.2.1.3.1 the reference to section N1102.6, which is no longer accurate.
- Add ASTM C1371 and ASTM E408 as new standards within Chapter 6 of the residential provisions. They are already present in Chapter 6 of the commercial provisions.
- To coordinate with this comment, add ASTM C1371, ASTM C1549, ASTM E408, ASTM E903, ASTM E1918, and ASTM E1980 to Chapter 44 of the IRC.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This comment primarily makes improvements for clarity, which should have no impact on cost of construction. The addition of more options for measuring radiative properties provides greater flexibility but is not expected to lead to a change in cost of construction.

Workgroup Recommendation

RED1-258-22

Proponents: Glen Clapper, representing National Roofing Contractors Association (gclapper@nrca.net)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

TABLE R408.2.1.3 MINIMUM ROOF REFLECTANCE[a]

ROOF SLOPE	THREE-YEAR AGED SOLAR REFLECTANCE INDEX[b]
Low-slope	~~75~~ 64[b, c]
Steep-slope	16

a. The use of area-weighted averages to comply with these requirements shall be permitted. Materials lacking 3-year-aged tested values for solar reflectance shall be assigned a 3-year-aged solar reflectance in accordance with Section R408.2.1.3.1.

b. Aged solar reflectance tested in accordance with ASTM C1549, ASTM E903 or ASTM E1918 or CRRC-S100.

c. Solar reflectance index (SRI) shall be determined in accordance with ASTM E1980 using a convection coefficient of 2.1 Btu/h × ft^2 × °F (12 W/m^2 × K). Calculation of aged SRI shall be based on aged tested values of solar reflectance and thermal emittance.

2024 ENERGY Chapter11

Revise as follows:

TABLE N1108.2.1.3 MINIMUM ROOF REFLECTANCE[a]

ROOF SLOPE	THREE-YEAR AGED SOLAR REFLECTANCE INDEX[b]
Low-slope	~~75~~ 64[b,c]
Steep-slope	16

a. The use of area-weighted averages to comply with these requirements shall be permitted. Materials lacking 3-year-aged tested values for solar reflectance shall be assigned a 3-year aged solar reflectance in accordance with Section N1108.2.1.3.1.

b. Aged solar reflectance tested in accordance with ASTM C1549, ASTM E903 or ASTM E1918 or CRRC-S100.

c. Aged solar reflectance tested in accordance with ASTM C1549, ASTM E903 or ASTM E1918 or CRRC-S100.

Reason: This public comment code change proposal aligns the SRI values between the residential and commercial sections of the IECC. In addition, the proposal aligns the SRI requirement in Climate Zones 0-4 and 4C with that of Section R407 Tropical Climate Region.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This code change proposal will neither increase nor decrease the cost of construction.

Workgroup Recommendation

Proposal # 1434

RED1-259-22

Proponents: Amy Boyce, representing Energy Efficient Codes Coalition (EECC) (amy.boyce@imt.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

~~**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 frame 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 R408.2.2.~~
2. ~~All installed water heaters are heat pumps that meet one of the efficiencies in 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 R408.2.7.~~

Reason: This proposal maintains the wall insulation requirements established in the 2021 IECC to help ensure that the 2024 IECC does not take a step backwards in efficiency. REPI-33 added new section R408.2.9, which allows wall insulation to be reduced if one of several alternatives is selected by the code user. The proponent of REPI-33 did not provide any energy analysis demonstrating that these alternatives will produce equivalent energy savings, particularly when considering the much longer useful life of the insulation measures. In fact, none of the four options would be allowed as trade-offs against the prescriptive envelope requirements in the 2021 IECC, and thus each alternative represents a reduction in efficiency in the draft 2024 IECC. We do recognize that there could be some value in promoting beneficial electrification, but this can be done without reducing the efficiency of the permanent thermal envelope. In a separate proposal, we have provided a revision of Section R408.2.9 that would incentivize electrification without rolling back efficiency; without such a revision, we recommend deleting this trade-off altogether.
As a general matter, we oppose adding new alternatives to efficiency measures when it results in the rollbacks to the current base energy code. Allowing a trade-off between the guaranteed efficiency benefits of a well-built thermal envelope for “credit” derived from the difference between federally-regulated equipment efficiencies and commonly-installed efficient equipment or renewable energy resources will only lead to less-efficient buildings overall. Creating new product-specific trade-offs in R408 is also a bad precedent, as it invites additional rollbacks and carve-outs into a compliance path that was intended to be layered on top of the prescriptive path—not serve as a means of reducing the prescriptive path. Code users who wish to take credit for equipment efficiency improvements can already use the Energy Rating Index, where trade-offs like this are more carefully evaluated. This proposal is an unnecessary efficiency giveaway, and it sets the stage for additional reductions in future editions.Even if these alternatives were deemed equivalent, we are concerned that code users could “double-count” credits under options 1, 2, or 4 for compliance with R408 generally and for the rollback represented in R408.2.9. This would essentially double the reduction in efficiency because it would both allow the reduction in wall insulation and reduce the number of credits required for compliance in R408.

Please see attached "Support Letter - EECC Comments" for a list of government representatives and organizations supporting this proposal.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This proposal neither increases nor decreases the cost of construction because it maintains the wall insulation requirements exactly as they are published in the 2021 IECC. The U.S. Department of Energy found the 2021 IECC to be cost-effective (see https://www.energycodes.gov/sites/default/files/2021-07/2021IECC_CostEffectiveness_Final_Residential.pdf); these findings were further confirmed by ICF International in a follow-up analysis of cost-effectiveness (see https://energyefficientcodes.org/wp-content/uploads/Cost-Effectiveness-of-the-Residential-Provisions-of-the-2021-IECC-Rev-June-2022.pdf). Because REPI-33 would diverge from the 2021 IECC, the burden is on the proponent of REPI-33 to explain how an efficiency rollback is consistent with Section R101.3 Intent, and that burden was not met.

Attached Files

- **Support Letter - EECC Comments.pdf**
  https://energy.cdpaccess.com/proposal/1233/2649/files/download/480/

Workgroup Recommendation

RED1-260-22

Proponents: Hendrik Shank, representing New York State, Department of State (hendrikus.shank@dos.ny.gov); Daniel Carroll, representing Division of Building Standards & Codes (daniel.carroll@dos.ny.gov)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R503.1.1 Building thermal envelope. Alterations of existing building thermal envelope assemblies shall comply with this section. New Building building thermal envelope assemblies that are part of the *alteration* shall comply with Section R402. In no case shall the R-value of insulation be reduced or the U-factor of a building thermal envelope assembly be increased as part of a building thermal envelope alteration.

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

1. Storm windows installed over existing fenestration.
2. ~~Roof recover~~ *Roof recover*.
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. An existing building undergoing alterations that is demonstrated to be in compliance with Section R405 or Section R406

Reason: The purpose of this code change proposal is to change the title of the code section from "building envelope" to the defined term in Chapter 2, "building thermal envelope", and to italicize the defined terms "building" and "roof recover" in the same code section.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This code change proposal is editorial so there is no cost impact associated with it.

Workgroup Recommendation

Proposal # 1203

RED1-261-22

Proponents: Jay Crandell, representing Foam Sheathing Committee of the American Chemistry Council (jcrandell@aresconsulting.biz)

2024 International Energy Conservation Code [RE Project]

APPENDIX RF
ALTERNATIVE BUILDING THERMAL ENVELOPE INSULATION R-VALUE OPTIONS

Add new text as follows:

RF 101 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 of this standard. 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.*

Revise as follows:

~~RF101~~ RF102
ABOVE-GRADE WALL ASSEMBLIES

Reason: Appendix RF is missing a general section establishing the scope and purpose of the appendix and also related general requirements important to proper application of the appendix in coordination with the IECC standard and also related IRC building code provisions, such as R702.7 for water vapor control (which may constrain appropriate insulation solutions used to comply with the IECC or vice versa).

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
The added general section does not change requirements in Appendix RF and clarifies how to properly apply the requirements of the Appendix in coordination with the IECC provisions and the building code. This will not impact cost of construction but will help ensure it is compliant with the intended application of Appendix RF.

Workgroup Recommendation

Proposal # 1345

RED1-262-22

Proponents: Glen Clapper, representing National Roofing Contractors Association (gclapper@nrca.net)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

ROOF REPLACEMENT. ~~An *alteration* that includes the removal of all existing layers of roof assembly materials down to the roof deck and installing 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.

2024 ENERGY Chapter11

Revise as follows:

ROOF REPLACEMENT. ~~An alteration that includes the removal of all existing layers of roof assembly materials down to the roof deck and installing 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.

Reason: This public comment proposal returns the definition to its 2021 form to align with the same definition in the ICC family of codes. A similar proposal, CEPI-17, Part II, was previously disapproved by the Residential Consensus Committee earlier this year, as were similar proposals for the IBC, IRC and IEBC during the Group B Code Development Cycle.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This code change proposal will neither increase or decrease the cost of constrcuction.

Workgroup Recommendation

Proposal # 1393

RED1-263-22

Proponents: Sean Denniston, representing New Buildings Institute (sean@newbuildings.org)

2024 International Energy Conservation Code [RE Project]

Add new definition as follows:

Substantial Energy Alteration. SUBSTANTIAL ENERGY ALTERATION.An*alteration*that includes replacement of two or more of the following:1. 50% or more of the area of interior wall-covering material of the*building thermal envelope*.2. 50% or more of the area of the exterior wall-covering material of the*building thermal envelope*or fenestration.3. Space-conditioning equipment constituting 50% or more of the total input capacity of the space heating or space cooling equipment serving the *building*.4. Water-heating equipment constituting 50% of more of the total input capacity of all the water heating equipment serving the*building*.5. 50% or more of the luminaires in the*building*.

Revise as follows:

TABLE R408.2 CREDITS FOR ADDITIONAL ENERGY EFFICIENCY

Measure Number	Measure Description	Credit Value								
		Climate Zone 0 & 1	Climate Zone 2	Climate Zone 3	Climate Zone 4	Climate Zone 4C	Climate Zone 5	Climate Zone 6	Climate Zone 7	Climate Zone 8
R408.2.1.1(1)	≥2.5% Reduction in total UA	0	0	0	1	1	1	1	1	1
R408.2.1.1(2)	≥5% reduction in total UA	0	1	1	2	2	3	3	3	3
R408.2.1.1(3)	>7.5% reduction in total UA	0	1	2	2	2	3	3	4	4
R408.2.1.2(1)	0.22 U-factor windows	1	2	2	3	3	4	4	4	5
R408.2.1.2(2)	U-factor and SHGC for windows per Table R408.2.1	1	1	1	0	0	0	0	1	2
R408.2.1.3	Cool Roof	TBD	TBD	TBD	TBD	TBD	0	0	0	0
R408.2.2(1)	High performance cooling system option 1	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(2)	High performance cooling system option 2	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(3)	High performance gas furnace option 1	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(4)	High performance gas furnace option 2	0	0	0	0	0	TBD	TBD	TBD	0
R408.2.2(5)	High performance gas furnace and cooling system option 2	TBD	TBD	TBD	TBD	TBD	0	0	0	TBD
R408.2.2(6)	High performance gas furnace and heat pump system option 1	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(7)	High performance gas furnace option 2	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(8)	High performance heat pump system option 1	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(9)	High performance heat pump system option 2	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(10)	High performance heat pump system option 3	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(11)	Ground source heat pump	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(12)	Ductless - Single zone	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(13)	Ductless - Multizone (Non-ducted indoor unit)	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(14)	Ductless – Multizone (Ducted or Mixed)	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.3(1)	Gas-fired storage water heaters	7	6	5	3	3	2	2	3	1
R408.2.3(2)	Gas-fired instantaneous water heaters	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.3(3)	Electric water heaters	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.3(4)	Electric water heaters	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.3(5)	Solar hot water heating system	4	5	6	6	6	6	5	5	4
R408.2.3(6)	Compact hot water distribution	2	2	2	2	2	2	2	2	2
R408.2.4(1)	More efficient distribution system	4	6	7	10	10	12	13	15	16
R408.2.4(2)	100% of ducts in conditioned space	4	6	8	12	12	15	17	19	20
R408.2.4(3)	Reduced total duct leakage	1	1	1	1	1	1	2	2	2
R408.2.5(1)	2 ACH50 air leakage rate with ERV or HRV installed	1	4	5	10	10	13	15	8	8
R408.2.5(2)	2 ACH50 air leakage rate with balanced ventilation	2	3	2	4	4	5	6	6	6

R408.2.5(3)	1.5 ACH50 air leakage rated with ERV or HRV installed	2	4	6	12	12	15	18	11	11
R408.2.5(4)	1 ACH50 air leakage rate with ERV or HRV installed	2	5	6	14	14	17	21	14	14
R408.2.6	Energy efficient appliances	9	8	8	7	7	5	5	5	4
R408.2.7	Renewable energy measures	17	16	17	11	11	9	8	7	4
R408.2.9	Demand responsive thermostat	1	1	1	1	1	1	1	1	1
R408.2.10	Higher efficacy lighting	1	1	1	1	1	1	1	1	1

Add new text as follows:

R408.2.10 Higher efficacy lighting. All spaces shall be provided with hard wired lighting with a lamp efficacy of 90 lm/W or a luminaire efficacy of 55 lm/W.

Revise as follows:

R502.2.5 Additional Efficiency Requirements~~Packages~~. *Additions* shall ~~comply with Section R506~~ comply with sufficient measures from Table R408.2 to achieve not less than 5 credits. *Alterations* to the existing building that are not part of the *addition*, but permitted with the *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 Sections R403.5 or R403.7.
3. Additions that do not contain conditioned space.
4. Where the *addition* alone or the existing building and *addition* together comply with Section R405 or R406.

R503.1.5 Additional Efficiency Requirements~~Packages~~. ~~Alterations shall comply with Section R506 where the alteration contains replacement of two or more of the following:~~ *Substantial energy alterations* shall comply with sufficient measures from Table R408.2 to achieve not less than 1 credits.

1. ~~HVAC unitary systems or HVAC central heating or cooling equipment serving the *work area* of the *alteration.*~~
2. ~~Water heating equipment serving the *work area* of the *alteration.*~~
3. ~~50 percent or more of the lighting fixtures in the *work area* of the *alteration.*~~
4. ~~50 percent or more of the area of interior surfaces of the thermal envelope in the *work area* of the *alteration.*~~
5. ~~50 percent or more the area of the building's *exterior wall envelope.*~~

Exceptions:

1. *Alterations* that are permitted with an *addition* complying with Section R502.3.5.
2. *Alterations* that comply with Section R405 or R406.

~~**R506.1 General.** Where required in Section R502 or R503, the building shall comply with one or more additional efficiency package options in accordance with the following:~~

1. ~~Enhanced envelope performance in accordance with Section R408.2.1.~~
2. ~~More efficient HVAC equipment performance in accordance with Section R408.2.2.~~
3. ~~Reduced energy use in service water-heating in accordance with Section R408.2.3.~~
4. ~~More efficient duct thermal distribution system in accordance with Section R408.2.4.~~
5. ~~Improved air sealing and efficient ventilation system in accordance with Section R408.2.5.~~

Reason: This public comment does two things: it correlates the language with changes that were approved for Section R408 and it clarifies the language.

Alignment

The approved language in R503.1.5 was constructed to work with the 2021 version of Section R408, but Section R408 was ultimately modified for the public comment draft in ways that made it incompatible with this language. This public comment adapts the language to make it compatible with the new credit approach in R408. Since there are no more packages and R408 incorporates a target table, the new Section R506 is not necessary and has been struck. The additions and alterations sections just reference that table directly.

- **Target Setting:** The public comment sets the targets at 5 credits (about 50% of the target for new buildings) for subject additions and 1 credit for subject alterations. The new table approach is more flexible but provides less credit forexisting systems that meet the “substantial alteration” definition.
- **Additional Credit Option:** The credit table has no credit options for lighting. Since the definition of “substantial alteration” includes alterations to the lighting, the lack of a lighting option is problematic. Therefore, this PC adds an additional credit option for lighting that sets an efficacy requirement higher than the requirements in the main body of the code. It also requires that spaces have hard-wired lighting that meets the requirement to ensure that there are actually savings.

Language clarifications

During the committee hearing process for this language and related language in the commercial section, this new code section received substantial support, but there were some concerns, particularly the clarity of the language, the alteration threshold for the requirement and the compliance criteria.

- **Clarity of the Language:** The original language was structured so that only "substantial" alterations would be subject to the requirements. This was done by creating an exception that effectively defined an alteration that was not substantial and exempted those alterations. During the committee process, concerns were raised about how this was a confusing way to structure the requirement even if the language itself was reasonably clear. In order to increase clarity, the language was reconfigured so that the threshold would not be defined through the exception.This public comment defines a new term: "substantial energy alteration" and only makes this specific kind of alteration subject to the requirements. The definition of the term is largely the same as the exception, except expressed in terms of what it is instead of what it isn't. This is clearer since alterations that are not substantial energy alterations will not even need to look at the section. This term was chosen because it follows an approach to substantial alterations that is already in the code. The International Existing Building Code (IEBC) has a definition for "substantial structural alteration" that sets a threshold for alterations to the structure that are considered substantial enough for special requirements. This definition does the same thing, it creates a threshold for alterations to the energy systems that are substantial enough for special requirements. This definition is mirrored in a public comment for the commercial section.
- **Threshold:** The other concern raised was that the original language defined the substantial alteration as one that impact more that 50% of the systems serving the alteration area. Concerns were raised that the area of an alteration is difficult to define. Concerns were also raised that even if the alteration area is defined, it could be easy for substantial alterations to a limited part of the building to meet the threshold but hard for them to achieve points, particularly areas of the building served by central systems. To address this issue, this public comment changes the threshold for the alteration from just the alteration area to the entire building. While there is some loss in stringency, this will be much easier to understand, much clearer to enforce, and much easier to comply with.
- **Compliance Criteria:** The third concern was related to clarity about what portion of the building would have to comply with the credit criteria to achieve the credit. It was not entirely clear whether the entire building would have to comply with the credit criteria or only the alteration. This was of special concern for multi-tenant buildings where portions of the building that are not part of the alteration may be inaccessible. The public comment adds language to make it clear that only the alteration needs to comply with the credits. But it also includes language to ensure that only portions of the alteration that cross that 50% impact threshold are able to be used.

Cost Impact: The code change proposal will decrease the cost of construction.
The PC results in slightly less stringency than the language in the public comment draft.

Workgroup Recommendation

RED1-264-22

Proponents: Patricia Chawla, representing Austin Energy (patricia.chawla@austinenergy.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

ADDITION. An extension or increase in the ~~*conditioned space*~~ floor area, number of stories or height of a building or structure.

ALTERATION. Any ~~construction, retrofit or renovation to an existing structure other than repair or addition. Also, a change in a building, electrical, gas, mechanical or plumbing system that involved an extension, addition or change to the arrangement, type or purpose of the original installation~~ construction or renovation to an *existing structure* other than a *repair* or *addition*.

Add new definition as follows:

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.

Revise as follows:

REPAIR. The reconstruction, replacement or renewal of any part of an existing *building* for the purpose of its maintenance or to correct damage.

Add new definition as follows:

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

Revise as follows:

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 ***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 as applicable**. Changes where unconditioned space is changed to *conditioned space* shall comply with Section ~~R502~~ R501.6.

~~**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.~~

~~**R501.5**~~ **R501.4 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.

~~**R501.6**~~ **R501.5 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*.

~~**R501.7**~~ **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 ~~this code~~ Section 503.

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.

R503.1.1.2 Roof alterations. Roof insulation shall comply ~~complying~~ with Section R402.1 or an *approved* design ~~shall be~~ provided for the following roof alteration conditions as applicable:

1. An alteration to roof-ceiling construction where there is no insulation above conditioned space.
2. Roof replacements for roofs with insulation entirely above deck,

Exceptions: Where compliance with Section R402.1 cannot be met due to limiting conditions on an existing roof, the following shall be permitted to demonstrate compliance with the insulation requirements:

1. Construction documents that include a report by a registered design professional or other approved source documenting details of the limiting conditions affecting compliance with the insulation requirements.
2. Construction documents that include a roof design by a registered design professional or other approved source that minimize deviation from the insulation requirements.
3. Conversion of an unconditioned attic space into conditioned space, and
4. Replacement of ceiling finishes exposing cavities or surfaces of the roof-ceiling construction to which insulation can be applied.

R503.1.1.3 Above-grade wall alterations. Above-grade wall alterations shall comply with the following requirements as applicable:

1. Where interior finishes are removed exposing wall cavities, the existing cavity shall be filled with existing or new insulation complying with Section R303.1.4;
2. Where exterior wall coverings and fenestration are removed and replaced for the full extent of any exterior wall assembly, continuous insulation shall be provided where required in accordance with Section R402.1 or an ~~approved~~ *approved* design;
3. Where Items 1 and 2 apply, the entire wall assembly shall be insulated in accordance with Section R402.1; and,
4. 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 where required in accordance with Section R402.1 or an approved design.

Where any of the above requirements are applicable, the above-grade wall alteration shall comply with the insulation and water vapor retarder requirements of Section R702.7 of the International Residential Code. Where the exterior wall coverings are removed and replaced, the above-grade wall alteration shall comply with the water and wind resistance requirements of Section R703.1.1 of the International Residential Code.

R503.1.1.5 Below-grade wall alterations. Where a ~~blow~~ below-grade space is changed to conditioned space, the below-grade walls shall be insulated where required in accordance with Section R402.1. Where the below-grade space is conditioned space and a below-grade wall is altered by removing or adding interior finishes, it shall be insulated where required in accordance with Section R402.1.

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 ~~R502~~ R501.7.

Reason: A working group of few (mostly committee) members was formed during public comment period #2 to specifically look at Chapter 5 [RE]. The proposed changes in this modification seek to clarify the existing chapter 5 language and the new chapter 5 language from public comment draft #1. No substantial changes have been made.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
The proposed code changes will not increase nor decrease the cost of construction since they are changes to clarify the code language. The proposed new definitions are in the International Existing Building Code. Amendments to existing definitions bring the definitions in alignment with the International Existing Building Code.

Workgroup Recommendation

Proposal # 1276

RED1-265-22

Proponents: Shane Hoeper, representing myself (shoeper@cityofdubuque.org)

2024 International Energy Conservation Code [RE Project]

Delete without substitution:

~~**R501.7 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 this code.~~

> ~~**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.~~

Reason: An addition is, by definition, an increase in conditioned floor area. This section is unnecessary.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This section deletion has no impact on costs.

Workgroup Recommendation

Proposal # 1356

RED1-266-22

Proponents: Robert Schwarz, representing BUILDTank, Inc. (robby@btankinc.com)

2024 International Energy Conservation Code [RE Project]

CHAPTER 5 [RE]
EXISTING BUILDINGS

SECTION R502
ADDITIONS

Revise as follows:

R502.1 General. *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. *Additions* shall not create an unsafe or hazardous condition or overload existing *building* systems.
A RESNET, BPI, or other approved energy audit shall be performed prior to the commencement of construction of any addition using this compliance option to baseline the efficiency of the existing building and offer opportunities for cost-effective energy upgrades.

R502.2 ~~Prescriptive~~ Compliance. ~~*Additions* shall comply with Sections R502.2.1 through.R502.3.5.~~ An addition shall be deemed to comply with this code where one of the following compliance options is sections R502.2.1 or R502.2.2 is used.

Add new text as follows:

R502.2.1 Existing building plus addition (Prescriptive compliance for additions of any size). . Prescriptive compliance verification using sections R402.1.4 or R402.1.5 shall demonstrate that the addition alone complies with this code including section R402.4 air leakage testing of the addition plus the existing structure.

> **Exception:** Where the measured air leakage rate exceeds 5.0 air changes per hour or 0.28 cubic feet per minute (CFM) per square foot of dwelling unit enclosure area when tested in accordance with Section R402.4.1.2 a diagnostic evaluation using smoke tracer or infrared imaging shall be conducted while the building is pressurized or depressurized along with a visual inspection of the air barrier. Noted air leaks shall be sealed where such sealing can be made without destruction of existing or new building components. A report documenting corrective actions taken to seal leaks and pre and post blower door results, shall be submitted to the code official and shall be deemed to comply with the requirements of this section.

R502.2.1.1 Compliance Reports (Prescriptive compliance).. The following compliance reports shall be submitted for permitting and to obtain the certificate of occupancy.

1. For permitting: Submit Documentation showing that an energy audit was performed on the existing structure.
2. For permitting: Submit a plan set documenting the proposed R-values to be installed per Section R402.1.4 or a Section R402.1.5 Total UA compliance report.
3. For Certificate of Occupancy: Submit a blower door compliance report.

R502.2.2 Existing building plus addition compliance (Simulated Building Performance).. Simulated building performance Section R405 compliance verification shall demonstrate that the existing building plus the addition uses no more energy than the existing *building* did prior to the addition. This method requires the project to create cost compliance verification at three stages as outlined in Section R502.2.2.1.

R502.2.2.1 Compliance Reports (Simulated Building Performance). . The following compliance reports shall be submitted for permitting and to obtain the certificate of occupancy.

1. For permitting: Submit Documentation showing that an energy audit was performed on the existing structure.
2. For permitting: Submit a baseline total building performance cost compliance report of the existing structure prior to construction.
3. For permitting: Submit a projected total building performance cost compliance report of the existing building plus the addition based on the proposed design for the building in its entirety demonstrating that the building plus the addition uses no more energy than the existing building did prior to the addition.
4. For Certificate of Occupancy: Submit a final confirmed total building performance cost compliance report prior to final inspection.
5. For Certificate of Occupancy: Submit a blower door compliance report.

Revise as follows:

R502.3 ~~R502.2.1~~ Building envelope. New *building* envelope assemblies that are part of the *addition* shall comply with Sections R402.1.1, R402.2, R402.3.1 through R402.3.5, and R402.4. ~~R402.4.1 through R402.4.5, and R402.5.~~

~~**Exception:** New envelope assemblies are exempt from the requirements of Section R402.5.1.2.~~

<u>**R502.4**</u> ~~**R502.2.2**~~ **Heating and cooling systems.** HVAC ducts newly installed as part of an *addition* shall comply with Section R403.<u> 1, R403.3 through R403.3.7, and R403.7.</u>

Exception: Where ducts from an existing heating and cooling system are extended into an *addition* that does not exceed 400 square feet.~~Section R403.3.5 and Section R403.3.6 shall not be required.~~

<u>**R502.5**</u> ~~**R502.2.3**~~ **Service hot water systems.** New service hot water systems that are part of the *addition* shall comply with Section R403.5.

<u>**R502.6**</u> ~~**R502.2.4**~~ **Lighting.** New lighting systems that are part of the *addition* shall comply with Section R404.1.

<u>**R502.7**</u> ~~**R502.2.5**~~ **Additional Efficiency Packages.** *Additions* shall comply with Section R506. <u>Whole house mechanical ventilation installed to ventilate the existing building plus the addition and 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, may be used as an alternative compliance option to Section R506.</u>*Alterations* to the existing building that are not part of the *addition*, but permitted with the *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 Sections R403.5 or R403.7.
3. Additions that do not contain conditioned space.
4. Where the *addition* alone or the existing building and *addition* together comply with Section R405 or R406.

Reason: The additions section R502 struggles with how to determine compliance with the requirements of the IECC as they relate to existing home additions. The existing section R502.1 general spoke loosely to demonstrating compliance but it is not specific enough to guide enforcement well. We therefore stuck language from this section and created a true compliance section for additions in Section R502.2. The new language incorporates the reality that the house is an integrated system and that compliance with the IECC when associated with an existing building requires that the existing building also get evaluated.

<u>**Section R502.2.2 Existing building plus addition compliance (Simulated Building Performance)**</u>

This new section R502.2 leverages some existing compliance language but now offers two distinct compliance alternatives that can be used to demonstrate compliance with this section of code.

1. The prescriptive option R502.2.1 allows the use of the R-value table or the Total UA alternative approach and focuses on the addition alone but includes the R402.4 air leakage section with an exception for meeting the 3 or 5 air changes depending on climate zone. If the code require leakage rate cannot be met this section requires effort be made to make the house as tight as possible. Language was incorporated from the Section C402.5.3 exception in the commercial section of the IECC as a defined way to require air tightening of the building's thermal envelope.

2. The building performance Section R502.2.2 use cost compliance modeling to demonstrate that the existing building plus the addition uses no more energy than the existing *building* did prior to the addition. This is a current compliance option in the 2021 IECC but it was not clear how one would demonstrate compliance. The proposed new section of code spells outlines exactly how to use this compliance option.

Regardless of the compliance path chosen the new addition must conform to the provisions of IECC as those provisions relate to new construction. In addition, we felt that it was important in an energy code to require an informative energy audit be performed on the existing home prior to construction of the addition in order to offer an opportunity to baseline the efficiency of the existing building prior to construction the addition and as a means to incorporate cost effective addition efficiency and comfort measures during the construction of the addition if the homeowner deemed it appropriate. The requirements is to perform the energy audit not to act on the findings of the energy audit. In this way the homeowner may realize that it makes sense to add additional insulation to an existing attic at the same time the addition is being insulated for example.

Additions on existing building like alterations are perhaps one of the primary opportunities to reduce national energy consumption, yet Chapter 5 currently does little to address this need. There are many opportunities to cost-effectively improve energy efficiency of the existing building stock using reasonable criteria as outlined in the above proposal.

This proposal strikes a balance in a practical and cost-effective manner for addressing manageable energy efficiency upgrades at the same time an addition is being proposed on an existing building. It is clear that the intent of the existing IECC chapter 5 is to ensure that energy use of the existing building plus the addition uses no more energy than the building did prior to the addition. This proposal now offers a means by which compliance with this statement can be verified. It does so by providing flexibility and choice of what to address in the existing structure while offering a logical way to enforce the base code on the addition. This was not possible in the past because the base energy code never provided guidance on how to addresses the house in its entirety not sections of the house in isolation.

Lastly, Section R502.2.5 additional Energy Efficiency Packages has been introduced into the R502 addition section for existing buildings. Whole House controlled mechanical ventilation is important for all homes new and existing. This new section of code has been added to allowing the introduction of a whole house mechanical ventilation system to meet the requirements of Section R506 Additional Efficiency Packages.

Cost Impact: The code change proposal will increase the cost of construction.
Cost of construction will increase with this proposal primarily due to the cost of demonstrating compliance. However, there was no true means developed in the past existing home additions section to demonstrate compliance other than a vague visual inspection. This approach truly quantifies compliance while offering an opportunity to address issues with the existing structure to better our countries existing housing stock.

Workgroup Recommendation

Proposal # 1003

RED1-267-22

Proponents: Lucyna de Barbaro, representing Rebuilding Together Pittsburgh (ldbarbaro@rtpittsburgh.org); Mike Turns, representing Performance System Development of New York, LLC (mturns@psdconsulting.com)

2024 International Energy Conservation Code [RE Project]

R503.1.1 Building envelope. Alterations of existing building thermal envelope assemblies shall comply with this section. New Building building thermal envelope assemblies that are part of the *alteration* shall comply with Section R402. In no case shall the R-value of insulation be reduced or the U-factor of a building thermal envelope assembly be increased as part of a building thermal envelope alteration.

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. Roof recover.
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. An existing building undergoing alterations that is demonstrated to be in compliance with Section R405 or Section R406

Revise as follows:

R503.1.1.2 Roof alterations<u>, where roof is part of the thermal boundary of the building</u>. Roof insulation complying with Section R402.1 ~~or an approved design~~ shall be provided for the following roof alteration conditions as applicable:

1. An alteration to roof-ceiling construction where there is no insulation above conditioned space~~.~~<u> or the existing insulation does not meet the minimums permitted in Section R402.2.</u>
2. Roof replacements for roofs with insulation entirely above deck,

Exceptions: Where compliance with Section R402.1 cannot be met due to limiting conditions on an existing roof, the following shall be permitted to demonstrate compliance with the insulation requirements:

1. Construction documents that include a report by a registered design professional or other approved source documenting details of the limiting conditions affecting compliance with the insulation requirements.
2. Construction documents that include a roof design by a registered design professional or other approved source that minimize deviation from the insulation requirements.
3. ~~Conversion of an unconditioned attic space into conditioned space, and~~
4. ~~Replacement of ceiling finishes exposing cavities or surfaces of the roof-ceiling construction to which insulation can be applied.~~

3. <u>Conversion of an unconditioned attic space into conditioned space,</u>
4. <u>Replacement of ceiling finishes exposing cavities or surfaces of the roof ceiling construction to which insulation can be applied.</u>

<u>Where any of the above requirements are applicable, roof alteration shall comply with air and vapor management control of Section R806 of International Residential Code.</u>

Add new text as follows:

<u>R503.1.1.3</u> <u>Alterations of existing buildings where attic floor or knee walls are part of the thermal boundary</u>.

1. <u>Attic insulation in the altered portion of the building shall not be installed unless all accessible attic bypasses have been sealed and air barrier installed as per R503.1.1.6.</u>
2. <u>A ceiling or attic floor, or knee walls, that are a thermal boundary of a space being altered shall also be considered altered for the purpose of code compliance and shall comply with Section R402.</u>
3. <u>Attic knee wall assemblies that separate conditioned space from unconditioned attic spaces shall meet the same insulation requirements as above-grade walls. Such knee walls shall have an air barrier between conditioned an unconditioned space.</u>

Revise as follows:

R503.1.1.3 Above-grade wall alterations. Above-grade wall alterations shall comply with the following requirements as applicable:

1. Where interior finishes are removed exposing wall cavities, or new interior finishes are added to cover the existing finish, the existing cavity shall be filled with existing or new insulation complying with Section R303.1.4;
2. Where exterior wall coverings and 50% or more of the fenestration are removed and replaced for the full extent of any exterior wall assembly, continuous insulation shall be provided where required in accordance with Section R402.1~~ or an approved design~~;
3. Where Items 1 and 2 apply, the entire wall assembly shall be insulated in accordance with Section R402.1; and,
4. Where new interior finishes or exterior wall coverings are applied to the full extent of any exterior wall assembly of mass wall~~construction~~, insulation shall be provided where required in accordance with Section R402.1~~ or an approved design~~.

Where any of the above requirements are applicable, the above-grade wall alteration shall comply with the insulation and water vapor retarder requirements of Section R702.7 of the International Residential Code. Where the exterior wall coverings are removed and replaced, the above-grade wall alteration shall comply with the water and wind resistance requirements of Section R703.1.1 of the International Residential Code.

R503.1.1.4 Floor alterations. Where an alteration to a floor or floor overhang exposes cavities or surfaces to which insulation can be applied and the floor or floor overhang is part of the building thermal envelope, the floor or floor overhang shall be brought into compliance with Section R402.1~~ or an approved design~~. This requirement shall apply when the new floor is installed on top of the existing flooring. ~~to floor alterations where the floor cavities or surfaces are exposed and accessible prior to construction.~~

R503.1.2.1 Ducts. HVAC ducts newly installed as part of an alteration shall comply with Section R403. Ducts newly installed in wall cavities of exterior walls that do not have any wall insulation (on the interior or exterior) shall not be considered “located fully within the thermal envelope” for the purpose of compliance with Section R403.

Exception: Where ducts from an existing heating and cooling system are extended to an *addition*.

R503.1.2.3 Duct leakage. Where an *alteration* includes any of the following, ducts shall be tested in accordance with Section R403.3.5 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^2) of conditioned floor area:

1. Where 25 percent or more of the registers that are part of the duct system are relocated.
2. Where 25 percent or more of the total length of all ducts in the system are relocated.
3. Where the total length of all ducts in the system is increased by 25 percent or more.

Exception: Duct systems located entirely inside a conditioned space in accordance with Section R403.3.2~~.~~ , provided that these ducts are not located in the exterior walls.

Reason: This comment makes changes intended to improve clarity and to improve intended use compliance. Specifically, several potential loopholes appear to exist in the current draft proposal and this comment attempts to add clarifying language which would close some of these loopholes.

In general, I am very appreciative of the proposed changes to the R503 section of the IECC code. This section has not been updated and not kept up with the progress made with other sections of IECC code for a very long time. It has been sorely lacking in specifying adequate approach for buildings that were renovated and altered but were allowed to be unchanged in their thermal performance since as far back as 1890 (that’s how old some homes are in our region, climate zone 5, under IECC 2018 and Pennsylvania’s Universal Construction Code), as long as "no cavities were opened", etc., per our current and prior versions of the IECC code.

1. Strikethrough “an approved design”: It is unclear what "an approved design" would be, who would be approving it, and it may represent some way to avoid compliance with the code. If possible, this should be removed.

2. R503.1.1.2 item 1: The presence of, e.g., R-3 level of insulation should not be an acceptable way of avoiding this requirement. Use minimums defined in R402.2 or alternatively, define some other threshold which triggers the need to add more insulation, and which would not be the same as "lack of insulation".

3. R503.1.1.2 item 3, 4: Remove items 3 and 4 from the exception because they are intended to be in the enumerated list of alterations. The same comment has also been made in Proposal 978.

4. Unlike in Proposal 978, this comment proposes to divide up Roofs and Attics, where the attic floor and/or the knee wall is part of the thermal boundary, for more clarity. Items 1-3 in the new proposed sections cover those scenarios observed in currently performed alterations which leave the top of the conditioned space uninsulated and / or without the air barrier. Reference to IRC Section 806 is added to parallel similar reference present for the wall sections in R503.1.1.3.

5. R503.1.1.3 Above grade walls, item 1: This is a typical scenario encountered in renovations in our region. Old homes are upgraded to have modern finishes, including drywall, which is typically installed on top of the existing plaster. Adding insulation using blown in methods is cost-effective and timely, as the plaster patching can be avoided since new drywall will be installed over it.

6. R503.1.1.3 Item 2: This change is proposed to avoid "one window loophole" that could allow disregarding this requirement if one of the windows in the wall was not changed.

7. R503.1.1.3 Item 4: “Mass wall” is used elsewhere in the code instead of “mass construction”.

8. R503.1.1.4 item 1: The sentence is struck through, as it appears redundant within the same paragraph. Instead, we should be cognizant of a common scenario where the new flooring is applied on top of the existing flooring, in effect never exposing the cavity that could be filled with insulation. Making access holes in the floor that will be completely covered with new flooring should not be construed as an obstacle to meeting this requirement.

9. R503.1.2.1 and R503.1.2.3 Another common scenario encountered in renovations in our region: the walls have no insulation on the exterior or interior, and the new ducts are installed in the empty wall cavity. Could this be misconstrued as the ducts located “in conditioned space” and trigger exception to duct leakage testing? Upon re-reading the draft language of Section R403, one sees that an air barrier and R-10 insulation would need to separate the ductwork located within exterior walls from the unconditioned space. If that is met, does it qualify these ducts as "located within the conditioned space"? One may think so, since the thermal and air boundary are on the other side of the ducts. In new construction, these ducts would be required to be tested. In Alterations the exception would be triggered. Hence the suggestion to not permit this exception for the case of ducts in exterior walls. In extreme cases, if exterior walls are not changed at all during the alteration, they may have no other insulation in any other studs besides the stud with the ducts. Duct testing should be mandatory for new ducts in exterior walls due to excessive inefficiency of duct leakage in such locations.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
I believe that this proposal mostly addresses the intended uses of the new code changes in the IECC 2024 draft and focuses on removing loopholes that would allow avoiding compliance with these new provisions. While these new draft code changes indeed would or might increase the cost of construction, the proposal itself therefore does not. One area of potential cost increase is the added requirement to seal the thermal bypasses and add an air barrier in the attic before adding insulation. However, not adding this requirement would result in a missed opportunity to increase the thermal envelope with added insulation, which would not function correctly without this air barrier.

Workgroup Recommendation

Proposal # 1127

RED1-268-22

Proponents: Jay Crandell, representing Foam Sheathing Committee of the American Chemistry Council (jcrandell@aresconsulting.biz); Greg Johnson, representing National Multifamily Housing Council (gjohnsonconsulting@gmail.com)

2024 International Energy Conservation Code [RE Project]

Delete without substitution:

~~**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, methods or system analyses.~~

Revise as follows:

R503.1.1 Building thermal envelope. Alterations of existing *building thermal envelope* assemblies shall comply with this section. New ~~Building~~ *building thermal envelope* assemblies that are part of the *alteration* shall comply with Section R402. ~~In no case shall t~~ The *R-value* of insulation shall not be reduced ,nor~~or~~ the *U-factor* of a *building thermal envelope* assembly ~~be~~ 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. Roof recover.
> 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. ~~An existing building undergoing alterations that is demonstrated to be in compliance with Section R405 or Section R406~~

R503.1.1.1 Fenestration alterations. Where new fenestration area is added to an existing building, the new fenestration shall comply with Section R402.3. 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 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.

Revise as follows:

R503.1.1.2 Roof-ceiling and attic alterations. Roof insulation shall comply ~~complying~~ with Section R402.1. Alternatively, where limiting conditions prevent compliance with Section R402.1, ~~or~~ an *approved* design that minimizes deviation from Section R402.1 shall be provided . Such requirements shall apply to ~~for~~ the following ~~roof alteration conditions as applicable~~:

1. An alteration to roof-ceiling construction where there is no insulation above conditioned space.
2. *Roof replacements* for roofs with insulation entirely above deck. Where limiting conditions require use of an *approved* design to minimize deviation from Section R402.1 for a Group R-2 building, an *approved* third party shall provide *construction documents* that include the following:

   2.1. A report documenting the limiting conditions affecting compliance, and

   2.2. A roof design that minimizes deviation from Section R402.1.

> ~~**Exceptions:** Where compliance with Section R402.1 cannot be met due to limiting conditions on an existing roof, the following shall be permitted to demonstrate compliance with the insulation requirements:~~
>
> 1. ~~Construction documents that include a report by a registered design professional or other approved source documenting details of the limiting conditions affecting compliance with the insulation requirements.~~
> 2. ~~Construction documents that include a roof design by a registered design professional or other approved source that minimize deviation from the insulation requirements.~~
> 3. Conversion of an unconditioned attic space into conditioned space. ~~, and~~
> 4. Replacement of ceiling finishes exposing cavities or surfaces of the roof-ceiling construction ~~to which insulation can be applied~~.

R503.1.1.3 Above-grade wall alterations. Above-grade wall alterations shall comply with the following ~~requirements as applicable~~:

1. Where ~~interior finishes are removed exposing~~ wall cavities are exposed, the ~~existing cavity~~ cavities shall be filled with ~~existing or new~~ 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.

2. Where exterior wall coverings and fenestration are added or ~~removed and~~ replaced for the full extent of any exterior ~~wall assembly~~ facade of one or more elevations of the building, *continuous insulation* shall be provided where required in accordance with one of the following: ~~Section R402.1 or an approved design;~~

   2.1. An *R-value* of *continuous insulation* not less than that designated in Table R402.1.3;

   2.2. An *R-value* of *continuous insulation* not less than that required to comply with Table R402.1.2; or

   2.3. An approved design that minimizes deviation from Section R402.1.

3. Where Items 1 and 2 apply, the ~~entire wall assembly shall be insulated~~ insulation shall be provided in accordance with Section R402.1; and,
4. 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 ~~where required~~ in accordance with Section R402.1 or an *approved* design.

Where any of the above requirements are applicable, the above-grade wall alteration shall comply with t~~he insulation and water vapor retarder requirements of~~ Sections R702.7 and R703.1.1 of the *International Residential Code*. ~~Where the exterior wall coverings are removed and replaced, the above-grade wall alteration shall comply with the water and wind resistance requirements of Section R703.1.1 of the International Residential Code.~~

R503.1.1.4 Floor alterations. Where cavities in a floor or floor overhang are exposed ~~an alteration to a floor or floor overhang exposes cavities or surfaces to which insulation can be applied~~ and the floor or floor overhang is part of the *building thermal envelope*, the floor or floor overhang shall comply ~~be brought into compliance~~ with Section R402.1 or an *approved* design. ~~This requirement shall apply to floor alterations where the floor cavities or surfaces are exposed and accessible prior to construction.~~

R503.1.1.5 Below-grade wall alterations. Where unconditioned ~~a~~ below-grade space is changed to conditioned space, ~~the below-grade~~ *building thermal envelope* walls enclosing such space shall be insulated ~~where required~~ in accordance with Section R402.1. Where the below-grade space is conditioned space and where ~~a below-grade~~ *building thermal envelope* walls enclosing such space are ~~is~~ altered ~~by removing or adding interior finishes~~, they ~~it~~ shall be insulated ~~where required~~ in accordance with Section R402.1.

R503.1.1.6 Air barrier. Altered ~~B~~*building thermal envelope* assemblies ~~altered in accordance with Section R503.1.1~~ shall be provided with an air barrier in accordance with Section R402.5. ~~The~~ Such air barrier ~~shall~~ need not be ~~required to be made~~ continuous with unaltered portions of the building thermal envelope. Testing requirements of Section R402.5.1.2 shall not be required.~~Content~~

TABLE R402.1.2 MAXIMUM ASSEMBLY U-FACTORS[a] AND FENESTRATION REQUIREMENTS

Portions of table not shown remain unchanged.

CLIMATE ZONE	0	1	2	3	4 except Marine	5 and Marine 4	6	7 and 8
Insulation entirely above roof deck	0.039	0.039	0.039	0.039	0.032	0.032	0.032	0.028

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 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 0.28.

e. 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*.

~~f. Roofs with insulation entirely above deck shall comply with Section C402.2.1 and the Group R U-factors of Table C402.1.2.~~

~~g.~~ f. F-factors for heated slabs correspond to the configuration described by footnote (d) of Table R402.1.3

TABLE R402.1.3 INSULATION MINIMUM R-VALUES AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

Portions of table not shown remain unchanged.

CLIMATE ZONE	**0**	**1**	**2**	**3**	**4 except Marine**	**5 and Marine 4**	**6**	**7 and 8**
Insulation entirely above roof deck	R-25ci	R-25ci	R-25ci	R-25ci	R-30ci	R-30ci	R-30ci	R-35ci

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. 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 0.28.

c. “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.

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

f. 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.

g. 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.

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

~~i. Roofs with insulation entirely above deck shall comply with Section C402.2.1 and the Group R R-values of Table C402.1.2.~~

~~j.~~ i. "30 or 19+7.5ci or 20ci" means R30 cavity insulation alone or R19 cavity insulation with R7.5 continuous insulation or R20 continuous insulation alone.

Reason: This PC is submitted to coordinate with changes made by CEPI-221 to Section C503.1 of the commercial provisions based on additional input and review by the commercial subcommittee that occurred after the residential existing buildings and main committees had completed action on REPI-150. The two proposals intended to make the two codes consistent. So, this proposal is primarily one of editorial and formatting coordination between the IECC-C and IECC-R. It is not intended to make any technical requirement changes.
This PC also addresses a modification made to REPI-150 to provide direction for insulation entirely above the roof deck as it relates to roof replacement requirements. REPI-150 added a footnote ‘f’ to the U-factor and R-value tables to point to the commercial tables for Group R buildings for appropriate criteria since this specific roof condition (low slope roof with insulation entirely above deck) was not specifically addressed in the residential provisions. Rather than rely on a footnote pointing to IECC-C provisions for requirements, the relevant requirements are proposed to be brought directly into the R-value and U-factors tables of the IECC-R.

Finally, the following additional revisions were made to R503.1.1: (1) various editorial and formatting changes or corrections were made to simplify and improve clarity, (2) the “approved source” definition which was added by REPI-150 is now deleted preferring instead to use the term “approved third party” for consistency with this term's use in the air leakage and ERI provisions, (3) the additional approved third-party and construction document requirements which previously existed in an exception are made a part of the requirements for roof replacements with insulation entirely above deck and limited to Group R-2 buildings (e.g., apartments) which addresses the primary application and need for consistency with similar building types addressed in the IECC-C provisions. Roofs with above-deck insulation on other types of residential buildings (e.g., one- and two-family, townhouses, etc.) would comply with the charging language of Section R503.1.1.2 (allowing an approved design without additional requirement for a third party and construction documents).

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.

The proposal does not change requirements and focuses on editorial and formatting improvements to coordinate with similar provisions in the IECC-C. Therefore, there should be no cost impacts.

Workgroup Recommendation

Proposal # 1210

RED1-269-22

Proponents: Aaron Phillips, representing Asphalt Roofing Manufacturers Association (aphillips@asphaltroofing.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R503.1.1.2 ~~Roof alterations~~ Roof, ceiling, and attic alterations. ~~Roof i~~ Insulation complying with Section R402.1 or an approved design shall be provided for the following ~~roof~~ alteration s ~~conditions~~ as applicable:

1. An alteration to roof-ceiling construction where there is no insulation above conditioned space.
2. Roof replacements for roofs with insulation entirely above deck,

Exceptions: Where compliance with Section R402.1 cannot be met due to limiting conditions on an existing roof, the following shall be permitted to demonstrate compliance with the insulation requirements:

1. Construction documents that include a report by a registered design professional or other approved source documenting details of the limiting conditions affecting compliance with the insulation requirements.
2. Construction documents that include a roof design by a registered design professional or other approved source that minimizes deviation from the insulation requirements.
3. ~~Conversion of an unconditioned attic space into conditioned space, and~~
4. ~~Replacement of ceiling finishes exposing cavities or surfaces of the roof-ceiling construction to which insulation can be applied.~~

3. Conversion of an unconditioned attic space into conditioned space.
4. Replacement of ceiling finishes exposing cavities or surfaces of the roof-ceiling construction to which insulation can be applied.

2024 ENERGY Chapter11

Revise as follows:

N1111.1.1.2 ~~Roof alterations~~ Roof, ceiling, and attic alterations. ~~Roof i~~ Insulation complying with Section N1102.1 or an approved design shall be provided for the following ~~roof~~ alteration s ~~conditions~~ as applicable:

1. An alteration to roof-ceiling construction where there is no insulation above conditioned space.
2. Roof replacements for roofs with insulation entirely above deck,

Exceptions: Where compliance with Section N1102.1 cannot be met due to limiting conditions on an existing roof, the following shall be permitted to demonstrate compliance with the insulation requirements:

1. Construction documents that include a report by a registered design professional or other approved source documenting details of the limiting conditions affecting compliance with the insulation requirements.
2. Construction documents that include a roof design by a registered design professional or other approved source that minimizes deviation from the insulation requirements.
3. ~~Conversion of an unconditioned attic space into conditioned space, and~~
4. ~~Replacement of ceiling finishes exposing cavities or surfaces of the roof-ceiling construction to which insulation can be applied.~~

3. Conversion of an unconditioned attic space into conditioned space.
4. Replacement of ceiling finishes exposing cavities or surfaces of the roof-ceiling construction to which insulation can be applied.

Reason: This comment makes changes intended to improve clarity:

1. Removes items 3 and 4 from the exception because they are intended to be in the enumerated list of alterations.
2. Replaces the section title with one that encompasses the four enumerated alterations.
3. Removes "roof" twice from the opening sentence since not all the described situations are roof alterations.
4. Simplifies "alteration conditions" to "alterations."
5. Corrects verb tense in Exception 2.
6. Removes unnecessary "and" from item 3.

Comment CED1-144-22 offers similar changes to Section C503.2.1.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This comment does not affect cost of construction because it improves clarity without making technical changes.

Workgroup Recommendation

Proposal # 978

RED1-270-22

Proponents: Glen Clapper, representing National Roofing Contractors Association (gclapper@nrca.net)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R503.1.1.2 Roof alterations. Roof insulation complying with Section R402.1 or an approved design shall be provided for the following roof alteration conditions as applicable:

1. An alteration to roof-ceiling construction where there is no insulation above conditioned space.
2. Roof replacements for roofs with insulation entirely above deck,

Exceptions: Where compliance with Section R402.1 cannot be met due to limiting conditions on an existing roof, the following shall be permitted to demonstrate compliance with the insulation requirements:

1. Construction documents that include a report by a registered design professional or other approved ~~source~~ entity documenting details of the limiting conditions affecting compliance with the insulation requirements.
2. Construction documents that include a roof design by a registered design professional or other approved ~~source~~ entity that minimize deviation from the insulation requirements.
3. Conversion of an unconditioned attic space into conditioned space, and
4. Replacement of ceiling finishes exposing cavities or surfaces of the roof-ceiling construction to which insulation can be applied.

2024 ENERGY Chapter11

Revise as follows:

N1111.1.1.2 Roof alterations. Roof insulation complying with Section N1102.1 or an approved design shall be provided for the following roof alteration conditions as applicable:

1. An alteration to roof-ceiling construction where there is no insulation above conditioned space.
2. Roof replacements for roofs with insulation entirely above deck,

Exceptions: Where compliance with Section N1102.1 cannot be met due to limiting conditions on an existing roof, the following shall be permitted to demonstrate compliance with the insulation requirements:

1. Construction documents that include a report by a registered design professional or other approved ~~source~~ entity documenting details of the limiting conditions affecting compliance with the insulation requirements.
2. Construction documents that include a roof design by a registered design professional or other approved ~~source~~ entity that minimize deviation from the insulation requirements.
3. Conversion of an unconditioned attic space into conditioned space, and
4. Replacement of ceiling finishes exposing cavities or surfaces of the roof-ceiling construction to which insulation can be applied.

Reason: This public comment proposal modifies who is allowed to provide the report and roof design, since *approved source* is a newly defined term approved as modified by the Residential Consensus Committee earlier this year that excludes qualified parties, such as the contractor and the suppliers. The proposed term "entity" is more inclusive as to who may provide the information required on this section and more closely aligns with the soon to be published ASHRAE Standard 90.1-2022

Cost Impact: The code change proposal will decrease the cost of construction.
This code change proposal will decrease the cost of construction when the information required is provided by an entity already onsite to perform the work.

Workgroup Recommendation

RED1-271-22

Proponents: Daniel Carroll, representing Division of Building Standards & Codes (daniel.carroll@dos.ny.gov); Hendrik Shank, representing New York State, Department of State (hendrikus.shank@dos.ny.gov)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R503.1.1.3 Above-grade wall alterations. Above-grade wall alterations shall comply with the following requirements as applicable:

1. Where interior finishes are removed exposing wall cavities, the existing cavity shall be filled with existing or new insulation complying with Section R303.1.4;
2. Where exterior wall coverings and fenestration are removed and replaced for the full extent of any exterior wall assembly, continuous insulation shall be provided where required in accordance with Section R402.1 or an approved design;
3. Where Items 1 and 2 apply, the entire wall assembly shall be insulated in accordance with Section R402.1; and,
4. 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 where required in accordance with Section R402.1 or an approved design.

Where any of the above requirements are applicable, the above-grade wall alteration shall comply with the insulation and water vapor retarder requirements of Section R702.7 of the International Residential Code or Section 1404.3 of the International Building Code, as applicable. Where the exterior wall coverings are removed and replaced, the above-grade wall alteration shall comply with the water and wind resistance requirements of Section R703.1.1 of the International Residential Code or 1402.2 of the International Building Code, as applicable.

Reason: Not all buildings regulated by the IECC-Residential Provisions are regulated by the IRC. This change avoids confusion or the misapplication of the IRC for R-2, R-3, and R-4 buildings three stories or less that are regulated by the IECC-Residential Provisions and the IBC.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This code change is a clarification. There is no increase in cost, R-2, R-3 and R-4 buildings are required to comply with the IBC requirements not the IRC.

Workgroup Recommendation

Proposal # 1201

RED1-272-22

Proponents: Shane Hoeper, representing myself (shoeper@cityofdubuque.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R503.1.1.3 Above-grade wall alterations. ~~Above-grade wall alterations shall comply with the following requirements as applicable:~~

~~1.~~ Where interior finishes are removed exposing wall cavities, the existing cavity shall be filled with ~~existing or new~~ insulation.~~ complying with Section R303.1.4;~~

~~2. Where exterior wall coverings and fenestration are removed and replaced for the full extent of any exterior wall assembly, continuous insulation shall be provided where required in accordance with Section R402.1 or an approved design;~~

~~3. Where Items 1 and 2 apply, the entire wall assembly shall be insulated in accordance with Section R402.1; and,~~

~~4. 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 where required in accordance with Section R402.1 or an approved design.~~

~~Where any of the above requirements are applicable, t~~The above-grade wall alteration shall comply with the insulation and water vapor retarder requirements of Section R702.7 of the International Residential Code. Where the exterior wall coverings are removed and replaced, the above-grade wall alteration shall comply with the water and wind resistance requirements of Section R703.1.1 of the International Residential Code.

Reason: The deleted sections are overly burdensome. Bringing insulation levels in walls up to modern standards is technically difficult and certainly not cost effective.

Cost Impact: The code change proposal will decrease the cost of construction.
This change will decrease the cost of construction due to reduced insulation levels required for simple alterations to a structure.

Workgroup Recommendation

Proposal # 1358

RED1-273-22

Proponents: Vladimir Kochkin, representing NAHB (vkochkin@nahb.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R503.1.1.3 Above-grade wall alterations. Above-grade wall alterations shall comply with the following requirements as applicable:

1. Where interior finishes are removed exposing wall cavities, the existing cavity shall be filled with existing or new insulation complying with Section R303.1.4;
2. Where exterior wall coverings and fenestration are removed and replaced for the full extent of any exterior wall assembly, continuous insulation shall be provided where required in accordance with Section R402.1 or an approved design;

   Exception: where Class I vapor retarder is present in the existing wall assembly, the alteration shall be exempt from the continuous insulation requirement.

3. Where Items 1 and 2 apply, the entire wall assembly shall be insulated in accordance with Section R402.1; and,
4. 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 where required in accordance with Section R402.1 or an approved design.

Where any of the above requirements are implemented ~~applicable~~ and resulted in a change of the vapor retarder classsification, the above-grade wall alteration shall comply with the ~~insulation and~~ water vapor retarder requirements of Section R702.7 of the International Residential Code. Where the exterior wall coverings are removed and replaced, the above-grade wall alteration shall comply with the water and wind resistance requirements of Section R703.1.1 of the International Residential Code.

Exception: Where the existing backing material does not meet the requirements of R703.1.2 for new construction, the alteration shall not reduce the water resistance and wind resistance of the wall assembly.

Reason: This proposal addresses conflicts with the vapor retarder and wind resistance provisions.
The IRC provisions for vapor retarders do not allow prescriptive compliance for walls with "double" Class I vapor retarders.

The alteration does not need to comply with new vapor retarder requirements if vapor permeability characteristics did not change.

Section R702.7 does not contain insulation requirements.

The intent of this section is not to require replacement of the existing structural exterior sheathing when replacing the cladding.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This change may or may not impact the cost of alterations.

Workgroup Recommendation

Proposal # 1360

RED1-274-22

Proponents: Shane Hoeper, representing myself (shoeper@cityofdubuque.org)

2024 International Energy Conservation Code [RE Project]

Delete without substitution:

~~**R503.1.1.5 Below-grade wall alterations.** Where a blow-grade space is changed to conditioned space, the below-grade walls shall be insulated where required in accordance with Section R402.1. Where the below-grade space is conditioned space and a below-grade wall is altered by removing or adding interior finishes, it shall be insulated where required in accordance with Section R402.1.~~

Reason: Adding conditioned space is, by definition, an addition. This section is unnecessary.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This change will not affect the cost of construction.

Workgroup Recommendation

Proposal # 1357

RED1-275-22

Proponents: Glen Clapper, representing National Roofing Contractors Association (gclapper@nrca.net)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R503.1.1.6 Air barrier. Building thermal envelope assemblies altered in accordance with Section R503.1.1 shall be provided with an air barrier in accordance with Section R402.5. The air barrier shall not be required to be made continuous with unaltered portions of the building thermal envelope. Testing requirements of Section R402.5.1.2 shall not be required.~~Content~~

> **Exception:** An air barrier shall not be required for a roof replacement where the alteration or renovation to the building does not include alterations, renovations or repairs to the remainder of the building thermal envelope.

Reason: This public comment code change proposal aligns the residential provisions of the IECC with the commercial provisions (exemption). There is no value to installing an air barrier in a roof assembly that is part of the building thermal envelope when alterations, renovations or repairs are not also being performed to the remainder of the building or building thermal envelope.

Cost Impact: The code change proposal will decrease the cost of construction.
This code change proposal will decrease the cost of construction by not requiring an additional element or material in the alteration.

Workgroup Recommendation

Proposal # 1450

RED1-276-22

Proponents: Glen Clapper, representing National Roofing Contractors Association (gclapper@nrca.net)

2024 International Energy Conservation Code [RE Project]

Delete without substitution:

~~**R503.1.1.6 Air barrier.** Building thermal envelope assemblies altered in accordance with Section R503.1.1 shall be provided with an air barrier in accordance with Section R402.5. The air barrier shall not be required to be made continuous with unaltered portions of the building thermal envelope. Testing requirements of Section R402.5.1.2 shall not be required.Content~~

2024 ENERGY Chapter11

Delete without substitution:

~~**N1111.1.1.6 Air barrier.** Building thermal envelope assemblies altered in accordance with Section N1111.1.1 shall be provided with an air barrier in accordance with Section N1102.4. The air barrier shall not be required to be made continuous with unaltered portions of the building thermal envelope. Testing requirements of Section N1102.4.1.2 shall not be required.~~

Reason: This public comment code change proposal eliminates the installation of an element or material that has no value when alterations, renovations or repairs are not also being performed to the remainder of the building or building thermal envelope.

Cost Impact: The code change proposal will decrease the cost of construction.
This code change proposal will decrease the cost of construction by not requiring an additional element or material in an alteration.

Workgroup Recommendation

Proposal # 1461

RED1-277-22

Proponents: Jay Crandell, representing Foam Sheathing Committee of the American Chemistry Council (jcrandell@aresconsulting.biz)

2024 International Energy Conservation Code [RE Project]

Delete without substitution:

~~**EXTERIOR WALL ENVELOPE.** A system or assembly of exterior wall components, including exterior wall finish materials, that provides protection of the building structural members, including framing and sheathing materials, and conditioned interior space, from the detrimental effects of the exterior environment.~~

Revise as follows:

R503.1.5 Additional Efficiency Packages. Alterations shall comply with Section R506 where the alteration contains replacement of two or more of the following:

1. HVAC unitary systems or HVAC central heating or cooling equipment serving the *work area* of the *alteration*.
2. Water heating equipment serving the *work area* of the *alteration*.
3. 50 percent or more of the lighting fixtures in the *work area* of the *alteration*.
4. 50 percent or more of the area of interior surfaces of the *building thermal envelope* ~~thermal envelope~~ in the *work area* of the *alteration*.
5. 50 percent or more the *exterior wall* area of the *building thermal envelope* ~~building's *exterior wall envelope*~~ , including vertical fenestration area.

Exceptions:

1. *Alterations* that are permitted with an *addition* complying with Section R502.3.5.
2. *Alterations* that comply with Section R405 or R406.

Reason: This PC is submitted to coordinate with a similar proposal (CED1-149-22) submitted to the IECC commercial committee. The newly added "exterior wall envelope" definition is used only once in the entire IECC residential provisions in the newly added Section R503.1.5, Item 5. The term is deleted and existing defined terms are used instead to revise Item 5 in Section R503.1.5 to retain its intent while not requiring a new term to be created and applied. The exception is also clarified to apply the percentage trigger on the basis of area, not length of walls, number of walls, or other possible metrics that are currently left open to interpretation. It is clarified that the exterior wall area used for this purpose should also include the area of vertical fenestration. Finally, the new "exterior wall envelope" definition overlaps with the defined term "exterior wall covering" as used in the IBC and IRC and this could create confusion in coordination between the I-codes. Deleting the term and using existing definitions resolves this concern as well. However, if the intent was that "exterior wall envelope" was intended to be applied the same as "exterior wall covering", then use of the latter defined term in the building codes should be considered instead.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
The intent of this proposal is to provide a clean-up of terminology and not to change requirements. However, the clarification could result in a relaxation of the trigger for additional efficiency (and possible cost reduction for some alteration projects) by clarifying that vertical fenestration is to be included in the exterior wall area for purposes of the 50% of exterior wall trigger.

Workgroup Recommendation

Proposal # 1134

RED1-278-22

Proponents: Lucyna de Barbaro, representing Rebuilding Together Pittsburgh (ldbarbaro@rtpittsburgh.org)

2024 International Energy Conservation Code [RE Project]

R504.1 General. *Buildings*, structures and parts thereof shall be repaired in compliance with Section R501.3 and this section. Work on nondamaged components necessary for the required *repair* of damaged components shall be considered to be part of the *repair* and shall not be subject to the requirements for *alterations* in this chapter. Routine maintenance required by Section R501.3, ordinary repairs exempt from *permit*, and abatement of wear due to normal service conditions shall not be subject to the requirements for *repairs* in this section.

Revise as follows:

R504.2 Application. For the purposes of this code, the following shall be considered to be *repairs*:

1. Glass-only replacements in an existing sash and frame.
2. Roof *repairs*, unless the repair consists of the whole roof replacement.
3. *Repairs* where only the bulb, ballast or both within the existing luminaires in a space are replaced provided that the replacement does not increase the installed interior lighting power.

Reason: This comment clarifies the meaning of repair in R504.2. In our practice, I encountered building professionals who argued against adding insulation either below or above roof decking during roof replacement (as specified in R503 Alterations) on the ground of roof replacement being "a repair" of the roof.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This comment intends to clarify the language of R504 and hence has no cost impact.

Workgroup Recommendation

Proposal # 1317

RED1-279-22 Part I

Proponents: Fredric Zwerg, representing Southwest Gas Corporation (fredric.zwerg@swgas.com)

2024 International Energy Conservation Code [RE Project]

Delete without substitution:

~~**PILOT LIGHT, CONTINUOUSLY BURNING.** A small gas flame used to ignite gas at a larger burner. Once lit, a continuously pilot light remains in operation until manually interrupted. Pilot light ignition systems with the ability to switch between intermittent and continuous mode are considered continuous.~~

~~**PILOT LIGHT, INTERMITTENT.** A pilot which is automatically ignited when an appliance is called on to operate and which remains continuously ignited during each period of main burner operation. The pilot is automatically extinguished when each main burner operating cycle is completed.~~

~~**PILOT LIGHT, INTERRUPTED.** A pilot which is automatically ignited prior to the admission of fuel to the main burner and which is automatically extinguished after the main flame is established.~~

~~**PILOT LIGHT, ON-DEMAND.** A pilot which, 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.~~

Reason: Delete these four pilot light definitions entirely. Pilot light operation is generally defined by the appliance manufacture, the appliance controls and its sequence of operation. These definitions are not needed and may cause potential conflicts with the appliance operation.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
No cost impact.

Workgroup Recommendation

Proposal # 1112

RED1-279-22 Part II

Proponents: Fredric Zwerg, representing Southwest Gas Corporation (fredric.zwerg@swgas.com)

2024 ENERGY Chapter11

Delete without substitution:

~~**PILOT LIGHT, CONTINUOUSLY BURNING.** A small gas flame used to ignite gas at a larger burner. Once lit, a continuously pilot light remains in operation until manually interrupted. Pilot light ignition systems with the ability to switch between intermittent and continuous mode are considered continuous.~~

~~**PILOT LIGHT, INTERMITTENT.** A pilot which is automatically ignited when an appliance is called on to operate and which remains continuously ignited during each period of main burner operation. The pilot is automatically extinguished when each main burner operating cycle is completed.~~

~~**PILOT LIGHT, INTERRUPTED.** A pilot which is automatically ignited prior to the admission of fuel to the main burner and which is automatically extinguished after the main flame is established.~~

~~**PILOT LIGHT, ON-DEMAND.** A pilot which, 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.~~

Reason: Delete these four pilot light definitions entirely. Pilot light operation is generally defined by the appliance manufacture, the appliance controls and its sequence of operation. These definitions are not needed and may cause potential conflicts with the appliance operation.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
No cost impact.

Workgroup Recommendation

Proposal # 1155

RED1-280-22 Part I

Proponents: Fredric Zwerg, representing Southwest Gas Corporation (fredric.zwerg@swgas.com)

2024 International Energy Conservation Code [RE Project]

Delete without substitution:

~~**ZONAL HEATING.** A heating system in which each zone or room has a separate heater with a single controller in each zone.~~

Reason: Delete this definition entirely. Each HVAC zone is already required to have their own separate unit and controller. They are independent and considered separate units and could be confused with central HVAC systems with different zones. This definition is not necessary.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
No cost impact.

Workgroup Recommendation

Proposal # 1115

RED1-280-22 Part II

Proponents: Fredric Zwerg, representing Southwest Gas Corporation (fredric.zwerg@swgas.com)

2024 ENERGY Chapter11

Delete without substitution:

~~**ZONAL HEATING.** A heating system in which each zone or room has a separate heater with a single controller in each zone.~~

Reason: Delete this definition entirely. Each HVAC zone is already required to have their own separate unit and controller. They are independent and considered separate units and could be confused with central HVAC systems with different zones. This definition is not necessary.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
No cost impact.

Workgroup Recommendation

Proposal # 1156

RED1-281-22

Proponents: Theresa Weston, representing ABAA (Air Barrier Association of America) (holtweston88@gmail.com)

2024 International Energy Conservation Code [RE Project]

Update standard(s) as follows:

ASTM

ASTM International
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken, PA 19428-2959

E283/E283M~~— 2004(2012):~~ (2019)	Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls and Doors Under Specified Pressure Differences Across the Specimen
E779~~— 2010(2018)~~ :2019	Standard Test Method for Determining Air Leakage Rate by Fan Pressurization
E1554/E1554M~~—E2013:~~ 2013 (2018)	Standard Test Methods for Determining Air Leakage of Air Distribution Systems by Fan Pressurization
E1827~~— : 2011(2017):~~ 2022	Standard Test Methods for Determining Airtightness of Building Using an Orifice Blower Door
D8052/D8052M~~—2017:~~ 2022	Standard Test Method for Quantification of Air Leakage in Low-Sloped Membrane Roof Assemblies
E1186-~~17~~ 2022	Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems

Reason: This is to update reference standards related to air leakage assessment in order to keep the references current.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
The updates to these standards do not constitute changes in code requirements, therefore, will not effect the cost of construction.

Workgroup Recommendation

Proposal # 1367

RED1-282-22 Part I

Proponents: Christopher McWhite, representing Region VI (cmcwhite@me.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

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

Reason: The inclusion of a price seems out of place for a definition that is intended to define mechanical system activation based upon a modified consumption of energy. I don't see where the inspector would be able to discern or test a system that somehow responds to price changes in the markets, utility bill, or other fiscal pressures. Was that the intent? I propose this language be stricken because of the inherent difficulty in the inspector accomplishing a test of such a design.
Also, the Code is intended to address efficiency and affordability, but by including language that requires a price be a factor in modifying demand requires the system to respond to any modification. Not just modification in an upward direction but also in a downward direction. Was that also the intent?

Does the technology even exist to accomplish this proposed definition? If it does, are there multiple manufacturers that offer this technology?

Cost Impact: The code change proposal will decrease the cost of construction.
There will be a savings in the striking of this language because the inherent difficulty of the Inspecting of this and the lack of technology that is sufficiently integrated with thermostatic controls will be a relief to the Code Official.

Bibliography: I am a career, 22 year Building Code Official who has served communities in five states from the Midwest, to the South, and now in New England. Through The Rhode Island Building Code Standards Committee, I am accepted as a certified Building Official; *R.I.G.L. Ch. 23-27.3 §107.5*. Through The International Code Council, I am exam certified as a Certified Building Official, Housing Code Official, Combination Residential Building Inspector, and a Residential and Commercial Plans Examiner. Through the State of Massachusetts I am a certified/licensed Inspector of Buildings/Building Commissioner. Currently I am working as the Department Head Building and Zoning Official in the Town of Smithfield Rhode Island. Here we are committed to our communities' development through partnerships with local and statewide organizations, institutions, and people who are dedicated and/or focused on the process of maintaining existing buildings and constructing new edifices with the goal of making an ever safer built community. I am committed to pursuing improved life safety in residential and commercial structures and the judicious enforcement of current building code and its referenced standards through effective leadership both within the builders and design community and with the professional staff I have the honor to lead. My personal goal is the building of a team of amicable, fair, ethical, and consistently equitable Officials utilizing State and Local building regulations while also judiciously incorporating relevant 28 CFR, ADA requirements. My role is also to communicate these goals with political bodies, large stakeholder investors in high profile projects, local community projects, and simple renovations with homeowners, without parity. I am also a decades-long member of the International Code Council, the non-profit agency that develops and publishes the building Codes. I've twice served as a selected committee member for code development on the national level and I am currently serving as an elected, Governing Board Member with one ICC Membership Council while chairing a subcommittee in another.

Workgroup Recommendation

Proposal # 1213

RED1-282-22 Part II

Proponents: Christopher McWhite, representing Region VI (cmcwhite@me.com)

2024 ENERGY Chapter11

Revise as follows:

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

Reason: The inclusion of a price seems out of place for a definition that is intended to define mechanical system activation based upon a modified consumption of energy. I don't see where the inspector would be able to discern or test a system that somehow responds to price changes in the markets, utility bill, or other fiscal pressures. Was that the intent? I propose this language be stricken because of the inherent difficulty in the inspector accomplishing a test of such a design.
Also, the Code is intended to address efficiency and affordability, but by including language that requires a price be a factor in modifying demand requires the system to respond to any modification. Not just modification in an upward direction but also in a downward direction. Was that also the intent?

Does the technology even exist to accomplish this proposed definition? If it does, are there multiple entities that produce the tech? If not, it could show favoritism to a single provider; monopoly

Cost Impact: The code change proposal will decrease the cost of construction.
There will be a savings in the striking of this language because the inherent difficulty of the Inspecting of this and the lack of technology that is sufficiently integrated with thermostatic controls will be a relief to the Code Official.

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Workgroup Recommendation

Proposal # 1222

RED1-283-22

Proponents: Shannon Corcoran, representing American Gas Association

2024 International Energy Conservation Code [RE Project]

Revise as follows:

CONTINUOUS PILOT ~~LIGHT, CONTINUOUSLY BURNING~~. ~~A small gas flame used to ignite gas at a larger burner. Once lit, a continuously pilot light remains in operation until manually interrupted. Pilot light ignition systems with the ability to switch between intermittent and continuous mode are considered continuous.~~ Pilot which, once placed in operation, is intended to remain ignited continuously until it is manually interrupted.

INTERMITTENT IGNITION ~~PILOT LIGHT, INTERMITTENT~~. ~~A pilot which is automatically ignited when an appliance is called on to operate and which remains continuously ignited during each period of main burner operation. The pilot is automatically extinguished when each main burner operating cycle is completed.~~ Type of ignition which is energized when an appliance is called on to operate and which remains continuously energized during each period of main burner operation and where the ignition is deenergized when the main burner operating cycle is completed.

~~PILOT LIGHT,~~ INTERRUPTED IGNITION. ~~A pilot which is automatically ignited prior to the admission of fuel to the main burner and which is automatically extinguished after the main flame is established.~~ T ype of ignition which is energized prior to the admission of fuel to the main burner and which is deenergized when the main flame is established.

ON-DEMAND PILOT ~~LIGHT, ON-DEMAND~~. ~~A pilot which, 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.~~ A pilot which, 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.

Reason: Definitions of industry terms should be consistent with the source of the definition. The various types of pilot lights are defined in the Standard for Automatic electrical controls — Part 2-5: Particular requirements for automatic electrical burner control systems, CSA/ANSI Z21.20:22 • CSA C22.2 No. 60730-2-5:22 ♦ UL 60730-2-5. The code should be consistent with the ANSI standard.
these proposed changes ot the definitions apply to both the IECC Residential Code as well as the IRC Chapter 11.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
The proposal will not affect the cost of construction.

Workgroup Recommendation

Proposal # 1270

RED1-284-22 Part I

Proponents: Christopher McWhite, representing Region VI (cmcwhite@me.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

PILOT LIGHT, CONTINUOUSLY BURNING. A small gas flame used to ignite gas at a larger burner. Once lit, a continuously ignited pilot light remains in operation until manually interrupted. Pilot light ignition systems with the ability to switch between intermittent and continuous mode are considered continuous.

Reason: The sentence is awkward. It seems to omit a verb to describe the continuous action of the pilot light.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This included word will not increase or decrease the cost of construction.

Bibliography: I am a career, 22 year Building Code Official who has served communities in five states from the Midwest, to the South, and now in New England. Through The Rhode Island Building Code Standards Committee, I am accepted as a certified Building Official; *R.I.G.L. Ch. 23-27.3 §107.5*. Through The International Code Council, I am exam certified as a Certified Building Official, Housing Code Official, Combination Residential Building Inspector, and a Residential and Commercial Plans Examiner. Through the State of Massachusetts I am a certified/licensed Inspector of Buildings/Building Commissioner. Currently I am working as the Department Head Building and Zoning Official in the Town of Smithfield Rhode Island. Here we are committed to our communities' development through partnerships with local and statewide organizations, institutions, and people who are dedicated and/or focused on the process of maintaining existing buildings and constructing new edifices with the goal of making an ever safer built community. I am committed to pursuing improved life safety in residential and commercial structures and the judicious enforcement of current building code and its referenced standards through effective leadership both within the builders and design community and with the professional staff I have the honor to lead. My personal goal is the building of a team of amicable, fair, ethical, and consistently equitable Officials utilizing State and Local building regulations while also judiciously incorporating relevant 28 CFR, ADA requirements. My role is also to communicate these goals with political bodies, large stakeholder investors in high profile projects, local community projects, and simple renovations with homeowners, without parity. I am also a decades-long member of the International Code Council, the non-profit agency that develops and publishes the building Codes. I've twice served as a selected committee member for code development on the national level and I am currently serving as an elected, Governing Board Member with one ICC Membership Council while chairing a subcommittee in another.

Workgroup Recommendation

Proposal # 1216

RED1-284-22 Part II

Proponents: Christopher McWhite, representing Region VI (cmcwhite@me.com)

2024 ENERGY Chapter11

Revise as follows:

PILOT LIGHT, CONTINUOUSLY BURNING. A small gas flame used to ignite gas at a larger burner. Once lit, a continuously ignited pilot light remains in operation until manually interrupted. Pilot light ignition systems with the ability to switch between intermittent and continuous mode are considered continuous.

Reason: The sentence is awkward. It seems to omit a verb to describe the continuous action of the pilot light.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This included word will not increase or decrease the cost of construction.

Bibliography: I am a career, 22 year Building Code Official who has served communities in five states from the Midwest, to the South, and now in New England. Through The Rhode Island Building Code Standards Committee, I am accepted as a certified Building Official; *R.I.G.L. Ch. 23-27.3 §107.5*. Through The International Code Council, I am exam certified as a Certified Building Official, Housing Code Official, Combination Residential Building Inspector, and a Residential and Commercial Plans Examiner. Through the State of Massachusetts I am a certified/licensed Inspector of Buildings/Building Commissioner. Currently I am working as the Department Head Building and Zoning Official in the Town of Smithfield Rhode Island. Here we are committed to our communities' development through partnerships with local and statewide organizations, institutions, and people who are dedicated and/or focused on the process of maintaining existing buildings and constructing new edifices with the goal of making an ever safer built community. I am committed to pursuing improved life safety in residential and commercial structures and the judicious enforcement of current building code and its referenced standards through effective leadership both within the builders and design community and with the professional staff I have the honor to lead. My personal goal is the building of a team of amicable, fair, ethical, and consistently equitable Officials utilizing State and Local building regulations while also judiciously incorporating relevant 28 CFR, ADA requirements. My role is also to communicate these goals with political bodies, large stakeholder investors in high profile projects, local community projects, and simple renovations with homeowners, without parity. I am also a decades-long member of the International Code Council, the non-profit agency that develops and publishes the building Codes. I've twice served as a selected committee member for code development on the national level and I am currently serving as an elected, Governing Board Member with one ICC Membership Council while chairing a subcommittee in another.

Workgroup Recommendation

Proposal # 1225

RED1-285-22

Proponents: Gary Klein, representing Self (gary@garykleinassociates.com); Mark Lyles, representing California IOUs (markl@newbuildings.org); Gayathri Vijayakumar, representing Steven Winter Associates, Inc. (gvijayakumar@swinter.com)

2024 International Energy Conservation Code [RE Project]

Add new definition as follows:

AIR-HANDLING UNIT. A blower or fan used for the purpose of distributing supply air to a room, space or area.

Revise as follows:

CONDITIONED SPACE. An area, room or space that is enclosed within the *building thermal envelope* and is directly or indirectly heated or cooled. Spaces are indirectly heated or cooled where they communicate through openings with conditioned spaces, where they are separated from conditioned spaces by uninsulated walls, floors or ceilings, or where they contain uninsulated ~~ducts~~ *ducts*, piping or other sources of heating or cooling.

Add new definition as follows:

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

Revise as follows:

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*, *ductwork*, and shall include any apparatus installed in connection therewith.

Add new definition as follows:

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 or cooled. 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*.

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

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.

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*.

SPACE CONDITIONING. The treatment of air so as to control simultaneously the temperature, humidity, cleanness and 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*.

Revise as follows:

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* ~~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 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* ~~duct system~~ and building 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 R408.
8. Where a solar-ready zone is provided, the certificate shall indicate the location, and dimensions.

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 weatherstripped in accordance with Section R402.5.
6. The building thermal envelope separating the basement from adjacent conditioned spaces complies with Section R402.5.

TABLE R402.5.1.1 AIR BARRIER, AIR SEALING AND INSULATION INSTALLATION[a]

Portions of table not shown remain unchanged.

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
Shafts, penetrations	*Duct* ~~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.
Recessed lighting	Recessed light fixtures installed in the building thermal envelope shall be air sealed in accordance with Section R402.5.5.	Recessed light fixtures installed in the building thermal envelope shall be airtight and IC rated, and shall be buried in or surrounded with insulation.
Electrical,communication, and other equipment boxes, housings, and enclosures	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. The continuity of the air barrier shall be maintained around boxes, housings, and enclosures that penetrate the air barrier. Alternatively, air-sealed boxes shall be installed in accordance with R402.5.6.	Boxes, housing, and enclosures shall be ~~burried~~ 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 in a ~~the building's thermal envelope~~ *building thermal envelope* assembly shall be buried ~~burried~~ in or ~~and~~ surrounded by insulation.

a. Inspection of log walls shall be in accordance with the provisions of ICC 400.

b. Insulation full enclosure is not required in unconditioned/ventilated attic spaces and at rim joists.

SECTION R403
SYSTEMS

Revise as follows:

R403.3 Duct systems. ~~Ducts and air handlers~~*Duct systems* shall be installed in accordance with**Sections R403.3.1** through **R403.3.8~~7~~**.

R403.3.1 ~~Ducts~~ Ductwork located outside conditioned space. Supply and return *ductwork*~~*ducts*~~ 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. *Ductwork*~~*Ducts*~~ buried beneath a building shall be insulated as required per this section or have an equivalent *thermal distribution efficiency*. Underground *ductwork*~~*ducts*~~ utilizing the *thermal distribution efficiency* method shall be listed and *labeled* to indicate the *R*-value equivalency.

R403.3.2 Duct~~s~~ systems located in conditioned space. For ~~ductwork~~ *duct systems* to be considered inside a *conditioned space,* the *space conditioning equipment* shall be located completely within the *continuous air barrier* and within the *building thermal envelope.* The *ductwork*~~it~~ it shall comply with one of the following:

1. The ~~duct system~~ *ductwork*shall be located completely within the *continuous air barrier* and within the building thermal envelope.

2. *Ductwork* ~~Ductwork~~in ventilated attic spaces or unvented attic s with vapor diffusion port s shall be buried within ceiling insulation in accordance with Section R403.3.3 and all of 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 ~~duct~~ *ductwork*leakage, as measured either by a rough-in test of the supply and return ~~ducts~~ *ductwork* or a post-construction ~~total~~ *duct system* leakage test to outside the *building thermal envelope* in accordance with Section R403.3. 5~~6~~, is less than or equal to 1.5 cubic feet per minute (42.5 L/min) per 100 square feet (9.29 m^2) of *conditioned floor area* served by the *duct system*.

   2.~~3~~ 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* located in wall or floor building 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 the ~~duct~~ *ductwork* and the unconditioned space.

   3.2. ~~Ducts~~ *Ductwork* shall be installed in accordance with Section R403.3.1.

   Exception: Where the building assembly cavities containing ~~ducts~~ *ductwork* have been air sealed in accordance with Section R402.5.1,ductinsulation is not required.

   3.3. Not less than R-10 insulation, and not less than 50 percent of the required R-value specified in Table R402.1.3, shall be located between the ~~duct~~ *ductwork* and the unconditioned space.

   ~~3.4 For ducts in these building assemblies to be considered within conditioned space, the air handling equipment shall be installed within conditioned space.~~

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

1. The supply and return ~~ducts~~ *ductwork* shall have an insulation *R*-value not less than R-8.
2. At all points along ~~each duct~~ the *ductwork* , 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 ~~ducts~~ *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 when installed in an unvented attic with vapor diffusion ports, the supply ~~ducts~~ *ductwork* shall be completely buried within ceiling insulation, 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 ~~ducts~~ *ductwork* duct that are less than 3 feet (914 mm) from the supply outlet shall not be required to comply with these requirements.

   4.1 Air permeable insulation installed in unvented attics shall be in compliance with the requirements of Section R806.5.2 of the *International Residential Code*.

R403.3.3.1 Effective R-value of deeply buried ducts. Where using the Building Simulated Performance Compliance Option in accordance with Section R401.2.2, sections of ~~ducts~~ *ductwork* that are installed in accordance with Section R403.3.3 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.

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

R403.3.4.1 Sealed ~~air handler~~ air-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.

R403.3.5 Duct system testing. Each *duct system* ~~ducts system~~ shall be tested for air leakage in accordance with ANSI/RESNET/ICC 380 or ASTM E1554 . Total leakage shall be measured with a pressure differential of 0.1 inch water gauge ~~w.g.~~(25 Pa) across the ~~system~~ *duct system* and shall include the measured leakage from both the supply and return *ductwork*. ~~Registers shall be sealed during the test.~~ A written report of the test results shall be signed by the party conducting the test and provided to the *code official*. *Duct system* ~~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 temporarily sealed during the test. Where not installed, the face of the register boots shall be temporarily sealed.

Exceptions:

1. Testing shall not be required for *duct systems* ~~duct systems~~ serving ventilation systems that are not integrated with *duct systems* ~~duct systems~~ serving heating or cooling systems.
2. Testing shall not be required where there is not more than 10 feet of total *ductwork* e xternal to the *space conditioning equipment* and both the following are met :

   a. The *duct system* is located entirely within conditioned space .

   b. The *ductwork* does not include *plenums* constructed of building cavities or sheetrock.
3. W here the *space conditioning equipment* is not installed , testing shall be permitted. T he total measured leakage of the supply and return *ductwork* shall be less than or equal to 3.0 cubic f eet per minute (85 L/min) per 100 square feet (9.29 m^2) of *conditioned floor area.*

~~2~~ 4. Where tested in accordance with Section R403.3.7, testing of each *duct system* ~~duct system~~ is not required.

R403.3.6 Duct system leakage. The total measured ~~duct system~~ *duct system* leakage shall not be greater than the values in Table R403.3.6, 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~~ *duct system* 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.

TABLE R403.3.6 MAXIMUM TOTAL DUCT SYSTEM LEAKAGE

~~ROUGH IN~~	~~POST CONSTRUCTION~~	
~~**Duct systems serving more than 1,000 ft^2 of conditioned floor area**~~	~~**cfm/100 ft^2 (LPM/9.29 m^2)**~~	~~**cfm/100 ft^2 (LPM/9.29 m^2)**~~
~~Air handler is not installed~~	~~3 (85)~~	~~NA~~
~~Air handler is installed~~	~~4 (113.3)~~	~~4 (113.3)~~
~~Duct systems located in conditioned space, with air handler installed~~	~~8 (226.6)~~	~~8 (226.6)~~
~~**Duct systems serving less than or equal to 1,000 ft^2 of conditioned floor area**~~	~~**cfm (LPM)**~~	~~**cfm (LPM)**~~
~~Air handler is not installed~~	~~30 (849.5)~~	~~NA~~
~~Air handler is installed~~	~~40 (1132.7)~~	~~40 (1132.7)~~
~~Duct systems located in conditioned space, with air handler installed~~	~~80 (2265.4)~~	~~80 (2265.4)~~

	***Duct systems* serving more than 1,000 ft^2 of conditioned floor area**		***Duct systems* serving less than or equal to 1,000 ft^2 of conditioned floor area**
	cfm/100 ft^2 (LPM/9.29 m^2)		**cfm (LPM)**
	Number of ducted returns [a]		
	< 3	**≥ 3**	
Space conditioning equipment is not installed[b, c]	3 (85)	4 (113.3)	30 (849.5)
All components of the *duct system* are installed[c]	4 (113.3)	6 (170)	40 (1132.7)
All components of the *duct system* are installed and entirely located in conditioned space [c]	8 (226.6)	12 (340)	80 (2265.4)

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 approach to convey air from return or transfer grille(s) to the *air-handling unit* does not constitute a ducted return for the purpose of determining maximum total *duct system* leakage allowance.

b. Where the *space conditioning equipment* is not installed, *duct system* testing shall be permitted and shall include the measured leakage from both the supply and return *ductwork*. *Duct system* testing shall not be performed if the return *ductwork* is not installed.

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 shall be measured in accordance with ANSI/RESNET/ICC 380 or ASTM E1554 and shall be less than or equal to 1.5 cubic feet per minute (42.5 L/min) per 100 square feet (9.29 m^2) of *conditioned floor area* served by the *duct system.*

R403.3.7 Dwelling unit sampling. For buildings with eight or more *dwelling units* the duct systems in the greater of seven, or 20 percent of the *dwelling units* in the building 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*, the duct systems in each unit shall be tested. Where the leakage ~~rate~~ of a *duct system* is greater than the maximum permitted *duct system* leakage ~~rate~~, corrective actions shall be made to the *duct system* ~~system~~ and the *duct system* shall be retested until it passes. For each tested *dwelling unit* that has a greater total *duct system* leakage ~~rate~~ than the maximum permitted *duct system* leakage ~~rate~~, an additional three *dwelling units*, including the corrected unit, shall be tested.

R403.3.8 Building cavities. *Building* framing cavities shall not be used as ~~ducts~~ *ductwork* or *plenums*.

TABLE R403.6.2 WHOLE-DWELLING MECHANICAL VENTILATION SYSTEM FAN EFFICACY[a]

Portions of table not shown remain unchanged.

SYSTEM TYPE	AIRFLOW RATE (CFM)	MINIMUM EFFICACY (CFM/WATT)	TEST PROCEDURE
~~Air-handler~~ *Air-handling unit* that is integrated to tested and *listed* HVAC equipment	Any	1.2	Outdoor airflow as specified. *Air-handling unit* ~~Air-handler~~ fan power determined in accordance with the HVAC appliance's test method referenced by Section C403.3.2 of the IECC-Commercial Provisions.

For SI: 1 cubic foot per minute = 0.47 L/s.

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

SECTION R405
SIMULATED BUILDING PERFORMANCE

Revise as follows:

R405.3.2.1 Compliance report for permit application. A compliance report submitted 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 the software used to produce the results for the reference design and/or the rated home.
5. A certificate indicating that the proposed design complies with Section R405.3. 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~~ *duct system* and building 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 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.

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

Portions of table not shown remain unchanged.

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Thermal distribution systems	~~Duct system~~ *Duct system* leakage to outside: For *duct systems* serving > 1,000ft^2 of conditioned floor area, the duct leakage to outside rate shall be 4 cfm (113.3 L/min) per 100 ft^2 (9.29 m^2) of conditioned floor area. For *duct systems* serving ≤ 1,000ft^2 of conditioned floor area, the duct leakage to outside rate shall be 40 cfm (1132.7 L/min).	*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. **Exceptions:** 1. When *duct system* leakage to outside is tested in accordance ANSI/ RESNET/ICC 380 or ASTM E1554, the measured value shall be permitted to be entered. 2. When total *duct system* leakage is measured without the *space conditioning* equipment ~~air handler~~ installed, the simulation value shall be 4 cfm (113.3 L/min) per 100 ft^2 (9.29 m^2) of conditioned floor area.
	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 Table R405.4.2(2).

For SI: 1 square foot = 0.93 m^2, 1 British thermal unit = 1055 J, 1 pound per square foot = 4.88 kg/m^2, 1 gallon (US) = 3.785 L, °C = (°F-32)/1.8, 1 degree = 0.79 rad.

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.

g. For a proposed design the following assumptions shall be made for both the proposed design and standard reference design.

   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 §130.32

h. For residences with conditioned basements, R-2 and R-4 residences, and for townhouse units, 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.

i. 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 Table R405.4.2(1), the standard reference design shall be the same as proposed design.

TABLE R405.4.2(2) DEFAULT DISTRIBUTION SYSTEM EFFICIENCIES FOR PROPOSED DESIGNS[a]

DISTRIBUTION SYSTEM CONFIGURATION AND CONDITION	FORCED AIR SYSTEMS	HYDRONIC SYSTEMS[b]
Distribution system components located in unconditioned space	NA	0.95
Distribution system components entirely located in conditioned space[c]	NA	1
~~“~~Ductless~~”~~ systems[d]	1	NA

a. Default values in this table are for untested distribution systems, which must still meet minimum requirements form Section R403 ~~for duct system insulation~~.

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-handling unit,~~ is located outside of the conditioned space.

d. Ductless systems shall be allowed to have forced airflow across a coil but shall not have greater than 10 ft. of ~~any~~ ducted airflow external to the ~~manufacturer’s air-handler enclosure~~ *space conditioning equipment*.

SECTION R408
ADDITIONAL EFFICIENCY REQUIREMENTS

Revise as follows:

TABLE R408.2 CREDITS FOR ADDITIONAL ENERGY EFFICIENCY

Portions of table not shown remain unchanged.

Measure Number	Measure Description	Credit Value								
		Climate Zone 0 & 1	Climate Zone 2	Climate Zone 3	Climate Zone 4	Climate Zone 4C	Climate Zone 5	Climate Zone 6	Climate Zone 7	Climate Zone 8
R408.2.4(2)	100% of *duct systems* ~~ducts~~ in conditioned space	4	6	8	12	12	15	17	19	20

R408.2.4 More efficient ~~duct~~ thermal distribution system option. The thermal distribution system shall meet one of the following efficiencies:

1. 100 percent of ductless thermal distribution system or hydronic thermal distribution system is located completely inside the *building thermal envelope*.
2. 100 percent of the *duct system* ~~thermal distribution system~~ is located in *conditioned space* as defined by Section R403.3.2.
3. When ~~ducts are~~ *ductwork* is located outside conditioned space, the total leakage ~~of the ducts,~~ of the *duct system* measured in accordance with R403.3.5, shall be in accordance with one of the following:

   3.1 Where *space conditioning equipment* ~~air handler~~ is installed at the time of testing, 2.0 cubic feet per minute (0.94 L/s) per 100 square feet (9.29 m^2) of conditioned floor area.

   3.2 Where *space conditioning equipment* ~~air handler~~ is not installed at the time of testing, 1.75 cubic feet per minute (0.83 L/s) per 100 square feet (9.29 m^2) of conditioned floor area.

SECTION R502
ADDITIONS

Revise as follows:

R502.2.2 Heating and cooling systems. HVAC *ductwork* ~~ducts~~ newly installed as part of an *addition* shall comply with Section R403.

Exception: Where *ductwork* ~~ducts~~ from an existing heating and cooling system ~~are~~ is extended into an *addition* Section R403.3.5 and Section R403.3.6 shall not be required.

SECTION R503
ALTERATIONS

Revise as follows:

R503.1.2 Heating and cooling systems. New heating and cooling systems and *ductwork* ~~duct systems~~ that are part of the alteration shall comply with Section R403 and this section. Alterations to existing heating and~~,~~ cooling systems and *ductwork* ~~duct systems~~ shall comply with this section.

Exception: Where *ductwork* ~~ducts~~ from an existing heating and cooling system ~~are~~ is extended to an *addition*.

R503.1.2.1 ~~Ducts~~ *Ductwork*. HVAC *ductwork*~~ducts~~ newly installed as part of an alteration shall comply with Section R403.

Exception: Where *ductwork*~~ducts~~ from an existing heating and cooling system ~~are~~ is extended to an *addition*.

R503.1.2.3 Duct system leakage. Where an *alteration* includes any of the following, *duct systems* ~~ducts~~ shall be tested in accordance with Section R403.3.5 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^2) of conditioned floor area:

1. Where 25 percent or more of the registers that are part of the duct system are relocated.
2. Where 25 percent or more of the total length of all *ductwork* ~~ducts~~ in the *duct system* are relocated.
3. Where the total length of all *ductwork* ~~ducts~~ in the *duct system* is increased by 25 percent or more.

Exception: *Duct systems* located entirely inside a conditioned space in accordance with Section R403.3.2.

Reason: This public comment is being submitted to achieve the following:

- Better define what the code means when it says “ducts”, “ductwork”, and “duct system”, by using 2021 IMC definitions, modified as needed.
- Use these defined terms to better clarify what is meant by “ducts in conditioned space” and what components are included in the “total duct leakage test”
- Clarify what must be tested during the total duct leakage test (i.e., ALWAYS the return ‘ductwork’ which now clearly includes sheetrocked plenums, but sometimes air-handler can be excluded if lower allowance is met)
- Reduce the use of the phrase “rough-in” and “post-construction” since that is not actually the criteria of importance

- Add a test exemption for ductless systems, including ducted systems with less than 10 ft of ductwork, when in conditioned space
- Provide a greater duct leakage allowance where a greater amount of return ductwork (ducted returns) is installed (like ENERGY STAR).

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
The proposed changes clarify existing provisions and do not increase the stringency of the requirements.

Bibliography: None

Workgroup Recommendation

Proposal # 1060

RED1-286-22

Proponents: Gayathri Vijayakumar, representing Steven Winter Associates, Inc. (gvijayakumar@swinter.com)

2024 International Energy Conservation Code [RE Project]

CHAPTER 4 [RE]
RESIDENTIAL ENERGY EFFICIENCY

SECTION R402
BUILDING THERMAL ENVELOPE

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.

R402.5.2 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.

Delete without substitution:

~~**R402.5.2.1 Gas fireplace efficiency.** All gas fireplace heaters rated to ANSI Z21.88 shall be listed and labeled with a fireplace efficiency (FE) rating of 50 percent or greater in accordance with CSA P.4.1. Vented gas fireplaces (decorative appliances) certified to ANSI Z21.50 shall be listed and labeled, including their FE ratings, in accordance with CSA P.4.1.~~

SECTION R403
SYSTEMS

R403.1 Controls. Not less than one thermostat shall be provided for each separate heating and cooling system.

R403.1.1 Programmable thermostat. The thermostat controlling the primary heating or cooling system of the *dwelling unit* 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 thermostat shall include the capability to set back or temporarily operate the system to maintain *zone* temperatures of not less than 55°F (13°C) to not greater than 85°F (29°C). The thermostat 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).

R403.1.2 Heat pump supplementary heat. Heat pumps having supplementary electric-resistance heat shall have controls that are configured to prevent supplemental heat operation when the capacity of the heat pump compressor can meet the heating load. Limit supplemental heat operation to only those times when one of the following applies:

1. The vapor compression cycle cannot provide the necessary heating energy to satisfy the thermostat setting.
2. The heat pump is operating in defrost mode.
3. The vapor compression cycle malfunctions.
4. The thermostat malfunctions.

Delete without substitution:

~~**R403.1.3 Continuously burning pilot light.** Gas fireplace systems are not permitted to be equipped with a continuously burning pilot light.~~

~~**Exception:** Any fireplace equipped with an on-demand, intermittent or interrupted ignition pilot light (as defined in ANSI Z21.20) is not considered to have a continuously burning pilot light.~~

Add new text as follows:

<u>**R403.14 Gas fireplaces.** Gas fireplace systems are not permitted to be equipped with a continuously burning pilot light.</u>

<u>Exception</u> **<u>(Equation #)</u>**
<u>Any fireplace equipped with an on-demand, intermittent or interrupted ignition pilot light (as defined in ANSI Z21.20) is not considered to have a continuously burning pilot light.</u>

<u>**R403.14.1 Gas fireplace efficiency.** All gas fireplace heaters rated to ANSI Z21.88 shall be listed and labeled with a fireplace efficiency (FE) rating of 50 percent or greater in accordance with CSA P.4.1. Vented gas fireplaces (decorative appliances) certified to ANSI Z21.50 shall be listed and labeled, including their FE ratings, in accordance with CSA P.4.1.</u>

SECTION R405
SIMULATED BUILDING PERFORMANCE

Revise as follows:

TABLE R405.2 REQUIREMENTS FOR SIMULATED BUILDING PERFORMANCE

Portions of table not shown remain unchanged.

SECTION[a]	TITLE
Mechanical	
R403.1	Controls
R403.2	Hot water boiler temperature reset
R403.3	Duct systems
R403.4	Mechanical system piping insulation
R403.5 except Section R403.5.2	Service hot water system
R403.5.2	Hot water pipe insulation
R403.6	Mechanical ventilation
R403.7, except Section R403.7.1	Equipment sizing and efficiency rating
R403.8	Systems serving multiple dwelling units
R403.9	Snow melt and ice system controls
R403.11	Energy consumption of pools and spas
R403.12	Portable spas
R403.13	Residential pools and permanent residential spas
R403.14	Gas fireplaces

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

SECTION R406
ENERGY RATING INDEX COMPLIANCE ALTERNATIVE

Revise as follows:

TABLE R406.2 REQUIREMENTS FOR ENERGY RATING INDEX

Portions of table not shown remain unchanged.

SECTION[a]	TITLE
Mechanical	
R403.1	Controls
R403.2	Hot water boiler temperature reset
R403.3	Duct systems
R403.4	Mechanical system piping insulation
R403.5 except Section R403.5.2	Service hot water systems
R403.5.2	Hot water pipe insulation
R403.6	Mechanical ventilation
R403.7, except Section R403.7.1	Equipment sizing and efficiency rating
R403.8	Systems serving multiple dwelling units
R403.9	Snow melt and ice system controls
R403.11	Energy consumption of pools and spas
R403.12	Portable spas
R403.13	Residential pools and permanent residential spas
R403.14	Gas fireplaces

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

CHAPTER 6 [RE]
REFERENCED STANDARDS

Revise as follows:

CSA

CSA Group
8501 East Pleasant Valley Road
Cleveland, OH 44131-5516

P.4.1-2021 — Testing method for measuring fireplace efficiency
R403.14.1

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
R403.14

Z21-50-2019/CSA 2.22-19 — Vented Decorative Gas Appli~~e~~ances
R403.14.1

Z21.88-2019/CSA 2.23-19 — Vented Gas Fireplace Heaters
R403.14.1

Reason: This Public Comment is a clean-up proposal to move a gas fireplace efficiency requirement from the R402.5 Building Thermal Envelope section, into the more appropriate R403 (Systems) section. This PC also combines the moved requirement with another gas fireplace requirement for pilot lights, that does not belong in the R403.1 Controls section. They are combined in proposed new section R403.14 and this new added section is then added to Table R405.2 and Table R406.2 and updated in the Referenced Standards.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
N/A

Bibliography: N/A

Workgroup Recommendation

Proposal # 1104

RED1-287-22

Proponents: Shannon Corcoran, representing American Gas Association (corcoransm@att.net)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R402.5.2.1 Gas fireplace efficiency. All gas fireplace heaters rated to CSA/ANSI Z21.88 • CSA 2.33 shall be listed and labeled with a fireplace efficiency (FE) rating of 50 percent or greater in accordance with CSA P.4.1. Vented gas fireplaces (decorative appliances) certified to CSA/ANSI Z21.50 • CSA 2.22 shall be listed and labeled, including their FE ratings, in accordance with CSA P.4.1.

Reason: The code should use the full designation of the referenced standards.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
Editorial change to use the full designation of the referenced standard, and will have no impact on construction cost.

Workgroup Recommendation

Proposal # 1285

RED1-288-22 Part I

Proponents: Fredric Zwerg, representing Southwest Gas Corporation (fredric.zwerg@swgas.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R402.5.2.1 Gas fireplace ~~efficiency~~. All gas fireplace heaters rated to ANSI Z21.88 shall be listed and labeled. ~~with a fireplace efficiency (FE) rating of 50 percent or greater in accordance with CSA P.4.1.~~ Vented gas fireplaces (decorative appliances) certified to ANSI Z21.50 shall be listed and labeled . ~~, including their FE ratings, in accordance with CSA P.4.1.~~

Reason: Modify proposed section to incorporate only the labeling and listing requirements. The fireplace efficiency testing method for annual efficiency uses interpolation and extrapolation of test data which is subject to potential error. Fireplace efficiency for decorative appliances is unnecessary.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
No cost impact.

Workgroup Recommendation

Proposal # 1116

RED1-288-22 Part II

Proponents: Fredric Zwerg, representing Southwest Gas Corporation (fredric.zwerg@swgas.com)

2024 ENERGY Chapter11

Revise as follows:

N1102.5.2.1 Gas fireplace ~~efficiency~~. All gas fireplace heaters rated to ANSI Z21.88 shall be listed and labeled. ~~with a fireplace efficiency (FE) rating of 50 percent or greater in accordance with CSA P.4.1.~~ Vented gas fireplaces (decorative appliances) certified to ANSI Z21.50 shall be listed and labeled . ~~, including their FE ratings, in accordance with CSA P.4.1.~~

Reason: Modify proposed section to incorporate only the labeling and listing requirements. The fireplace efficiency testing method for annual efficiency uses interpolation and extrapolation of test data which is subject to potential error. Fireplace efficiency for decorative appliances is unnecessary.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
No cost impact.

Workgroup Recommendation

Proposal # 1160

RED1-289-22

Proponents: Ben Rabe, representing New Buildings Institute (ben@newbuildings.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R403.1 Controls. Not less than one thermostat shall be provided for each separate heating and cooling system. The primary heating or cooling system serving the dwelling unit shall comply with Sections R403.1.1, R403.1.2, R403.1.3 and R403.1.4

.

Add new text as follows:

R403.1.4 Demand responsive thermostat. The thermostat 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 homeowner 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 R403.1.3.1. Thermostats controlling variable capacity systems shall comply with Section R403.1.3.2. Thermostats controlling multi-stage HVAC systems shall comply with either Section R403.1.3.1 or R403.1.3.2. Where a demand response signal is not available the thermostat shall be capable of performing all other functions.

Exception: Assisted living facilities.

R403.1.4.1 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

R403.1.4.2 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.

Revise as follows:

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 and is controlled by a thermostat in accordance with Sections R403.1.1, R403.1.2, R403.1.3 and R403.1.4.
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 roof surface complies with one of the options in Table C402.3 of the *International Energy Conservation Code*–Commercial Provisions 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 $^1/_4$ unit vertical in 12 units horizontal (21-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 R408.2 CREDITS FOR ADDITIONAL ENERGY EFFICIENCY

Measure Number	Measure Description	Credit Value								
		Climate Zone 0 & 1	Climate Zone 2	Climate Zone 3	Climate Zone 4	Climate Zone 4C	Climate Zone 5	Climate Zone 6	Climate Zone 7	Climate Zone 8
R408.2.1.1(1)	≥2.5% Reduction in total UA	0	0	0	1	1	1	1	1	1
R408.2.1.1(2)	≥5% reduction in total UA	0	1	1	2	2	3	3	3	3
R408.2.1.1(3)	>7.5% reduction in total UA	0	1	2	2	2	3	3	4	4
R408.2.1.2(1)	0.22 U-factor windows	1	2	2	3	3	4	4	4	5
R408.2.1.2(2)	U-factor and SHGC for windows per Table R408.2.1	1	1	1	0	0	0	0	1	2
R408.2.1.3	Cool Roof	TBD	TBD	TBD	TBD	TBD	0	0	0	0
R408.2.2(1)	High performance cooling system option 1	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(2)	High performance cooling system option 2	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(3)	High performance gas furnace option 1	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(4)	High performance gas furnace option 2	0	0	0	0	0	TBD	TBD	TBD	0
R408.2.2(5)	High performance gas furnace and cooling system option 2	TBD	TBD	TBD	TBD	TBD	0	0	0	TBD
R408.2.2(6)	High performance gas furnace and heat pump system option 1	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(7)	High performance gas furnace option 2	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(8)	High performance heat pump system option 1	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(9)	High performance heat pump system option 2	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(10)	High performance heat pump system option 3	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(11)	Ground source heat pump	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(12)	Ductless - Single zone	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(13)	Ductless - Multizone (Non-ducted indoor unit)	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(14)	Ductless – Multizone (Ducted or Mixed)	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.3(1)	Gas-fired storage water heaters	7	6	5	3	3	2	2	3	1
R408.2.3(2)	Gas-fired instantaneous water heaters	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.3(3)	Electric water heaters	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.3(4)	Electric water heaters	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.3(5)	Solar hot water heating system	4	5	6	6	6	6	5	5	4
R408.2.3(6)	Compact hot water distribution	2	2	2	2	2	2	2	2	2
R408.2.4(1)	More efficient distribution system	4	6	7	10	10	12	13	15	16
R408.2.4(2)	100% of ducts in conditioned space	4	6	8	12	12	15	17	19	20
R408.2.4(3)	Reduced total duct leakage	1	1	1	1	1	1	2	2	2
R408.2.5(1)	2 ACH50 air leakage rate with ERV or HRV installed	1	4	5	10	10	13	15	8	8
R408.2.5(2)	2 ACH50 air leakage rate with balanced ventilation	2	3	2	4	4	5	6	6	6

R408.2.5(3)	1.5 ACH50 air leakage rated with ERV or HRV installed	2	4	6	12	12	15	18	11	11
R408.2.5(4)	1 ACH50 air leakage rate with ERV or HRV installed	2	5	6	14	14	17	21	14	14
R408.2.6	Energy efficient appliances	9	8	8	7	7	5	5	5	4
R408.2.7	Renewable energy measures	17	16	17	11	11	9	8	7	4
~~R408.2.9~~	~~Demand responsive thermostat~~	~~1~~	~~1~~	~~1~~	~~1~~	~~1~~	~~1~~	~~1~~	~~1~~	~~1~~

Delete without substitution:

~~**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 multi-stage 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.~~

Reason: As buildings account for over 70% of U.S. electricity use, effectively managing their loads can greatly facilitate the transition towards a clean, reliable grid. Grid-interactive efficient buildings (GEBs) combine efficiency and demand flexibility with smart technologies and communication to provide occupant comfort and productivity while serving the grid as a distributed energy resource (DER). In turn, GEBs can play a key role in ensuring access to an affordable, reliable, sustainable and modern U.S. electric power system. Their national adoption could provide $100-200 billion in U.S. electric power system cost savings over the next two decades. The associated reduction in CO emissions is estimated at 6% per year by 2030[1].
Building codes represent standard design practice in the construction industry and continually evolve to include advanced technologies and innovative practices. Historically, national model energy codes establish minimum efficiency requirements for new construction[2]. Expanding codes to support GEB capabilities is a pivotal step towards realizing demand flexibility in support of a clean grid by addressing capabilities to improve interoperability between smart building systems, the grid, and renewable energy resources. Realizing GEBs requires buildings with automated demand response (DR) capabilities that enable standardized control, subject to explicit consumer consent, of energy smart appliances on an electricity network. This is achieved through communication between appliances and a controlling entity that is in communication with the consumer participants.

Energy codes can support DR communication standardization and advance the deployment of flexible load technologies such as smart home energy management systems, energy storage, behind-the-meter generation, and electric vehicles (EVs). Incorporating automated demand response capabilities in energy codes provides many benefits to consumers and society. Specifically, it matches intermittent renewable energy sources to building electric loads, decreases peak load on the electric grid, allows buildings to respond to utility price signals, supports electrical network reliability and market growth of products and processes aligned with clean economic growth.

The incorporation of DR into the model residential energy codes was considered for the 2021 International Energy Conservation Code (IECC) code development cycle. The scope of this proposal includes two strategies for DR in residential buildings: 1) smart thermostats with demand-responsive control and 2) electric water heating incorporating demand-responsive controls and communication.

[1] DOE (U.S. Department of Energy). 2021. A National Roadmap for Grid-Interactive Efficient Buildings. Washington DC. Accessed on June 9, 2021 at https://gebroadmap.lbl.gov/

[2] While advanced codes can be considered model codes, in this document, the term “model energy code” refers to the current published version of the International Energy Conservation Code-Residential and ASHRAE Standard 90.1, as those documents are referenced by Energy Conservation and Production Act as modified by the Energy Policy Act of 1992 as the minimum requirements for states adopting energy codes. https://www.govinfo.gov/content/pkg/USCODE-2011-title42/pdf/USCODE-2011-title42-chap81-

subchapII.pdf.

Cost Impact: The code change proposal will increase the cost of construction.
The code change proposal will increase the cost of construction. The costs associated with installing residential DR control strategies highlighted in this technical brief are discussed below. The installed costs for smart thermostats and electric water heaters with DR control are modest and depend on the design of the home.

The cost of a standard programmable thermostat required in the 2021 IECC ranges from $20 to $100 based on costs at local home improvement stores. A smart thermostat can range from $120 to $400 based on brand, model, and level of sophistication. The cost to install a programmable or smart thermostat ranges from $112 to $255, with the national average cost of $175. Thus, the incremental cost of upgrading from a standard programmable thermostat to a smart thermostat with DR controls is anywhere between $100 and $300.

Electric resistance water heaters supplied with CTA-2045 communication have been manufactured but are not widely available. HPWHs have taken over the energy efficiency segment of the water heater market, and brands at local home improvement stores include the CTA-2045 communication ports. The average cost for a 50-gallon electric resistance heater is $400, while the average cost for a 50-gallon HPWH is $1,300 at local home improvement stores (Salcido et al. 2021). The incremental cost of $900 plus additional condensate removal equipment of $75 results in a total cost differential of $975. Therefore, for buildings already including HPWHs in the original design, the incremental increase in cost is $0. If the building specified an electric resistance water heater, the most straightforward way to implement the CTA-2045 communication for DR control is to switch to an HPWH with an incremental cost of $975.

While DR control functionality will reduce costs to utilities as well as electric costs to consumers, it is difficult to estimate or calculate the actual cost savings. DR will present cost-saving opportunities for buildings as more homeowners take advantage of time-of-use or real-time pricing controls as they become more widely available. Adding DR controls in model energy codes can help homeowners have the capability of participating in DR programs with alternative utility pricing structures whether they exist now or in the future. When DR requirements are part of the model energy code, it will not require homeowners or buildings to participate in any DR programs but will guarantee that residential buildings are capable of participating in DR programs.

Bibliography: Salcido V, Y Chen, B Taube, E Franconi, and M Rosenberg. 2021. Demand Response in Residential Energy Code. Pacific Northwest National Laboratory, Richland, Washington. PNNL-31994

Workgroup Recommendation

Proposal # 1418

RED1-290-22

Proponents: Greg Johnson, representing National Multifamily Housing Council (gjohnsonconsulting@gmail.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R403.1.2 Heat pump supplementary heat. Heat pumps having supplementary electric-resistance heat shall have controls that are configured to prevent supplemental heat operation when the capacity of the heat pump compressor can meet the heating load. ~~Limit supplemental~~ Supplemental heat operation shall be limited to only ~~those times when~~ where one of the following applies:

1. The vapor compression cycle cannot provide the necessary heating energy to satisfy the thermostat setting.
2. The heat pump is operating in defrost mode.
3. The vapor compression cycle malfunctions.
4. The thermostat malfunctions.

Reason: Preferable code language.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
Editorial.

Workgroup Recommendation

Proposal # 1092

RED1-291-22 Part I

Proponents: Fredric Zwerg, representing Southwest Gas Corporation (fredric.zwerg@swgas.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R403.1.2 Heat pump supplementary heat. Heat pumps having supplementary electric-resistance heat shall have controls that, except during defrost, ~~are configured to~~ prevent supplemental heat operation when th~~e capacity of the~~ heat pump compressor can meet the heating load. ~~Limit supplemental heat operation to only those times when one of the following applies:~~

1. ~~The vapor compression cycle cannot provide the necessary heating energy to satisfy the thermostat setting.~~
2. ~~The heat pump is operating in defrost mode.~~
3. ~~The vapor compression cycle malfunctions.~~
4. ~~The thermostat malfunctions.~~

Reason: Delete the proposed text changes and use the original text. The conditions requiring the limiting of supplemental heat operation are for conditions when the unit is undersized, operating during the outdoor coil defrost mod or there is a unit/system failure. The proposed changes are not necessary.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
No cost impact.

Workgroup Recommendation

Proposal # 1117

RED1-291-22 Part II

Proponents: Fredric Zwerg, representing Southwest Gas Corporation (fredric.zwerg@swgas.com)

2024 ENERGY Chapter11

Revise as follows:

N1103.1.2 Heat pump supplementary heat. Heat pumps having supplementary electric-resistance heat shall have controls that except during defrost, ~~are configured to~~ prevent supplemental heat operation when the ~~capacity of the~~ heat pump compressor can meet the heating load. ~~Limit supplemental heat operation to only those times when one of the following applies:~~

1. ~~The vapor compression cycle cannot provide the necessary heating energy to satisfy the thermostat setting.~~
2. ~~The heat pump is operating in defrost mode.~~
3. ~~The vapor compression cycle malfunctions.~~
4. ~~The thermostat malfunctions.~~

Reason: Delete the proposed text changes and use the original text. The conditions requiring the limiting of supplemental heat operation are for conditions when the unit is undersized, operating during the outdoor coil defrost mode or there is a unit/system failure. The proposed changes are not necessary.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
No cost impact.

Workgroup Recommendation

Proposal # 1161

RED1-292-22

Proponents: Adam Berry, representing Colorado Energy Office (adam.berry@state.co.us)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R403.1.2 Heat pump supplementary heat. Heat pumps having a supplementary electric-resistance, fuel gas, or fuel oil heat system shall have controls that are configured to prevent supplemental heat operation when the capacity of the heat pump compressor can meet the heating load. Limit supplemental heat operation to only those times when one of the following applies:

1. The vapor compression cycle cannot provide the necessary heating energy to satisfy the thermostat setting.
2. The heat pump is operating in defrost mode.
3. The vapor compression cycle malfunctions.
4. The thermostat malfunctions.

2024 ENERGY Chapter11

Revise as follows:

N1103.1.2 Heat pump supplementary heat. Heat pumps having a supplementary electric-resistance, fuel gas, or fuel oil heat system shall have controls that are configured to prevent supplemental heat operation when the capacity of the heat pump compressor can meet the heating load. Limit supplemental heat operation to only those times when one of the following applies:

1. The vapor compression cycle cannot provide the necessary heating energy to satisfy the thermostat setting.
2. The heat pump is operating in defrost mode.
3. The vapor compression cycle malfunctions.
4. The thermostat malfunctions.

Reason: Heat pumps in colder climates, such as those of Colorado, often are supported by backup systems that are not limited to just electric resistance systems. Many homeowners that upgrade to an electric heat pump will keep their natural gas furnace, propane heating system, or other non-electric heating system to function as the backup during the coldest periods where the heat pump is not able to meet the demand. Controls for these backup systems should apply to all types of systems, whether electric, fuel gas, or fuel oil, to ensure that the heat pump is the primary source of heating and that the backup systems are being used only in very limited circumstances when the heat pump is unable to keep up.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This proposal should not increase the cost of construction, as it just widens the applicability for backup controls to apply to non-electric backup heating systems.

Workgroup Recommendation

Proposal # 1321

RED1-293-22

Proponents: Eric Tate, representing Atmos Energy (eric.tate@atmosenergy.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R403.1.2 Heat pump supplementary heat. Heat pumps having supplementary electric-resistance heat shall have controls that are configured to prevent supplemental heat operation when the capacity of the heat pump compressor can meet the heating load. Limit supplemental heat operation to only those times when one of the following applies:

1. The vapor compression cycle cannot provide the necessary heating energy to satisfy the thermostat setting.
2. The heat pump is operating in defrost mode.
3. The vapor ~~compression cycle malfunction~~ compressor failure.
4. ~~The thermostat malfunctions.~~

Reason: The terminology “vapor compression cycle malfunction” is broad enough to include inadequate system maintenance and low refrigerant charge and operation of supplementary heating under low charge conditions for extended periods of time and consequent very high electricity consumption. In contrast, “compressor failure” addresses as specific technical failure that cannot be addressed without system repair but where life safety protection afforded by supplementary heating can be provided prior to completion of repairs. “Thermostat malfunction” is undefined and could include a broad set of thermostat problems including inability to hold stored programmable cycles of operation. Under such conditions, a “thermostat malfunction” should not be a justification to use supplementary heat.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
The clarifying language will not affect the cost of construction.

Workgroup Recommendation

Proposal # 1440

RED1-294-22

Proponents: Ted Williams, representing ONE Gas (ngdllc@outlook.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R403.1.2 Heat pump supplementary heat. Heat pumps having supplementary electric-resistance heat shall have controls that are configured to prevent supplemental heat operation when the capacity of the heat pump compressor can meet the heating load. Limit supplemental heat operation to only those times when one of the following applies:

1. The vapor compression cycle cannot provide the necessary heating energy to satisfy the thermostat setting.
2. The heat pump is operating in defrost mode.
3. The vapor ~~compression cycle malfunctions~~ compressor failure.
4. ~~The thermostat malfunctions.~~

Reason: The terminology “vapor compression cycle malfunction” is broad enough to include inadequate system maintenance and low refrigerant charge and operation of supplementary heating under low charge conditions for extended periods of time and consequent very high electricity consumption. In contrast, “compressor failure” addresses a specific technical failure that cannot be addressed without system repair but where life safety protection afforded by supplementary heating can be provided prior to completion of repairs. “Thermostat malfunction” is undefined and could include a broad set of thermostat problems including inability to hold stored programmable cycles of operation. Under such conditions, a “thermostat malfunction” should not be a justification to use supplementary heat.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
Zero

Workgroup Recommendation

Proposal # 1390

RED1-295-22

Proponents: Steven Rosenstock, representing Edison Electric Institute (srosenstock@eei.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R403.1.2 Heat pump supplementary heat. Heat pumps having supplementary electric-resistance heat shall have controls that are configured to prevent supplemental heat operation when the capacity of the heat pump compressor can meet the heating load. Controls shall limit ~~Limit~~ supplemental heat operation to only those times when one of the following applies:

1. The vapor compression cycle cannot provide the necessary heating energy to satisfy the thermostat setting.
2. The heat pump is operating in defrost mode.
3. The vapor compression cycle malfunctions.
4. The thermostat malfunctions.

Reason: This is a suggested editorial fix for the revised language of this section. It does not alter any of the requirements.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This is only an editorial fix that will not change the cost of construction.

Workgroup Recommendation

Proposal # 1018

RED1-296-22

Proponents: Eric Tate, representing Atmos Energy (eric.tate@atmosenergy.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R403.1.3 Continuously burning pilot light. Gas fireplace systems are not permitted to be equipped with a continuously burning pilot light.
Exceptions:

1. Any fireplace equipped with an on-demand, intermittent or interrupted ignition pilot light (as defined in ANSI Z21.20) is not considered to have a continuously burning pilot light.
2. Gas-fired appliances using pilots within a listed combustion safety device.

Reason: Appliances such as space heaters use continuously burning pilots in oxygen depletion sensors (ODS) as a means of shutting off the appliance in the event that room oxygen is reduced to 18% by volume and as a correlated indoor air quality accumulation of carbon monoxide (CO). Disruption of the stability of the continuously burning pilot within the ODS, caused by oxygen depletion, closes the gas valve shutting of the appliance. Banning continuously burning pilots, *per se*, would disqualify use of ODS systems despite its listing and incorporation in the gas appliance. Changes to alternate means of achieving gas shut off are not currently recognized in standards for safety for gas appliances.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
The proposed language will not affect cost of construction.

Workgroup Recommendation

Proposal # 1441

RED1-297-22

Proponents: Ted Williams, representing ONE Gas (ngdllc@outlook.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R403.1.3 Continuously burning pilot light. Gas fireplace systems are not permitted to be equipped with a continuously burning pilot light.
Exceptions:

1. Any fireplace equipped with an on-demand, intermittent or interrupted ignition pilot light (as defined in ANSI Z21.20) is not considered to have a continuously burning pilot light.

2. Gas-fired appliances using pilots within a listed combustion safety device.

Reason: Appliances such as space heaters use continuously burning pilots in oxygen depletion sensors (ODS) as a means of shutting off the appliance in the event that room oxygen is reduced to 18% by volume and as a correlated indoor air quality accumulation of carbon monoxide (CO). Disruption of the stability of the continuously burning pilot within the ODS, caused by oxygen depletion, closes the gas valve shutting of the appliance. Banning continuously burning pilots, *per se*, would disqualify use of ODS systems despite its listing and incorporation in the gas appliance. Changes to alternate means of achieving gas shut off are not currently recognized in standards for safety for gas appliances.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
Zero

Workgroup Recommendation

Proposal # 1392

RED1-298-22

Proponents: Shannon Corcoran, representing American Gas Association (corcoransm@att.net)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R403.1.3 ~~Continuously burning~~ Continuous pilot ~~light~~. Gas fireplace systems are not permitted to be equipped with a ~~continuously burning~~ continuous pilot ~~light~~.

Exception: Any fireplace equipped with an on-demand, intermittent or interrupted ignition pilot light (as defined in CSA/ANSI Z21.20: 2 • CSA C22.2 No. 60730-2-5:22 •UL 60730-2-5) is not considered to have a continuous pilot ~~light~~.

Reason: The code should use proper designation of the referenced standard - CSA/ANSI Z21.20:22 • CSA C22.2 No. 60730-2-5:22 ♦ UL 60730-2-5. Terminology and definitions should be consistent with the standard (since the exception states "as defined in").

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
The proposal does not affect construction codes.

Workgroup Recommendation

Proposal # 1294

RED1-299-22

Proponents: Steven Rosenstock, representing Edison Electric Institute (srosenstock@eei.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R403.11.2 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.

Reason: This proposed change updates the exception language to be consistent with other changes in the code, such as in 403.11.3 for pool covers (which also has the same language in its exception).
In addition, there are multiple types of renewable energy systems that can be used for pool heating and should qualify for the exception.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This is language for an exception to a requirement. It may change the cost of the exception, as more renewable energy systems will be allowed to be used for the exception, but it does not change the cost of the required time switch.

Workgroup Recommendation

Proposal # 1020

RED1-300-22 Part I

Proponents: Tom Ortiz, representing National Propane Gas Association (tortiz@npga.org); Bruce Swiecicki, representing National Propane Gas Association (bswiecicki@npga.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R403.11.3 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.~~

Reason: There is no reason to exempt heat recovery or renewable energy systems from energy conservation measures. The systems which are used to acquire this energy must be sized for the required demand, and larger systems represent additional Scope 2/3 carbon emissions as well as additional materials and expense.

Cost Impact: The code change proposal will increase the cost of construction.
This proposal may require a pool cover.

Workgroup Recommendation

Proposal # 1249

RED1-300-22 Part II

Proponents: Tom Ortiz, representing National Propane Gas Association (tortiz@npga.org); Bruce Swiecicki, representing National Propane Gas Association (bswiecicki@npga.org)

2024 ENERGY Chapter11

Revise as follows:

N1103.11.3 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.~~

Reason: There is no reason to exempt heat recovery or renewable energy systems from energy conservation measures. The systems which are used to acquire this energy must be sized for the required demand, and larger systems represent additional Scope 2/3 carbon emissions as well as additional materials and expense.

Cost Impact: The code change proposal will increase the cost of construction.
This proposal may require a pool cover.

Workgroup Recommendation

Proposal # 1283

RED1-301-22

Proponents: Robert Salcido, representing DOE (victor.salcido@pnnl.gov)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R403.3 Duct systems. Ducts and air handlers shall be installed in accordance with Sections R403.3.1 through R403.3.7. <u>For buildings or dwelling units complying with R401.2.1, 100% of the ducts shall be located in conditioned space.</u>

Reason: Ducts that are located in unconditioned spaces can significantly increase energy use in the home or dwelling unit due to thermal losses and air leakage outside of the building envelope. As proposed, the 2024 IECC would credit ducts located within conditioned space. While locating ducts within conditioned space is indeed best practice, there is a problem in how R405, as proposed, would handle ducts, effectively crediting every system installed *as if it would have otherwise been installed outside of conditioned space.* The consequences of this approach can be severe and were not sufficiently evaluated in previous committee deliberations.

Pacific Northwest National Laboratory (PNNL) has analyzed the impact of moving ducts from unconditioned space into conditioned space and found that the associated energy impact can be up to 18% of whole-building energy use, and corresponding energy costs of almost $400 per year, with the largest impacts experienced in colder climates. In addition to thermal losses, there are many other widely recognized benefits of locating ducts in conditioned space, such as lower risk of moisture issues and increased indoor air quality, among others. The following table depicts the expected energy use reductions across U.S. climate zones.

	HVAC Distribution System	CZ 1	CZ 2	CZ 3	CZ 4	CZ 5	CZ 6	CZ 7	CZ 8
	100 Percent of Ducts In Conditioned Space	3.57%	5.10%	6.65%	9.58%	12.13%	14.04%	16.13%	18.44%
	100 Percent of Ducts In Conditioned Space	$74	$88	$99	$118	$104	$155	$209	$361

The challenge of modeling duct location in performance-based approaches is that it can be difficult to credit positive behaviors (i.e., encouraging ducts to be located within conditioned space) without creating a severe false credit in areas and situations where ducts are already commonly located within conditioned space, which is heavily influenced by geographic location and other design choices (e.g., foundation type and number of floors). The issue of false credit, often referenced as *free ridership*, is especially prominent in colder climate zones. DOE field study data indicates that approximately 25% of homes commonly have 100% of their duct system installed in conditioned space. Over 50% of homes with heated basements, as are common in colder climates, had duct systems located completely within conditioned space. In these areas, the resulting credit is large enough to significantly erode the overall energy efficiency of the home, costing the home owner thousands over the life of the home. This tends to be a binding decision, as duct systems are difficult and costly to relocate after initial design and construction of the home. This challenge of properly rewarding, or penalizing, duct location is a primary reason duct location has not been credited in recent editions of the IECC. As proposed, the 2024 IECC introduces this challenge without appropriate safeguards—and to a magnitude that can dwarf other design choices.

The Committee should reconsider this approach and seek alternatives with lower risk of falsely crediting common design choices. In support of this objective, PNNL is offering two proposals which are intended to function independently or work in tandem; one which specifies ducts within conditioned space as a prescriptive requirement, and the second which addresses duct location in R405. In the latter case, ducts may still be located in unconditioned space, and comply with R405, and the associated (negative) energy impact can be offset through additional energy efficiency achieved elsewhere in the home.

Cost Impact: The code change proposal will increase the cost of construction.
The costs of a prescriptive requirement to have ducts in conditioned space can range from $0 (for the many homes that already commonly include ducts in conditioned space) to $400 for dropped ceiling strategy. A higher cost strategy where ducts are installed in a conditioned attic, which typically involves insulating and sealing the roof deck is estimated at a cost of $3,000. An average cost ranges from $1,000 to $1,300 based on previous research studies. (https://energy.gov/sites/prod/files/2014/01/f6/1_1g_ba_innov_ductsconditionedspace_011713.pdf)

Cost-effectiveness analysis, based on the approach and parameters established by the 2024 IECC development committee, indicates that locating ducts within conditioned space is cost effective across all climate zones and costs up to $1300. Associated paybacks range from 3.8 to 11.0 years, and life-cycle cost savings from $520 to $8,120.

Workgroup Recommendation

RED1-302-22

Proponents: Vladimir Kochkin, representing NAHB (vkochkin@nahb.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R403.3.2 Ducts located in conditioned space. For ductwork to be considered inside a *conditioned space,* it shall comply with one of the following:

1. The duct system shall be located completely within the *continuous air barrier* and within the building thermal envelope.
2. Ductwork in ventilated attic spaces or unvented attic with vapor diffusion port shall be buried within ceiling insulation in accordance with Section R403.3.3 and all of 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. The duct leakage, as measured either by a rough-in test of the ducts or a post-construction total system leakage test to outside the *building thermal envelope* in accordance with Section R403.3.6, is less than or equal to 1.5 cubic feet per minute (42.5 L/min) per 100 square feet (9.29 m^2) of *conditioned floor area* served by the duct system.

   2.3. The ceiling insulation *R*-value installed against and above the insulated duct is greater than or equal to the proposed ceiling insulation *R*-value, less the *R*-value of the insulation on the duct.

3. Ductwork located in wall or floor building 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 the duct and the unconditioned space.

   3.2. Ducts shall be installed in accordance with Section R403.3.1.

   Exception: Where the building assembly cavities containing ducts have been air sealed in accordance with Section R402.5.1 <u>and insulated in accordance with Item 3.3</u>, duct insulation is not required.

   3.3. Not less than R-10 insulation, and not less than 50 percent of the required R-value specified in Table R402.1.3, shall be located between the duct and the unconditioned space.

   3.4 For ducts in these building assemblies to be considered within conditioned space, the air handling equipment shall be installed within conditioned space.

Reason: This is clarification of intent. The exception applies to duct insulation. The building assembly insulation requirements of Item 3.3 must be met.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
Clarification of intent.

Workgroup Recommendation

Proposal # 1000

RED1-303-22

Proponents: Robert Salcido, representing DOE (victor.salcido@pnnl.gov)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R403.3.2 Ducts located in conditioned space. For ductwork to be considered inside a *conditioned space,* it shall comply with one of the following:

1. The duct system shall be located completely within the *continuous air barrier* and within the building thermal envelope.
2. Ductwork in ventilated attic spaces or unvented attic with vapor diffusion port shall be buried within ceiling insulation in accordance with Section R403.3.3 and all of 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. The duct leakage, as measured either by a rough-in test of the ducts or a post-construction total system leakage test to outside the *building thermal envelope* in accordance with Section R403.3.6, is less than or equal to 1.5 cubic feet per minute (42.5 L/min) per 100 square feet (9.29 m^2) of *conditioned floor area* served by the duct system.

    2.3. The ceiling insulation *R*-value installed against and above the insulated duct is greater than or equal to the proposed ceiling insulation *R*-value, less the *R*-value of the insulation on the duct.

3. Ductwork located in wall or floor building 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 the duct and the unconditioned space.

    3.2. Ducts shall be installed in accordance with Section R403.3.1.

    ~~**Exception:** Where the building assembly cavities containing ducts have been air sealed in accordance with Section R402.5.1, duct insulation is not required.~~

    3.3. Not less than R-10 insulation, and not less than 50 percent of the required R-value specified in Table R402.1.3, shall be located between the duct and the unconditioned space.

    3.4 For ducts in these building assemblies to be considered within conditioned space, the air handling equipment shall be installed within conditioned space.

Reason: The simplified code for duct insulation in the 2024 IECC was a combination of subsections 3 and 4 in R403.3.2 of the 2021 IECC. However, there was no exception for the removal of duct insulation due to air sealing of Section R402.5.1. This will help seal the duct for leakage but does nothing for the conductive heat loss through the duct surface. This exception increases conductive duct losses for ducts in cavities.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This will have no cost impact from the basis of the 2021 IECC as there was no exception for removing duct insulation for ducts in envelope cavity spaces. From the perspective of the current language, there could be a slight cost increase for duct insulation being applied for ducts in cavity spaces.

Workgroup Recommendation

Proposal # 1191

RED1-304-22

Proponents: Alisa McMahon, representing self (mcmahon.gbac@cox.net)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R403.3.2 Ducts located in conditioned space. For ductwork to be considered inside a *conditioned space,* it shall comply with one of the following:

1. The duct system shall be located completely within the *continuous air barrier* and within the building thermal envelope.
2. Ductwork in ventilated attic spaces or unvented attic with vapor diffusion port shall be buried within ceiling insulation in accordance with Section R403.3.3 and all of 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. The duct leakage, as measured either by a rough-in test of the ducts or a post-construction total system leakage test to outside the *building thermal envelope* in accordance with Section R403.3.6, is less than or equal to 1.5 cubic feet per minute (42.5 L/min) per 100 square feet (9.29 m^2) of *conditioned floor area* served by the duct system.

    2.3. The ceiling insulation *R*-value installed against and above the insulated duct is greater than or equal to the proposed ceiling insulation *R*-value, less the *R*-value of the insulation on the duct.

~~3. Ductwork located in wall or floor building 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 the duct and the unconditioned space.~~

~~3.2. Ducts shall be installed in accordance with Section R403.3.1.~~

~~**Exception:** Where the building assembly cavities containing ducts have been air sealed in accordance with Section R402.5.1, duct insulation is not required.~~

~~3.3. Not less than R-10 insulation, and not less than 50 percent of the required R-value specified in Table R402.1.3, shall be located between the duct and the unconditioned space.~~

~~3.4 For ducts in these building assemblies to be considered within conditioned space, the air handling equipment shall be installed within conditioned space.~~

Reason: R403.3.2(3) should be deleted in its entirety because:

1. It is not strong enough to warrant being "considered inside a *conditioned space*."
2. It is not on par with R403.3.2(1) and R403.3.2(2).
3. It would give undeserved efficiency credit in the R405 Performance and R406 ERI pathways, directly reducing energy efficiency.
4. It would undercut an Additional Efficiency Requirements option, R408.2.4(2).
5. R403.3.2(3.2) Exception is inappropriate. Air sealing is not a substitute for insulation.
6. R403.3.2(3.3) has multiple meanings.
7. R-values in R403.3.2(3) are likely deficient.
8. R403.3.2 is not the right place in the code to address ductwork located within floor and wall cavities.

See full "Reason Statement" attached.

R403.3.2 clarification request:

Under R403.3.2, "for ductwork to be considered inside a *conditioned space*, it shall comply with one of the following." It is unclear how R403.3.2 would be applied when a duct system has ductwork in locations specified in both R403.3.2(2) and R403.3.2(3). For example, if some ductwork is located in a ventilated attic and some is located in a floor cavity above a garage, how is R403.3.2 applied?

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
Deleting R403.3.2(3) would not directly increase or decrease the cost of construction. If ductwork located within floor and wall cavities were to be comprehensively addressed elsewhere in the code, there could be an increase in the cost of construction.

Bibliography: See full "Reason Statement" attached.

Attached Files

- **R403.3.2(3) reason statement.pdf**
  https://energy.cdpaccess.com/proposal/1490/2846/files/download/494/

Workgroup Recommendation

Proposal # 1490

RED1-305-22

Proponents: Jay Crandell, representing Foam Sheathing Committee of the American Chemistry Council (jcrandell@aresconsulting.biz)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

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

1. The supply and return ducts shall have an insulation *R*-value not less than R-8.
2. At all points along each duct, the sum of the ceiling insulation *R*-value against and above the top of the duct, and against and below the bottom of the duct, 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 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 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 when installed in an unvented attic with vapor diffusion port, the supply ducts shall be completely buried within ceiling insulation <u>of the story below at the floor of the attic</u>, 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 duct that are less than 3 feet (914 mm) from the supply outlet shall not be required to comply with these requirements.

   4.1 Air permeable insulation installed in unvented attics shall be in compliance with the requirements of Section R806.5.2 of the *International Residential Code*.

Reason: Item 4 in Section R403.3.3 was newly added during the initial public input phase. It addresses the case of a conditioned (unvented) attic space using a diffusion port to remove water vapor from the attic space by diffusion instead of ventilation. However, these unvented attic systems in the building code may be constructed with insulation at the ceiling of the attic (e.g., on or between rafters) or at the floor of the attic which is the ceiling of the story below. For Section R403.3.3, the former condition (placing buried ducts in insulation between rafters because it is consider the "ceiling" of the attic) is not intended but could be interpreted that way when constructing an unvented attic in accordance with the building code with insulation between or on rafters at the ceiling of the attic space. This would cause the diffusion port methodology to potentially not function properly. Therefore, text is added to clarify that the "ceiling insulation" being discussed in Item 4 of Section R403.3.3 is on the ceiling of the story below at the floor of the attic, not at the ceiling of the unvented attic as permitted option in the building code for unvented attics.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This proposal clarifies what is intended and does not change requirements. Therefore, it should have no cost impact and should help avoid unintended consequences in coordination with building code requirements for unvented attics.

Workgroup Recommendation

Proposal # 1339

RED1-306-22

Proponents: Greg Johnson, representing National Multifamily Housing Council (gjohnsonconsulting@gmail.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

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

1. The supply and return ducts shall be insulated with ~~have an insulation *R*-value~~ not less than R-8 insulation.
2. At all points along each duct, the sum of the ceiling insulation *R*-value against and above the top of the duct, and against and below the bottom of the duct, 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 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 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 ~~when~~ where installed in an unvented attic with vapor diffusion port, the supply ducts shall be completely buried within ceiling insulation, 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 duct that are less than 3 feet (914 mm) from the supply outlet ~~shall not be required to comply with these requirements~~.

   4.1 Air permeable insulation installed in unvented attics shall ~~be in compliance~~ comply with ~~the requirements of~~ Section R806.5.2 of the *International Residential Code*.

Reason: Edited for preferred code language.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
Editorial.

Workgroup Recommendation

Proposal # 1093

RED1-307-22

Proponents: Robert Schwarz, representing BUILDTank, Inc. (robby@btankinc.com)

2024 International Energy Conservation Code [RE Project]

R403.3 Duct systems. Ducts and air handlers shall be installed in accordance with Sections R403.3.1 through R403.3.7.

Revise as follows:

R403.3.4.1 Sealed air handler. Air handlers shall have a manufacturer's designation, tested in accordance with **ASHRAE 193,** for an air leakage of not greater than 2 percent of the design airflow rate. The designation shall be printed on the manufactures Model # and informational sticker and placed inside the air handler cabinet for inspection. ~~when tested in accordance with ASHRAE 193.~~

Delete and substitute as follows:

~~TABLE R403.3.6~~ ~~MAXIMUM TOTAL DUCT SYSTEM LEAKAGE~~

	~~ROUGH IN~~	~~POST CONSTRUCTION~~
~~**Duct systems serving more than 1,000 ft^2 of conditioned floor area**~~	~~**cfm/100 ft^2 (LPM/9.29 m^2)**~~	~~**cfm/100 ft^2 (LPM/9.29 m^2)**~~
~~Air handler is not installed~~	~~3 (85)~~	~~NA~~
~~Air handler is installed~~	~~4 (113.3)~~	~~4 (113.3)~~
~~Duct systems located in conditioned space, with air handler installed~~	~~8 (226.6)~~	~~8 (226.6)~~
~~**Duct systems serving less than or equal to 1,000 ft^2 of conditioned floor area**~~	~~**cfm (LPM)**~~	~~**cfm (LPM)**~~
~~Air handler is not installed~~	~~30 (849.5)~~	~~NA~~
~~Air handler is installed~~	~~40 (1132.7)~~	~~40 (1132.7)~~
~~Duct systems located in conditioned space, with air handler installed~~	~~80 (2265.4)~~	~~80 (2265.4)~~

TABLE R403.3.6 MAXIMUM TOTAL DUCT SYSTEM LEAKAGE

-	ROUGH IN	POST CONSTRUCTION
Duct systems serving more than 1,000 ft^2 of conditioned floor area		
Air handler is not installed	3 CFM/100 ft^2 (85 LPM/9.29 m^2)	NA
Air handler is installed	4 CFM/100 ft^2 (113.3 LPM/9.29 m^2)	4 CFM/100 ft^2 (113.3 LPM/9.29 m^2)
Duct systems serving less than or equal to 1,000 ft^2 of conditioned floor area		
Air handler is not installed	30 cfm (849.5 LPM)	NA
Air handler is installed	40 cfm (1132.7 LPM)	40 cfm (1132.7)

Reason: When testing in the field much of the air leakage that is observed is through the air handler or furnace air handler. There is no indication that the air handler manufactures equipment is actually meeting the 2 % requirement and if 2% is the correct number. Requiring that the designation be printed on the manufactures Model # and informational sticker and placed inside the air handler cabinet for inspection will better ensure that the air handler cabinet has actually been built and tested in accordance with ASHREAE 193. After we have ensured this, we can later determine if 2% of leakage at the air handler is appropriate.

Table R403.3.6 is a great idea but I believe that the way it is currently laid out is confusing. I was not able to change the table layout in CDPAccess so my suggested table layout has been attached

I have removed the allowance for leakier duct systems when duct systems are installed in conditioned space for three reasons. First, when speaking with a national production builder that builds in 17 markets, I was told that meeting the 4 CFM/100 Sqft target was not difficult. Second, it has been documented that the total system performance is improved the tighter duct are.

- Energy Improvement - When the design flow of air reaches each room comfort is achieved per the design. When the design flow of air does not reach each room comfort it impacted resulting in raising the temperature on the thermostat which results in increased energy use.
- Comfort Improvement – tight duct systems better ensures that the design BTUs are delivered to each room creating more uniformed comfort floor to floor and room to room.
- Building Durability Improvement – when duct leakage is not occurring within the enclosed cavities where ducts are run less condensation on exterior rim joists or other building assemblies occurs.
- Health and Safety Improvement – especially when the duct system on the return side is tighter there is less of a possibility to create negative pressures that could back draft automorphically vented water heaters or other appliances. Since the code does not mandate the installation of sealed combustion furnaces this is a concern.

Lastly, the HVAC industry has been building duct systems to the 4 CFM/100 sqft leakage target since the 2012 IECC. They have demonstrated that when they know that the system is required to be tight that they can achieve that level of tightness is a cost-effective way with a little more attention to installation detail. There is no reason to relax the requirement.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
Cost is not impacted by this proposal

Workgroup Recommendation

Proposal # 1066

RED1-308-22

Proponents: Greg Johnson, representing National Multifamily Housing Council (gjohnsonconsulting@gmail.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

TABLE R403.3.6 MAXIMUM ~~TOTAL~~ DUCT SYSTEM LEAKAGE

Portions of table not shown remain unchanged.

ROUGH IN	POST CONSTRUCTION	
Duct systems serving ~~less than or equal to~~ 1,000 ft^2 or less of conditioned floor area	**cfm (LPM)**	**cfm (LPM)**

Reason: 'Maximum' and 'total' appear redundant in this case, given no instructions on summing leakage. Simpler language is preferable for ducts systems serving 1,000 sf of cfa.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
Editorial

Workgroup Recommendation

Proposal # 1094

RED1-309-22

Proponents: Alex Smith, representing NAHB (asmith@nahb.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

TABLE R403.3.6 MAXIMUM TOTAL DUCT SYSTEM LEAKAGE

ROUGH IN	POST CONSTRUCTION	
Duct systems serving more than 1,000 ft^2 of conditioned floor area	**cfm/100 ft^2 (LPM/9.29 m^2)**	**cfm/100 ft^2 (LPM/9.29 m^2)**
Air handler is not installed	3 (85)	NA
Air handler is installed	4 (113.3)	4 (113.3)
Duct systems located in conditioned space, with air handler not installed	6 (170)	6 (170)
Duct systems located in conditioned space, with air handler installed	8 (226.6)	8 (226.6)
Duct systems serving less than or equal to 1,000 ft^2 of conditioned floor area	**cfm (LPM)**	**cfm (LPM)**
Air handler is not installed	30 (849.5)	NA
Air handler is installed	40 (1132.7)	40 (1132.7)
Duct systems located in conditioned space, with air handler not installed	60 (1699.1)	60 (1699.1)
Duct systems located in conditioned space, with air handler installed	80 (2265.4)	80 (2265.4)

Reason: It's common practice in many markets around the country to test ducts in conditioned space before the air handler is installed. Air handlers in these situations are often installed after the drywall. Therefore, the code needs to provide a compliance metric for this construction scenario.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
The change would have no effect on the cost of construction

Workgroup Recommendation

Proposal # 1042

RED1-310-22

Proponents: Alisa McMahon, representing self (mcmahon.gbac@cox.net)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R403.5.1.1.1 Demand recirculation water systems. Where installed, *d emand recirculation water systems* shall have controls that start the pump upon receiving a signal from the action of a user of a fixture or applianc~~e, sensing the presence of a user of a fixture~~ or sensing the flow of hot or tempered water to a fixture fitting or appliance.

Reason: Using a control that senses the presence of a user (i.e., an occupancy sensor) means that every time someone walks up to, or even past, a fixture – *for any reason* – the demand recirculation pump activates and may in turn activate the water heater.

There are many reasons to approach a bathroom or kitchen sink that do not involve the use of hot water. In fact, anecdotally, I kept track of my approaches and found I use hot water < 5% of the time, often using no water at all (e.g., comb hair, look in mirror, get something from cabinet under sink).

Push button control is preferred because it eliminates these "false signals" for pump operation that an occupancy sensor would generate. (California Energy Commission Building Energy Efficiency Standards Residential Compliance Manual)

"False signals" waste energy, both transporting unneeded hot water and when the draw triggers the water heater to fire up.

California Building Energy Efficiency Standards and California Green Building Standards Code specify the following recirculation system controls:

- manual activation with thermostat automatic shut off in one- and two-family dwellings
- controls that sense hot water demand and recirculation return temperatures for central recirculation systems that serve multiple dwelling units

Both of these controls remain represented in R403.5.1.1.1 after this proposed change.

The City of Scottsdale (Arizona) recently adopted the 2021 IECC with this proposed change as a local amendment.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
The code change proposal will neither increase nor decrease the cost of construction, but will decrease the cost of energy use.

Bibliography: https://www.energy.ca.gov/programs-and-topics/programs/building-energy-efficiency-standards/2019-building-energy-efficiency-0
https://up.codes/viewer/california/ca-green-code-2019/chapter/A4/residential-voluntary-measures#A4.303.5
https://up.codes/viewer/california/ca-green-code-2019/chapter/2/definitions#demand_hot_water_recirculation_system

Attached Files

- **CA Codes re Demand Recirc Controls.pdf**
  https://energy.cdpaccess.com/proposal/1351/2828/files/download/468/

Workgroup Recommendation

RED1-311-22

Proponents: Mary Koban, representing AHRI (mkoban@ahrinet.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R403.5.4 Water volume determination. The water volume in the piping between a source of heated water and the termination of supply fixture shall be calculated in accordance with this section. The water volume approach is used instead of the length of pipe approach to encourage water savings through the use of smaller diameter pipes. 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 R403.5.4. 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.

Add new text as follows:

R408.2.3.1 Compact Hot Water Distribution System. A hot water distribution system designed to minimize the energy loss due to the volume of hot water generated but not used.

Revise as follows:

R408.2.3.~~1~~ 2 Compact Hot Water Distribution Credit. ~~For~~ To claim the Compact Hot Water Distribution system credit, the ~~volume~~ pipe shall store not more than 16 ounces of water ~~in the~~ between the nearest source of heated water and the termination of the fixture supply pipe when calculated using section R403.5.4. Where the source of heated water is a circulation loop, the loop shall be primed with a *demand recircualtion water system.* 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. ~~When the hot water source is the nearest primed plumbing loop or trunk, this must be primed with an on-demand recirculation pump and must run a dedicated ambient return line from the furthest fixture or end of loop to the water heater. In order to claim this credit, the dwelling must have a minimum of 1.5 bathrooms.~~
~~To field or plan review, verify that the system meets the prescribed limit, one of the following must be done:~~

1. ~~At plan review, referencing ounces of water per foot of tube on plans as per Table R403.5.4.1~~
2. ~~At rough in (plumbing), referencing ounces of water per foot of tube installed as per Table R403.5.4.1~~
3. ~~At final inspection, in accordance with Department of Energy's Zero Energy Ready Home National Specification (Rev. 07 or higher) footnote on Hot water delivery systems.~~

Reason: AHRI has noted several times that there is no definition of *compact hot water distribution (CHWD) system.* It is noted in section twice in 408, but needs to have a true definition. Therefore, we included a definition for CHWDs..
Futhermore, AHRI notes that although energy savings is the goal of the IECC, embodiments of CHWD system must not create environments suitable for the growth of Legionella. See references …..“Plumbing systems shall comply with the requirements of ASHRAE Standard 188, Legionellosis: Risk Management for Building Water Systems with practice informed by Guideline 12, Managing the Risk of Legionellosis Associated with Building Water Systems and shall be in accordance with the applicable rules and regulations, this code, and the mechanical code.”

It is not clear how these systems will comply with ASHRAE 188. This standard needs to be included in the thought process to successfully employ CHWD systems

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This code change should not increase or decrease the cost of construction.

Bibliography: ASHRAE Standard 188 can be viewed at the following link https://ashrae.iwrapper.com/ASHRAE_PREVIEW_ONLY_STANDARDS/STD_188_2021

Workgroup Recommendation

Proposal # 1449

RED1-312-22

Proponents: Shannon Corcoran, representing American Gas Association (corcoransm@att.net)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

TABLE R403.5.4 INTERNAL VOLUME OF VARIOUS WATER DISTRIBUTION TUBING

OUNCES OF WATER PER FOOT OF TUBE									
NOMINAL SIZE (inches)	COPPER TYPE M	COPPER TYPE L	COPPER TYPE K	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	~~5.19~~ 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 oz/ft^2 = 305.15 g/m^2.

N/A = Not available.

Reason: To be consistent with the requirements/values in the International Plumbing Code

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
The proposal does not affect construction costs.

Bibliography: the International Plumbing Code

Workgroup Recommendation

Proposal # 1299

RED1-313-22

Proponents: Gary Klein, representing Self (gary@garykleinassociates.com); Mark Lyles, representing California IOUs (markl@newbuildings.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R403.5.4 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 R403.5.4. 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.

R408.2.3 Reduced energy use in service water-heatingoptions. For measure numbers R408.2.3 (1) through R408.2.3 (5), the hot water system shall meet one of the Uniform Energy Factors (UEF) or Solar Uniform Energy Factors (SUEF)~~:~~ in Table R408.2.3. The compact hot water distribution measure ~~For measure number R408.2.3 (6), the hot water system~~ shall comply with R408.2.3.1.
~~To field or plan review verify that the system meets the prescribed limit, one of the following must be done:~~

1. ~~At plan review, referencing ounces of water per foot of tube on plans as per Table R403.5.4.~~
2. ~~At rough in (plumbing), referencing ounces of water per foot of tube installed as per Table R403.5.4.~~
3. ~~At final inspection. In accordance with Department of Energy's Zero Energy Ready Home National Specification (Rev. 07 or higher) footnote on Hot water delivery systems.~~

R408.2.3.1 Compact hot water distribution. To claim the ~~For Co~~compact ~~H~~ hot ~~W~~ water D distribution system credit, the ~~volume~~ pipe shall store not more than 16 ounces of water ~~in~~ between the nearest source of heated water and the termination of the fixture supply pipe when calculated using section R403.5.4. Where the source of heated water is a circulation loop, the loop shall be primed with a *demand recirculation water system.* 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. ~~When the hot water source is the nearest primed plumbing loop or trunk, this must be primed with an on-demand recirculation pump and must run a dedicated ambient return line from the furthest fixture or end of loop to the water heater. In order to claim this credit, the dwelling must have a minimum of 1.5 bathrooms.~~
~~To field or plan review, verify that the system meets the prescribed limit, one of the following must be done:~~

1. ~~At plan review, referencing ounces of water per foot of tube on plans as per Table R403.5.4.1~~
2. ~~At rough in (plumbing), referencing ounces of water per foot of tube installed as per Table R403.5.4.1~~
3. ~~At final inspection, in accordance with Department of Energy's Zero Energy Ready Home National Specification (Rev. 07 or higher) footnote on Hot water delivery systems.~~

Reason: Minor edits were made to the language which clarify the requirements. This public comment removes the minimum requirement of 1.5 bathrooms to claim this credit. If there is only one bathroom, a kitchen and perhaps a laundry room, they could be close to each other and to the water heater or far from each other and the water heater, or one could be close and the other far. The intent of the credit is to encourage the architect to get the fixtures close to the water heater(s). If this is somehow not possible, then installing an on-demand primed circulation loop gives them good performance.
The requirements for field or plan review are recommended to be moved to the Code Commentary section. Modifications were made to these provisions and specificity was added for clarity. The proposed new language is presented below.

Recommended for inclusion in the commentary:

R408.2.3.1 Compact hot water distribution systems. The purpose of a compact hot water distribution system is to minimize the volume in the piping between the sources of hot water and the uses of hot water. Sources of hot water include water heaters, circulating water systems and heat trace temperature maintenance systems. There are many ways to meet the requirements as long as the maximum volume between the source and the use is not exceeded.

To verify compliance with R408.2.3.1

1. *Construction documents* shall indicate the lengths, diameters and ounces of water in the piping between the sources of heated water and the termination of the fixture supply.

2. At plumbing rough-in, compare the length and diameter of the piping from the sources of heated water to the termination of the fixture supply pipes to those contained in the *construction documents*.

3. At final inspection verify that either:

a. No more than 32 ounces of water comes out of the fixtures before the temperature of the water rises above 105F.

b. No more than 20 ounces of water shall come out of the fixtures before the temperature of the water rises 10F above the ambient water temperature.

c. If there is a *demand recirculation water system* or a heat trace system, ensure that these are primed with hot water prior to verifying the volume.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
The changes that have been proposed clarify the language, but do not add provisions, so there is no impact on construction costs.

Bibliography: none

Workgroup Recommendation

Proposal # 1079

RED1-314-22

Proponents: Greg Johnson, representing National Multifamily Housing Council (gjohnsonconsulting@gmail.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R403.5.5 Demand responsive water heating. Electric storage water heaters <u>in R-1 occupancies</u> with a rated water storage volume of 40 gallons (150L) to 120 gallons (450L) and a nameplate input rating equal to or less than 12kW shall be provided with demand responsive controls in accordance with Table R403.5.5 or another equivalent approved standard.

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 3-phase electric power.

TABLE R408.2 CREDITS FOR ADDITIONAL ENERGY EFFICIENCY

Portions of table not shown remain unchanged.

Measure Number	Measure Description	Credit Value								
		Climate Zone 0 & 1	Climate Zone 2	Climate Zone 3	Climate Zone 4	Climate Zone 4C	Climate Zone 5	Climate Zone 6	Climate Zone 7	Climate Zone 8
R408.2.10	Demand responsive water heating	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD

Add new text as follows:

R408.2.10 Demand responsive electric water heaters. Electric storage water heaters in R-2,R-3, and R-4 occupancies shall comply with Section R403.5.5.

Reason: The primary purpose of demand responsive controls is to facilitate the operations of the business or utility that provides electricity to the building. The expense of demand response controls should therefore be borne by the business or utility that benefits from those controls.
It is wildly inappropriate for an energy code to mandate the transfer of an operational cost from a business or utility to a property owner. It's analogous to a building code requiring a property owner to provide cold storage for food products simply because the property owner buys groceries at the market that needs such storage.

If the electricity provider wants property owners to support the provider's business operations it can provide the demand response controls and purchase the participation of the owners.

This code change makes owner participation voluntary and awards credit to those owners who choose to provide controls. This is a market based approach to meeting the electricity provider's needs.

The provision is left applicable to R-1 occupancies which, unlike R-2 occupancies, will have a single owner in control of the property.

Cost Impact: The code change proposal will decrease the cost of construction.
This code change removes a mandate to buy equipment that may not be able to be used because of the lack of an available demand response program.

Workgroup Recommendation

Proposal # 1057

RED1-315-22

Proponents: Mary Koban, representing AHRI (mkoban@ahrinet.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R403.5.5 Demand responsive water heating. Electric storage water heaters with a rated water storage volume of 40 gallons (150L) to 120 gallons (450L) and a nameplate input rating equal to or less than 12kW shall be provided with demand responsive controls in accordance with Table R403.5.5 or ~~another equivalent approved standard.~~ AHRI Standard 1430-2022 (I-P).

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 3-phase electric power.

Add new standard(s) as follows:

AHRI

AHRI Standard 1430-2022 (I-P) Demand Flexible Electric Storage Water Heaters
2111 Wilson Blvd, Suite 500
Arlington, VA 22201

Reason: AHRI notes that AHRI Standard 1430 is a harmonized specification for demand flexible electric resistance storage and electric heat pump water heaters (HPWH)s capable of load management that policymakers can use, state government, electric utilities, authorized third parties, manufacturers, designers, installers, contractors, and users. By providing standardized requirements for Demand Flexible Electric Storage Water Heaters (DFWH), utilities and load management program managers can be assured that DFWHs can communicate using standard hardware and software.
AHRI Standard 1430 published December 2022. Therefore, the standard is ready to be included in the code to guide DFWHs.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
Referencing AHRI Standard 1430 will neither increase nor decrease the cost of construction. If anything, since manufacturers will already employ AHRI 1430, the expected cost to manufacture products will decrease.

Bibliography: AHRI notes that AHRI Standard 1430 is available as a free download at the following link: https://www.ahrinet.org/sites/default/files/2022-12/AHRI%20Standard%201430-2022%20%28I-P%29.pdf.
The standard has also been uploaded for convenience.

Workgroup Recommendation

Proposal # 1227

RED1-316-22

Proponents: Greg Johnson, representing National Multifamily Housing Council (gjohnsonconsulting@gmail.com)

2024 International Energy Conservation Code [RE Project]

Delete without substitution:

~~**R403.5.5 Demand responsive water heating.**~~ ~~Electric storage water heaters with a rated water storage volume of 40 gallons (150L) to 120 gallons (450L) and a nameplate input rating equal to or less than 12kW shall be provided with demand responsive controls in accordance with Table R403.5.5 or another equivalent approved standard.~~

~~**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 3-phase electric power.~~

Revise as follows:

TABLE R408.2 CREDITS FOR ADDITIONAL ENERGY EFFICIENCY

Portions of table not shown remain unchanged.

Measure Number	Measure Description	Credit Value								
		Climate Zone 0 & 1	Climate Zone 2	Climate Zone 3	Climate Zone 4	Climate Zone 4C	Climate Zone 5	Climate Zone 6	Climate Zone 7	Climate Zone 8
R408.2.10	Demand responsive water heating	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD

Add new text as follows:

R408.2.10 Demand responsive water heating. Electric storage water heaters with a rated water storage volume of 40 gallons (150L) to 120 gallons (450L) and a nameplate input rating equal to or less than 12kW shall be provided with demand responsive controls in accordance with Table R403.5.5 or another equivalent approved standard.

Reason: The primary purpose of demand responsive controls is to facilitate the operations of the business or utility that provides electricity to the building. The expense of demand response controls should therefore be borne by the business or utility that benefits from those controls.
It is wildly inappropriate for an energy code to mandate the transfer of an operational cost from a business or utility to a property owner. It's analogous to a building code requiring a property owner to provide cold storage for food products simply because the property owner buys groceries at the market that needs such storage.

If the electricity provider wants property owners to support the provider's business operations it can provide the demand response controls and purchase the participation of the owners.

This code change makes owner participation voluntary and awards credit to those owners who choose to provide controls. This is a market based approach to meeting the electricity provider's needs.

Cost Impact: The code change proposal will decrease the cost of construction.
Expensive controls that may not be used will not be required.

Workgroup Recommendation

Proposal # 1059

RED1-317-22

Proponents: Steven Rosenstock, representing Edison Electric Institute (srosenstock@eei.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R403.5.5 Demand responsive water heating. Electric storage water heaters with a rated water storage volume of 30 ~~40~~ gallons (113 ~~150~~L) to 120 gallons (450L) and a nameplate input rating equal to or less than 12kW shall be provided with demand responsive controls in accordance with Table R403.5.5 or another equivalent approved standard.

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 3-phase electric power.
4. Electric Resistance storage water heaters with a maximum electrical input that is not greater than 3000 Watts.

Reason: There are 30 gallon electric storage water heaters with the same electrical specifications as 40 gallon or larger water heaters (e.g., two elements rated at 4500 Watts each, as shown at https://www.homedepot.com/p/Rheem-Performance-30-Gal-Medium-6-Year-4500-4500-Watt-Elements-Electric-Tank-Water-Heater-XE30M06ST45U1/205810657?source=shoppingads&locale=en-US&&mtc=SHOPPING-RM-RMP-GGL-D26P-026_010_WATER_HEATER-SB-RHEEM-NA-SMART-NA-NA-MK492193300-9016832392-NBR-2529-CON-NA-FY22_2529Feed&cm_mmc=SHOPPING-RM-RMP-GGL-D26P-026_010_WATER_HEATER-SB-RHEEM-NA-SMART-NA-NA-MK492193300-9016832392-NBR-2529-CON-NA-FY22_2529Feed-71700000084558371-58700007181517082-92700073320334949&gclid=Cj0KCQiAyracBhDoARIsACGFcS7Zw20w2BHbSuYhCRzK8IrxiCDqIVYFFWL2JK19TP6aCOrj885sRWgaArTwEALw_wcB&gclsrc=aw.ds
and

https://www.lowes.com/pd/A-O-Smith-Signature-30-Gallon-Short-6-year-Limited-4500-Watt-Double-Element-Electric-Water-Heater/1000217553?cm_mmc=shp-_-c-_-prd-_-plb-_-ggl-_-LIA_PLB_209_Water-Heaters-_-1000217553-_-local-_-0-_-0&ds_rl=1286981&gclid=Cj0KCQiAyracBhDoARIsACGFcS78jz0cxP-uMSwNAOnEFsap3Csno1qdp520vkZN881ooxEQlEHdQDMaApD6EALw_wcB&gclsrc=aw.ds).

Such water heaters could also provide the same or similar demand response capabilities as larger water heaters. Although these units are typically used in smaller homes and apartments, the ones with the larger elements can provide the same benefit as a 40 gallon unit. Ones with smaller elements will provide less demand response and are added to the exceptions.

Also, there is an editorial suggestion to change "12kW" to "12 kW" (add a space in between 12 and kW).

Cost Impact: The code change proposal will increase the cost of construction.
This will only increase the cost of construction where 30-39 gallon electric storage water heaters with larger heating elements are installed.

Workgroup Recommendation

Proposal # 1019

RED1-318-22

Proponents: Mike Moore, representing Broan-NuTone (mmoore@statorllc.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

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 *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.

2024 ENERGY Chapter11

Revise as follows:

N1103.6 Mechanical ventilation. The *buildings* and *dwelling units* complying with Section N1102.5.1.1 shall be provided with mechanical *ventilation* that complies with the requirements of Section M1505 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.

Reason: Based on approval of RE132-19 Part 1, as modified, the text of Section R403.6/N1103.6 of the 2021 IECC-R/IRC should read as follows:
R403.6 (IRC N1103.6). Mechanical ventilation. Buildings and dwelling units complying with Section 402.4.1 shall be provided with mechanical ventilation that complies with the requirements of M1505 of the International Residential Code or International Mechanical Code, as applicable, or with other approved means of ventilation...

(Note that in the PC draft #1, the numbering of the reference has editorially changed to R402.5.1.)

In consultation with ICC staff, an erratum has been submitted to ICC to correct the 2021 IECC-R/IRC language to read as shown above. This proposal seeks to modify the corrected 2021 IECC/IRC language by changing the R402.5.1/N1102.5.1 reference to R402.5.1.1/N1102.5.1.1. Use of the current reference could be misinterpreted to mean that mechanical ventilation is only required when each subsection of R402.5.1/N1102.5.1 is completed, including a blower door test. There are many adopting jurisdictions that waive blower door test requirements based on lack of access to qualified testers, but perhaps without exception, these jurisdictions retain the prescriptive air sealing requirements in R402.5.1.1/N1102.5.1.1. The requirement for mechanical ventilation should not be determined by whether a blower door test has been conducted but by whether air sealing measures have been pursued. The blower door test is simply there to confirm that the air sealing required by R402.5.1.1/N1102.5.1.1 has been executed properly. By modifying the reference in R403.6, the IECC sends the right message that mechanical ventilation is required in tightly constructed dwelling units and buildings, while ensuring that mechanical ventilation requirements are not inadvertently dropped by adopting jurisdictions that do not have access to blower door testers.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This proposal clarifies existing requirements and does not affect construction costs.

Workgroup Recommendation

RED1-319-22

Proponents: Shane Hoeper, representing myself (shoeper@cityofdubuque.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

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 5,6,7, and 8. The system shall be a balanced ventilation system with a sensible recovery efficiency (SRE) of no less than 65 percent at 32°F (0°C) at 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.

Reason: Prior action by the Residential Consensus Committee showed that it was cost effective to add climate zone 5. This proposal received a majority vote but was removed by the omnibus.

Cost Impact: The code change proposal will increase the cost of construction.
This change will increase the cost of construction in climate zone 5.

Workgroup Recommendation

Proposal # 1359

RED1-320-22

Proponents: Mike Moore, representing The Home Ventilating Institute (mmoore@statorllc.com)

2024 ENERGY Chapter11

Add new definition as follows:

ENTHALPY RECOVERY RATIO. Change in the enthalpy of the outdoor air supply divided by the difference between the outdoor air and entering exhaust air enthalpy, expressed as a percentage.

Revise as follows:

N1103.6.1 Heat or energy recovery ventilation. Heat or energy recovery ventilation systems shall be provided as specified in either Section N1103.6.1.1 or N1103.6.1.2, as applicable.~~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 sensible recovery efficiency (SRE) of no less than 65 percent at 32°F (0°C) at 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.~~

Add new text as follows:

N1103.6.1.1 Group R-2 occupancy *dwelling units* adjoining a corridor . Within buildings of Group R-2 occupancy, *dwelling units* adjoining a corridor shall be provided with a balanced ventilation system having an *enthalpy recovery ratio* of not less than 50 percent at cooling design condition and not less than 60 percent at heating design condition.

Exceptions:

1. Dwelling units in Climate Zone 3C.
2. Dwelling units with not more than 500 square feet (46 m) of conditioned floor area that are located in Climate Zones 0, 1, 2, 3, 4C and 5C and either adjoin an open-ended corridor or do not adjoin a corridor.
3. Dwelling units with not more than 500 square feet (46 m2) of conditioned floor area that are located in Climate Zones 1A, 2B, 3B, and 3C.
4. Enthalpy recovery ratio requirements at heating design condition in Climate Zones 0, 1 and 2.
5. Enthalpy recovery ratio requirements at cooling design condition in Climate Zones 4, 5, 6, 7 and 8.

N1103.6.1.2 All other dwelling units. All other 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 sensible recovery efficiency (SRE) of no less than 65 percent at 32°F (0°C) at 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.

N1103.6.2 Whole-dwelling mechanical ventilation system fan efficacy. Fans used to provide whole-dwelling mechanical ventilation shall meet the efficacy requirements of Table N1103.6.2 at one or more rating points. Fans shall be tested in accordance withthe test procedure referenced by Table N1103.6.2 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, ERV, balanced and in-line fans shall be determined at a static pressure of not less than 0.2 inch water column (49.82 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 water column (24.91 Pa).

2024 International Energy Conservation Code [RE Project]

Add new definition as follows:

ENTHALPY RECOVERY RATIO.. Change in the enthalpy of the outdoor air supply divided by the difference between the outdoor air and entering exhaust air enthalpy, expressed as a percentage.

Revise as follows:

R403.6.1 Heat or energy recovery ventilation . Heat or energy recovery ventilation systems shall be provided as specified in either Section R403.6.1.1 or R403.6.1.2, as applicable.

R403.6.1.1 Group R-2 occupancy *dwelling units* adjoining a corridor . Within buildings of Group R-2 occupancy, *dwelling units* adjoining a corridor shall be provided with a balanced ventilation system having an *enthalpy recovery ratio* of not less than 50 percent at cooling design condition and not less than 60 percent at heating design condition.

Exceptions:

1. *Dwelling units* in Climate Zone 3C.

2. *Dwelling units* with not more than 500 square feet (46 m) of *conditioned floor area* that are located in Climate Zones 0, 1, 2, 3, 4C and 5C and either adjoin an open-ended corridor or do not adjoin a corridor.

3. *Dwelling units* with not more than 500 square feet (46 m2) of *conditioned floor area* that are located in Climate Zones 1A, 2B, 3B, and 3C.

4. *Enthalpy recovery ratio* requirements at heating design condition in Climate Zones 0, 1 and 2.

5. *Enthalpy recovery ratio* requirements at cooling design condition in Climate Zones 4, 5, 6, 7 and 8.

R403.6.1.2 All other *dwelling units*. All other ~~D~~*welling 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 sensible recovery efficiency (SRE) of no less than 65 percent at 32°F (0°C) at 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.

Add new text as follows:

R403.6.1.1 Group R-2 occupancy dwelling units adjoining a corridor .. Within buildings of Group R-2 occupancy, dwelling units adjoining a corridor shall be provided with a balanced ventilation system having an enthalpy recovery ratio of not less than 50 percent at cooling design condition and not less than 60 percent at heating design condition.

Exceptions:

1. Dwelling units in Climate Zone 3C.
2. Dwelling units with not more than 500 square feet (46 m) of conditioned floor area that are located in Climate Zones 0, 1, 2, 3, 4C and 5C and either adjoin an open-ended corridor or do not adjoin a corridor.
3. Dwelling units with not more than 500 square feet (46 m2) of conditioned floor area that are located in Climate Zones 1A, 2B, 3B, and 3C.
4. Enthalpy recovery ratio requirements at heating design condition in Climate Zones 0, 1 and 2.
5. Enthalpy recovery ratio requirements at cooling design condition in Climate Zones 4, 5, 6, 7 and 8.

R403.6.1.2 All other dwelling units.. All other 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 sensible recovery efficiency (SRE) of no less than 65 percent at 32°F (0°C) at 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.

Reason: This proposal establishes a requirement for a balanced ventilation system with heat recovery (i.e., an HRV or an ERV) for low-rise dwelling units that adjoin a corridor in Group R-2 buildings based on a cost effectiveness analysis. The requirement aligns with the text approved by the IECC-C Consensus Committee and contained within the 2024 IECC PC#1 draft, Section C403.7.4.1.

Cost Impact: The code change proposal will increase the cost of construction.
This proposal imports the 2021 IECC-C H/ERV requirements for R-2 dwelling units from Section C403.7.4.1 and expands them to match the requirements 2024 PC#1 IECC-C H/ERV requirements for R-2 dwelling units. Cost effectiveness documentation supporting the existing 2021 IECC-C requirements for H/ERVs in R-2 dwelling units were submitted in that code cycle and were also submitted through ASHRAE 90.1 as the basis for establishing identical requirements in that standard. The assumptions used to characterize typical R-2 dwelling units in the 2021 IECC-C cost effectiveness study are also applicable to 2024 IECC-R R-2 dwelling units (at least in terms of the effects on ventilation energy use and savings), and so the cost effectiveness study does not need to be repeated to justify transitioning the requirements to the IECC-R. Stakeholders may refer to the cost effectiveness documentation submitted with the 2021 IECC-C code change for more information.

The cost effectiveness study submitted for this proposal supports the expansion of R-2 dwelling unit H/ERV requirements beyond those already established by the 2021 IECC-C, to align with the 2024 PC#1 IECC-C H/ERV requirements for R-2 dwelling units. The cost effectiveness analysis justifying this proposal was based on the method approved by the Residential Consensus Committee, using their cost effectiveness calculator, accessed through the following link in December, 2022. Details are provided in an Excel workbook that can be found through the following link:

https://www.dropbox.com/scl/fi/or5nrv3aqldm5jmdpqom2/HERV-R-2-Cost-Effectiveness-Final-20221216.xlsm?dl=0&rlkey=oax6xdr4w97cpwlyahie4d1jm.

Additional assumptions:

- 2024 IMC code-minimum ventilation rates for low rise, R-2 dwelling units (these rates are ~30% lower than ASHRAE 62.1 and European rates)
- Balanced ventilation as the minimum code-compliant reference system (see additional rationale below)
- Fan efficacy compliant with the minimum requirements of the 2021 IECC
- 1000 square foot, 2-bed/2-bath and 500 square foot 1-bed/1-bath dwelling units

Why choose balanced ventilation as the reference system?

Recent research has documented significant leakage pathways between the walls of newer, tight dwelling units and adjacent corridors in Group R-2 occupancies, with approximately 40% of dwelling unit leakage area to the corridor.[1] Operating an unbalanced outdoor air ventilation system in a dwelling unit with a wall adjacent to a corridor is expected to establish a pressure differential with respect to the corridor. When a supply ventilation system is specified for the dwelling unit, this is expected to pressurize the dwelling unit, transferring air from the dwelling unit to the corridor. When an exhaust system is specified for the dwelling unit, this is expected to depressurize the dwelling unit, transferring air from the corridor to the dwelling unit. Transferring air to or from the corridor and an adjoining dwelling unit is a violation of IBC Section 1020.5 and IMC 601.2, which prohibit corridors from serving as “supply, return, exhaust, relief, or ventilation air ducts.” Physically speaking, to comply with these requirements in the IBC and IMC, an outdoor air ventilation system must be balanced. Joe Lstiburek provides pages of rationale supporting this concept in his article, “Compartmentalization, Distribution and Balance” – which in 2019 laid out a game plan for energy efficient, construction and ventilation of multifamily dwelling units to achieve the building code’s fire safety, IAQ, and energy efficiency objectives.[2] Perhaps for such reasons, prior to 2015, any dwelling unit having mechanical ventilation was required to provide mechanical ventilation “by a method of supply and return or exhaust air,” where “the amount of supply air shall be approximately equal to the amount of return and exhaust air” (2012 IMC 403.1). As such, for the cost effectiveness analysis, this proposal assumes a balanced ventilation system for Group R-2 occupancy dwelling units adjoining a corridor.

Bibliography:

1. Bohac D., and Sweeney L. 2020. Energy Code Field Studies: Low-Rise Multifamily Air Leakage Testing. Prepared by the Center for Energy and Environment, Ecotope, and The Energy Conservatory. Prepared for the U.S. Department of Energy Office of Energy Efficiency & Renewable Energy. https://www.energycodes.gov/sites/default/files/2021-07/LRMF_AirLeakageTesting_FinalReport_2020-07-06.pdf. [See Table 45, which shows average leakage to “common” area of 42%. The report also notes, “for buildings in this study, “common areas” are made up almost completely of corridors and a few small rooms such as mechanical closets and elevator rooms.]
2. Lstiburek, J.W. 2019. Compartmentalization, Distribution and Balance. ASHRAE Journal: Vol. 61, no. 7. https://www.techstreet.com/standards/building-sciences-compartmentalization-distribution-and-balance?product_id=2076115.

Workgroup Recommendation

Proposal # 1433

RED1-321-22

Proponents: Mike Moore, representing Broan-NuTone (mmoore@statorllc.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

TABLE R403.6.2 (N1103.6.2) WHOLE-DWELLING MECHANICAL VENTILATION SYSTEM FAN EFFICACY~~[a]~~

SYSTEM TYPE	AIRFLOW RATE (CFM)	MINIMUM EFFICACY (CFM/WATT)	TEST PROCEDURE
HRV or ERV	Any	1.2[a]	CAN/CSA C439
~~HRV, ERV, or balanced~~ Balanced ventilation system without heat or energy recovery	Any	1.2[a]	~~HRV or ERV: CAN/CSA 439; Balanced without heat or energy recovery: ASHRAE Standard 51 (ANSI/AMCA Standard 210)~~ 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-handler that is integrated to tested and *listed* HVAC equipment	Any	1.2	Outdoor airflow as specified. Air-handler fan power determined in accordance with the HVAC appliance's test method referenced by Section C403.3.2 of the IECC-Commercial Provisions.

For SI: 1 cubic foot per minute = 0.47 L/s.

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

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

Reason: This proposal modifies the fan efficacy table to provide editorial changes that improve clarity and improve alignment with the IECC-C fan efficacy table, as published in PC#1 of the 2024 IECC-C.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
These are editorial changes that neither increase nor decrease costs.

Workgroup Recommendation

Proposal # 1167

RED1-322-22

Proponents: Greg Johnson, representing National Multifamily Housing Council (gjohnsonconsulting@gmail.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

TABLE R403.6.2 WHOLE-DWELLING MECHANICAL VENTILATION SYSTEM FAN EFFICACY[a]

Portions of table not shown remain unchanged.

SYSTEM TYPE	AIRFLOW RATE (CFM)	MINIMUM EFFICACY (CFM/WATT)	TEST PROCEDURE
HRV, ERV, or balanced	Any	1.2	HRV or ERV: CAN/CSA 439; Balanced without heat or energy recovery: ASHRAE Standard 51 (ANSI/AMCA Standard 210)
Range hood	Any	2.8	ASHRAE 51 (ANSI/AMCA Standard 210)
In-line supply or exhaust fan	Any	3.8	
Other exhaust fan	< 90	2.8	
	≥ 90 and < 200	3.5	
	≥ 200	4.0	
Air-handler that is integrated to tested and *listed* HVAC equipment	Any	1.2	Outdoor airflow as specified. Air-handler fan power determined in accordance with ~~the HVAC appliance's~~ an *approved* test method~~ referenced by Section C403.3.2 of the IECC-Commercial Provisions.~~

For SI: 1 cubic foot per minute = 0.47 L/s.

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

Reason: Section 105 requires residential buildings to comply with the IECC-Residential and not the IECC-Commercial provisions. Referencing the IECC-C is additionally inappropriate because of ICC commitments to industry and the chance of the IECC-C not being adopted by the jurisdiction. More technically competent persons can provide the appropriate test method(s) direct reference(s) if approval by the code official is deemed inadequate.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This is a formatting issue.

Workgroup Recommendation

Proposal # 1420

RED1-324-22

Proponents: Mary Koban, representing AHRI (mkoban@ahrinet.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

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. 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.

Exception~~s~~:

~~1.~~ Kitchen range hoods that are ducted to the outside with 6-inch (152 mm) or larger , a length of 10ft (3048 mm) or less, and not more than two 90° elbows or equivalent 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, programmable airflow settings, and a user interface that communicates the installed airflow rate.~~

Reason: AHRI notes that this language is not necessary. By reference, ANSI/RESNET/ICC 380 allows manufacturer-integrated devices to qualify airflow measurements, but it does not include the limitations of having programmable airflow settings and a communicating user interface. This language is contrary to the RESNET standard and could be directed toward specific existing equipment.

Furthermore, since this language contradicts ANSI/RESNET/ ICC 380, it may cause confusion regarding how to apply the code. Therefore, AHRI notes that this exception should be deleted.

Cost Impact: The code change proposal will decrease the cost of construction.
It is expected that by removing the exception, construction costs will decrease. Manufacturers will have clear direction on which standard to use and additional ambiguity noted in the exception will be removed. Therefore, construction costs will decrease.

Bibliography: AHRI notes that the RESNET/ICC 380 standard can be reviewed at this link https://codes.iccsafe.org/content/RESNET3802019P1

Workgroup Recommendation

Proposal # 1229

RED1-325-22

Proponents: Gayathri Vijayakumar, representing Steven Winter Associates, Inc. (gvijayakumar@swinter.com); Mary Koban, representing AHRI (mkoban@ahrinet.org)

2024 International Energy Conservation Code [RE Project]

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.

Revise as follows:

R403.7.1 Electric-resistance space heating ~~zone heated units~~. ~~All d~~ Detached one- and two-family dwellings and townhouses in Climate Zones 4 through 8~~4-8~~ using electric-resistance ~~zonal~~ space heating shall limit the total installed heating capacity of all electric-resistance space heating serving the *dwelling unit* to no more than 2 kW, or shall install a heat pump in the largest space that is not used as a bedroom.~~as the primary heat source shall install one additional heating unit in the largest living zone. The additional unit shall have an HSPF greater than 7.4 (6.3 HSPF2). Building permit drawings shall specify the heating equipment type and location of the heating system.~~

~~**Exceptions:**~~

1. ~~Total installed heating capacity of 2 kW per dwelling or less.~~
2. ~~Dwellings that have central ducted or ductless cooling or heating systems~~

Reason: The intent of this Public Comment is to retain the intent of the original requirement as introduced and justified by REPI-99, but to use simpler, clearer language. A 3rd exception is introduced for homes where the original requirement may not be cost-effective. The language regarding permit drawings is removed because it is redundant to text already required in R103.2. A minimum efficiency is not necessary given that the federal standards for heat pumps (10 CFR 430.32(c)), other than small-duct high-velocity systems and space-constrained heat pumps, require a higher efficiency than 7.4 HSPF (6.3 HSPF2).

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
N/A

Bibliography: None

Workgroup Recommendation

Proposal # 1107

RED1-326-22

Proponents: Ted Williams, representing ONE Gas (ngdllc@outlook.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R403.7.1 Electric resistance zone heated units. All detached one- and two-family dwellings and townhouses in Climate Zones 4-8 using electric resistance zonal heating as the primary heat source shall install one zonal heat pump to serve as an additional heating unit in the largest living zone. The additional heat pump unit shall have an HSPF greater than 7.4 (6.3 HSPF2). Building permit drawings shall specify the heating equipment type and location of the heating system.

Exceptions:

1. Total installed heating capacity of 2 kW per dwelling or less.
2. Dwellings that have central ducted or ductless cooling or heating systems

Reason: The addition of heating units to a dwelling that uses electric resistance as the primary heat source should not expand the use of electric resistance but instead require a zone-compatible heat pump to achieve higher energy efficiency in meeting the living zone heating requirements. Requiring an additional electric resistance heater in the largest living zone will increase energy consumption over the addition of a heat pump for that service. Numerous heat pump products are available to provide this additional heating.

Cost Impact: The code change proposal will increase the cost of construction.
The requirement for a zonal heat pump unit instead of allowance for electric resistance heating as the additional electric heat source will add incrementally to the installed cost of the zonal heating system.

Workgroup Recommendation

Proposal # 1394

RED1-327-22

Proponents: Eric Tate, representing Atmos Energy (eric.tate@atmosenergy.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R403.7.1 Electric resistance zone heated units. All detached one- and two-family dwellings and townhouses in Climate Zones 4-8 using electric resistance zonal heating as the primary heat source shall install one zonal heat pump to serve as an additional heating unit in the largest living zone. The additional heat pump unit shall have an HSPF greater than 7.4 (6.3 HSPF2). Building permit drawings shall specify the heating equipment type and location of the heating system.

Exceptions:

1. Total installed heating capacity of 2 kW per dwelling or less.
2. Dwellings that have central ducted or ductless cooling or heating systems

Reason: The addition of heating units to a dwelling that uses electric resistance as the primary heat source should not expand the use of electric resistance but instead require a zone-compatible heat pump to achieve higher energy efficiency in meeting the living zone heating requirements. Requiring an additional electric resistance heater in the largest living zone will increase energy consumption over the addition of a heat pump for that service. Numerous heat pump products are available to provide this additional heating.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
The requirement for a zonal heat pump will not increase the cost of construction.

Workgroup Recommendation

Proposal # 1443

RED1-328-22

Proponents: Steven Rosenstock, representing Edison Electric Institute (srosenstock@eei.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R403.7.1 Electric resistance zone heated units. All detached one- and two-family dwellings and townhouses in Climate Zones 4-8 using electric resistance zonal heating as the primary heat source shall install one additional heating unit in the largest living zone. The additional unit, where space-constrained, shall have an HSPF 2 ~~greater~~ not less than 6.3 ~~7.4~~ (~~6.3 HSPF2~~ 7.4 HSPF). Building permit drawings shall specify the heating equipment type and location of the heating system.

Exceptions:

1. Total installed heating capacity of 2 kW per dwelling or less.
2. Dwellings that have central ducted or ductless cooling or heating systems.
3. Where installed, the additional small-duct high-velocity system shall have an HSPF2 not less than than 6.1.
4. Where installed, the additional single-package vertical unit shall have an HSPF2 not less than 6.7.

Reason: As of January 1, 2023, all heat pumps manufactured for sale and use in the United States will be tested and rated for heating efficiency using the HSPF2 metric, replacing the HSPF metric. For these units, HSPF2 will be the only heating efficiency rating shown on specifications and the "Energy Guide" labels. Since units manufactured prior to January 1, 2023, can still be sold in the US, the proposal suggests moving the value to inside the parentheses, to show that it is a secondary/backup value that could be used in certain situations.
In addition, the requirement of 6.3 HSPF2 is only applicable to space-constrained heat pump as regulated by the US Department of Energy. If other heat pumps are installed, such as a single-package vertical heat pump, there is a different minimum heating efficiency requirement. The additional language provides clarification for other systems that may be used to comply when serving one zone of a single or two-family dwelling or townhouse. If there are situations where a split system heat pump is used, then the minimum efficiency requirement for that system is 7.5 HSPF2 (see https://www.ecfr.gov/current/title-10/chapter-II/subchapter-D/part-430, *§ 430.32 Energy and water conservation standards and their compliance dates*, Table (c)(5) for more information).

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This change does not change the cost of construction, but clarifies the requirement and provides information on additional technologies that can be used to comply.

Bibliography: *US Code of Federal Regulations,* Title 10, Part 430, *§ 430.32 Energy and water conservation standards and their compliance dates*, Table (c)(5), accessible at: https://www.ecfr.gov/current/title-10/chapter-II/subchapter-D/part-430

Workgroup Recommendation

Proposal # 1125

RED1-329-22

Proponents: Greg Johnson, representing National Multifamily Housing Council (gjohnsonconsulting@gmail.com)

2024 International Energy Conservation Code [RE Project]

Delete without substitution:

~~**R403.8 Systems serving multiple dwelling units.** Systems serving multiple *dwelling units* shall comply with Sections C403 and C404 of the *International Energy Conservation Code—*Commercial Provisions instead of Section R403.~~

Reason: Section R101.5 clearly requires that residential buildings comply with the IECC-R rather than the IECC- commercial provisions.
The original proponent of this section should do the work of incorporating the actual requirements for the benefit of the code user instead of referencing a code that may not be adopted.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
There will be no impact if the original proponent completes the work.

Workgroup Recommendation

Proposal # 1095

RED1-330-22

Proponents: Mike Moore, representing Broan-NuTone (mmoore@statorllc.com)

2024 ENERGY Chapter11

Revise as follows:

N1104.1 Lighting equipment. All permanently installed luminaires , shall be capable of operation with an efficacy of not less than 45 lumens per watt or shall contain lamps capable of operation at 65 lumens per watt or greater.

Exceptions:

1. ~~kitchen appliance~~ lighting integral to a kitchen appliance or exhaust hood.

   .

2. antimicrobial lighting used for the sole purpose of disinfecting.

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R404.1 Lighting equipment. All permanently installed luminaires , shall be capable of operation with an efficacy of not less than 45 lumens per watt or shall contain lamps capable of operation at 65 lumens per watt or greater.

Exceptions:

1. ~~Kitchen appliance~~ lighting integral to a kitchen appliance or exhaust hood.

   .

2. Antimicrobial lighting used for the sole purpose of disinfecting.

Reason: This proposal correlates the language in the 2024 IECC-C PC#1 draft with the IECC-R while clarifying that range hoods are exempt from the fan efficacy provisions, maintaining the 2021 IECC-R and IECC-C exception for this product class based on concerns for durability and viability of high-efficacy lighting exposed to the elevated temperatures associated with residential cooking.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This language is an editorial clarification of the current language and will therefore neither increase nor decrease the cost of construction.

Aside: While high-efficacy lighting is now available in range hoods, the cost of products incorporating such lighting is currently much higher than for hoods without such technology.
A survey of range hoods on HomeDepot.com conducted on December 12, 2022, found the following:

- 42 results for 30” range hoods of all lighting types except LED, starting at $69.
- 186 results for 30” range hoods with LED lighting, starting at $139.

A $70 difference is a high premium to pay for a lamp that is expected to have a low duty cycle.

Workgroup Recommendation

Proposal # 1472

RED1-331-22

Proponents: Eric Tate, representing Atmos Energy (eric.tate@atmosenergy.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R404.1.5 Gas lighting. Gas-fired lighting appliances shall not be equipped with continuously burning pilot ignition systems.

Exceptions:

1. Any gas light equipped with an on-demand, intermittent or interrupted ignition (as defined in ANSI Z21.20)
2. Gas lights serving historical buildings.

Reason: Exception 1 resolves issues of continuously-burning pilots and associated energy use by requiring ignition only when lighting service is required. Exception 2 addresses historical buildings where gas lighting is important to the ambience of the structure.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
The added exceptions will not affect cost of construction.

Workgroup Recommendation

Proposal # 1444

RED1-332-22

Proponents: Adam Berry, representing Colorado Energy Office (adam.berry@state.co.us)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R404.1.5 Gas lighting. Gas-fired lighting appliances are not permitted ~~shall not be equipped with continuously burning pilot ignition systems~~.

2024 ENERGY Chapter11

Revise as follows:

N1104.1.5 Gas lighting. Gas-fired lighting appliances are not permitted ~~shall not be equipped with continuously burning pilot ignition systems~~.

Reason: While there may still be numerous applications for non-electric lighting fixtures in commercial and industrial buildings, there are very few, if any, applications in residential buildings. There are a great number of LED options that prove far more efficient and cost effective to operate than any gas lighting system, and those should be prioritized in new construction.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
Prohibiting gas lighting should have a minimal impact on construction costs, as any increased electric infrastructure costs would be relatively offset by any decreased costs from avoided natural gas infrastructure.

Workgroup Recommendation

Proposal # 1322

RED1-333-22

Proponents: Ted Williams, representing ONE Gas (ngdllc@outlook.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R404.1.5 Gas lighting. Gas-fired lighting appliances shall not be equipped with continuously burning pilot ignition systems.

Exceptions:

1. Any gas light equipped with an on-demand, intermittent or interrupted ignition (as defined in ANSI Z21.20).
2. Gas lights serving historical buildings.

Reason: Exception 1 resolves issues of continuously-burning pilots and associated energy use by requiring ignition only when lighting service is required. Exception 2 addresses historical buildings where gas lighting is important to the ambience of the structure.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
The proposed exceptions would not affect cost of construction.

Workgroup Recommendation

Proposal # 1484

RED1-334-22

Proponents: Ted Williams, representing Omega Flex Corp. (ngdllc@outlook.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

<u>**R404.5.5 Gaseous Fossil Fuel Systems.** Fuel gas systems serving space heating, cooking, clothes drying, and water heating shall be designed in accordance with the International Fuel Gas Code and constructed of stainless steel tubing for operation at 2 pounds per square inch (psi).</u>

R404.5.1 Cooking products. An individual branch circuit outlet with a rating not less than 250-volts, 40-amperes shall be installed, and terminate within three feet of conventional cooking tops, conventional ovens or cooking products combining both.
Exception: Cooking products not installed in an individual dwelling unit.

R404.5.2 Household Clothes Dryers. An individual branch circuit outlet with a rating not less than 240-volts, 30-amperes shall be installed, and terminate within three feet (304 mm) of each household clothes dryer.
Exception: Clothes dryers that serve more than one dwelling unit and are located outside of a dwelling unit.

R404.5.3 Water heaters. An individual branch circuit outlet with a rating not less than either 240-volts, 30-amperes or 120V, 20-amperes shall be installed, and terminate within three feet (304 mm) of each fossil fuel water heater. **Exception:** Water heaters in a centralized water heating system serving multiple dwelling units in a R-2 occupancy.

R404.5.4 Electrification-ready circuits. The unused conductors required by Sections R404.5.1 through R404.5.3 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 R404.5.1 through R404.5.3 shall be included in the load calculations of the original installation.

Reason: Fuel gas piping systems in electric ready occupancies should be designed for renewable gases and specifically "green" hydrogen blends of natural gas as the piping technology-limiting renewable fuel option. Hydrogen blends as high as 20% are likely to be introduced in U. S. natural gas systems by the time of state and local adoption of the 2024 IECC, reducing carbon footprint for end uses by approximately 12% from combustion emissions. Stainless steel tubing as a fuel gas piping material is immune to hydrogen degradation from hydrogen embrittlement and hydrogen stress corrosion cracking. Tubing piping systems reduce system joint counts and therefore joint fuel gas leakage points, which is a source of fugitive emissions of high global warming potential (GWP) methane fuel gas constituents. Stainless steel tubing in interior piping systems is sized to operate at 2 psi pressures, facilitating gas supply to high efficiency end use appliances which operate at pressures around 0.25 psi and traditionally serve lower efficiency products. In addition to minimizing tubing joints and potential leak points, joining methods for stainless steel tubing provide greater resistance to leakage over time than threaded steel piping joint, reducing the propensity of joints to leak high GWP natural gas or hydrogen/natural gas blends.

Cost Impact: The code change proposal will decrease the cost of construction.
Installation of stainless steel tubing in new construction has been shown to reduce fuel gas interior piping systems by requiring less labor. Smaller diameter tubing (less than 1/2 inch internal diamter) reduces the material required to serve high efficiency gas fired applications, which require high fuel gas inputs.

Bibliography: International Fuel Gas Code® (IFGC®), 2021, International Code Council, 2021.

Workgroup Recommendation

Proposal # 1485

RED1-335-22

Proponents: Shane Hoeper, representing myself (shoeper@cityofdubuque.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R404.5.3 Water heaters. An ~~individual~~ dedicated branch circuit ~~outlet~~ with a rating not less than either 240-volts, 30-amperes or 120V, 20-amperes shall be installed~~,~~ and terminate within three feet (304 mm) of each ~~fossil fuel~~ water heater.

Exception: Water heaters ~~in a centralized water heating system~~ serving multiple dwelling units in an R-2 occupancy.

Reason: The changes are editorial in nature and intended to make all the sections under R404.5 consistent.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
The changes are only editorial and does not affect the cost of construction.

Workgroup Recommendation

Proposal # 1188

RED1-336-22

Proponents: Gayathri Vijayakumar, representing Steven Winter Associates, Inc. (gvijayakumar@swinter.com)

2024 International Energy Conservation Code [RE Project]

R405.4 Calculation procedure. Calculations of the proposed design shall be in accordance with Sections R405.4.1 and R405.4.2.

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.

R405.4.2 Residence specifications. The *standard reference design* and *proposed design* 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.

Revise as follows:

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

Portions of table not shown remain unchanged.

<table>
<tr><th>BUILDING COMPONENT</th><th>STANDARD REFERENCE DESIGN</th><th colspan="3">PROPOSED DESIGN</th></tr>
<tr><td rowspan="12">Service water heating[d, g, k]</td><td rowspan="7">~~As proposed.~~
Use, in units of gal/day = 25.5 + (8.5 × N_{br})
where: N_{br} = number of bedrooms.</td><td colspan="3">~~As proposed~~
Use, in units of gal/day = 25.5 + (8.5 × N_{br}) × (1 – $HWDS$)
where:
N_{br} = number of bedrooms.
$HWDS$ = factor for the compactness of the hot water distribution system.</td></tr>
<tr><td colspan="2">Compactness ratio[i] factor</td><td>HWDS</td></tr>
<tr><td>1 story</td><td>2 or more stories</td><td></td></tr>
<tr><td>> 60%</td><td>> 30%</td><td>0</td></tr>
<tr><td>> 30% to ≤ 60%</td><td>> 15% to ≤ 30%</td><td>0.05</td></tr>
<tr><td>> 15% to ≤ 30%</td><td>> 7.5% to ≤ 15%</td><td>0.10</td></tr>
<tr><td>< 15%</td><td>< 7.5%</td><td>0.15</td></tr>
<tr><td>Fuel Type: Same as proposed design</td><td colspan="3">As proposed</td></tr>
<tr><td>Rated Storage Volume: Same as proposed design</td><td colspan="3">As proposed</td></tr>
<tr><td>Draw Pattern: Same as proposed design</td><td colspan="3">As proposed</td></tr>
<tr><td>Efficiencies: Uniform Energy Factor complying with 10 CFR §430.32</td><td colspan="3">As proposed</td></tr>
<tr><td>Tank Temperature: 120° F (48.9° C)</td><td colspan="3">Same as standard reference design</td></tr>
</table>

For SI: 1 square foot = 0.93 m^2, 1 British thermal unit = 1055 J, 1 pound per square foot = 4.88 kg/m^2, 1 gallon (US) = 3.785 L, °C = (°F-32)/1.8, 1 degree = 0.79 rad.

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.

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. 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 §4~~1~~30.32

h. For residences with conditioned basements, R-2 and R-4 residences, and for townhouse units, 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.

i. 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 Table R405.4.2(1), the standard reference design shall be the same as proposed design.

Reason: This Public Comment proposes that the Standard Reference Design should be modeled with a 40 gallon electric resistance storage water heater when the Proposed Design is a heat pump water heater. The current language would require the Standard Reference Design to be a heat pump water heater if that system type is in the Proposed Design. Given that electric storage is permitted by code, there should be more savings associated with this upgrade to a HPWH to encourage its adoption by builders. This approach is also the same as that used in the ERI Path and similar to the approach used to calculate points for HPWHs in R408.2.3.
Note: Some of the edits shown are errata, as they were approved through REPI-122:

1. removing "As Proposed" from the table in both columns
2. adding "without a proposed water heater" to note g.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This public comment does not increase the cost of construction.

Bibliography: None.

Workgroup Recommendation

Proposal # 1169

RED1-337-22

Proponents: Mike Moore, representing Broan-NuTone (mmoore@statorllc.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

TABLE N1105.4.2(1) R405.4.2(1) SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS
Portions of table not shown remain unchanged.

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Air ~~exchange~~ leakage rate	The air leakage rate at a pressure of 0.2 inch w.g. (50 Pa) shall be Climate Zones 0 through 2: 5.0 air changes per hour. Climate Zones 3 , 4, and 5: 3.0 air changes per hour. Climate Zones 6 through 8: 2.5 air changes per hour.	The measured air ~~exchange~~ leakage rate.[a]
Mechanical ventilation rate	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 B x M where: B = 0.01 × CFA + 7.5 × (Nbr + 1), cfm. M = 1.0 where the measured air ~~exchange~~ leakage rate is > = 3.0 air changes per hour at 50 Pascals, and otherwise, M = minimum (1.7, Q/B) Q = the proposed mechanical ventilation rate, cfm. CFA = conditioned floor area, ft2. Nbr = number of bedrooms. 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 Section R403.6.1. Heat recovery or energy recovery shall not be modeled for mechanical ventilation where not required by Section R403.6.1.	The mechanical ventilation rate[b], Q, shall be in addition to the air leakage rate and shall be as proposed.
Mechanical ventilation fan energy	Where mechanical ventilation is not specified in the proposed design: None Where mechanical ventilation is specified in the proposed design, the annual vent fan energy use, in units of kWh/yr, shall equal (8.76 × B × M)/e_f where: B and M are determined in accordance with the ~~Air Exchange~~ Mechanical Ventilation Rate row of this table. e_f = the minimum fan efficacy, as specified in Table 403.6.2, corresponding to the system type at a flow rate of B × M. *CFA* = conditioned floor area, ft^2. N_{br} = number of bedrooms.	As proposed

Reason: This proposal is an editorial clarification and reorganization to improve usability.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This proposal is editorial and will therefore neither increase nor decrease the cost of construction.

Workgroup Recommendation

Proposal # 1469

RED1-338-22

Proponents: Amy Boyce, representing Energy Efficient Codes Coalition (EECC) (amy.boyce@imt.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

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

Portions of table not shown remain unchanged.

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 Table R402.1.2.	As proposed
	Solar absorptance = 0.75.	As proposed
	Emittance = 0.90.	As proposed
Basement and crawl space walls	Type: same as proposed.	As proposed
	Gross area: same as proposed.	As proposed
	U-factor: as specified in Table R402.1.2, with the insulation layer on the interior side of the walls.	As proposed
Above-grade floors	Type: wood frame.	As proposed
	Gross area: same as proposed.	As proposed
	U-factor: as specified in Table R402.1.2.	As proposed
Ceilings	Type: wood frame.	As proposed
	Gross area: same as proposed.	As proposed
	U-factor: as specified in Table R402.1.2.	As proposed
Roofs	Type: composition shingle on wood sheathing.	As proposed
	Gross area: same as proposed.	As proposed
	Solar absorptance = 0.75.	As proposed
	Emittance = 0.90.	As proposed
Attics	Type: vented with an aperture of 1 ft^2 per 300 ft^2 of ceiling area.	As proposed
Foundations	Type: same as proposed.	As proposed
	Foundation wall area above and below grade and soil characteristics: same as proposed.	As proposed
Opaque doors	Area: 40 ft^2.	As proposed
	Orientation: North.	As proposed
	U-factor: same as fenestration as specified in Table R402.1.2.	As proposed
Vertical fenestration other than opaque doors	Total area[h] = (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 Table R402.1.2.	As proposed
	SHGC: as specified in Table R402.1.2 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 × SHGC for the standard reference design).	Interior shade fraction: 0.92 – (0.21 × SHGC as proposed)
	External shading: none	As proposed
Skylights	None	As proposed
Thermally isolated sunrooms	None	As proposed
	The air leakage rate at a pressure of 0.2 inch w.g. (50 Pa) shall be Climate Zones 0 through 2: 5.0 air changes per hour. Climate Zones 3 , 4, and 5: 3.0 air changes per hour. Climate Zones 6 through 8: 2.5 air changes per hour.	The measured air exchange rate.[a]
	The mechanical ventilation rate shall be in addition to the air leakage rate and shall	

Air exchange rate	be the same as in the proposed design, but not greater than B x M where: B = 0.01 × CFA + 7.5 × (Nbr + 1), cfm. M = 1.0 where the measured air exchange rate is > = 3.0 air changes per hour at 50 Pascals, and otherwise, M = minimum (1.7, Q/B) Q = the proposed mechanical ventilation rate, cfm. CFA = conditioned floor area, ft2. Nbr = number of bedrooms. 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 Section R403.6.1. Heat recovery or energy recovery shall not be modeled for mechanical ventilation where not required by Section R403.6.1.	The mechanical ventilation rate[b], Q, shall be in addition to the air leakage rate and shall be as proposed.
Mechanical ventilation	Where mechanical ventilation is not specified in the proposed design: None Where mechanical ventilation is specified in the proposed design, the annual vent fan energy use, in units of kWh/yr, shall equal (8.76 × B × M)/ef where: B and M are determined in accordance with the Air Exchange Rate row of this table. e_f = the minimum fan efficacy, as specified in Table 403.6.2, corresponding to the system type at a flow rate of B × M. *CFA* = conditioned floor area, ft^2. N_{br} = number of bedrooms.	As proposed
Internal gains	IGain, in units of Btu/day per dwelling unit, shall equal 17,900 + 23.8 ×*CFA* + 4,104 × N_{br} where: *CFA* = conditioned floor area, ft^2. N_{br} = number of bedrooms.	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[c] but not integral to the building 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 Table R402.1.3, 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[d, e, j, k]	For other than electric heating without a heat pump: as proposed. 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 Section R403.7.	
	Fuel Type/Capacity: Same as proposed design	As proposed
	Product class: Same as proposed design	As proposed
	Efficiencies:	As proposed
	Heat pump: Complying with 10 CFR §430.32	As proposed
	Non-electric furnaces: Complying with 10 CFR §430.32	As proposed
	Non-electric boilers: Complying with 10 CFR §430.32	As proposed
Cooling systems[d, f, k]	As proposed. Capacity: sized in accordance with Section R403.7.	
	Fuel Type: Electric Capacity: Same as proposed design	As proposed
	Efficiencies: Complying with 10 CFR §430.32	As proposed
		As proposed Use, in units of gal/day = 25.5 + (8.5 × N_{br}) ×

<table>
<tr>
<td>Service water heating[d, g, k]</td>
<td>As proposed.
Use, in units of gal/day = 25.5 + (8.5 × N_{br})
where: N_{br} = number of bedrooms.</td>
<td>(1 – HWDS)
where:
N_{br} = number of bedrooms.
HWDS = factor for the compactness of the hot water distribution system.
<table>
<tr><td colspan="2">Compactness ratio[i] factor</td><td>HWDS</td></tr>
<tr><td>1 story</td><td>2 or more stories</td><td></td></tr>
<tr><td>> 60%</td><td>> 30%</td><td>0</td></tr>
<tr><td>> 30% to ≤ 60%</td><td>> 15% to ≤ 30%</td><td>0.05</td></tr>
<tr><td>> 15% to ≤ 30%</td><td>> 7.5% to ≤ 15%</td><td>0.10</td></tr>
<tr><td>< 15%</td><td>< 7.5%</td><td>0.15</td></tr>
</table>
</td>
</tr>
<tr><td></td><td>Fuel Type: Same as proposed design</td><td>As proposed</td></tr>
<tr><td></td><td>Rated Storage Volume: Same as proposed design</td><td>As proposed</td></tr>
<tr><td></td><td>Draw Pattern: Same as proposed design</td><td>As proposed</td></tr>
<tr><td></td><td>Efficiencies: Uniform Energy Factor complying with 10 CFR §430.32</td><td>As proposed</td></tr>
<tr><td></td><td>Tank Temperature: 120° F (48.9° C)</td><td>Same as standard reference design</td></tr>
<tr>
<td>Thermal distribution systems</td>
<td>Duct location: as proposed.
<table>
<tr><td>~~Foundation Type~~</td><td>~~Slab on grade~~</td><td>~~Unconditioned crawl space~~</td><td>~~Basement or conditioned crawl space~~</td></tr>
<tr><td>~~Duct location (supply and return)~~</td><td>~~One-story building: 100% in unconditioned attic~~

~~All other: 75% in unconditioned attic and 25% inside conditioned space~~</td><td>~~One-story building: 100% in unconditioned crawlspace~~

~~All other: 75% in unconditioned crawlspace and 25% inside conditioned space~~</td><td>~~50% inside conditioned space~~

~~50% unconditioned attic~~</td></tr>
</table>
</td>
<td>Duct location: as proposed.</td>
</tr>
<tr><td></td><td>Duct insulation: in accordance with Section R403.3.1.</td><td>Duct insulation: as proposed.</td></tr>
<tr><td></td><td>Duct system leakage to outside:
For duct systems serving > 1,000ft2 of conditioned floor area, the duct leakage to outside rate shall be 4 cfm (113.3 L/min) per 100 ft2 (9.29 m2) of conditioned floor area.
For duct systems serving ≤ 1,000ft2 of conditioned floor area, the duct leakage to outside rate shall be 40 cfm (1132.7 L/min).</td>
<td>Duct System Leakage to Outside: The measure total duct system leakage rate shall be entered into the software as the duct system leakage to outside rate.
Exceptions:
<table>
<tr><td>1.</td><td>When duct system leakage to outside is tested in accordance ANSI/ RESNET/ICC 380 or ASTM E1554, the measured value shall be permitted to be entered.</td></tr>
<tr><td>2.</td><td>When total duct system leakage is measured without the air handler installed, the simulation value shall be 4 cfm (113.3 L/min) per 100 ft^2 (9.29 m^2) of conditioned floor area.</td></tr>
</table>
</td></tr>
<tr><td></td><td>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.</td><td>For hydronic systems and ductless systems, DSE shall be as specified in Table R405.4.2(2).</td></tr>
<tr><td>Thermostat</td><td>Type: Manual, cooling temperature setpoint = 75°F;
Heating temperature setpoint = 72°F.</td><td>Same as standard reference design.</td></tr>
<tr><td>Dehumidistat</td><td>Where a mechanical ventilation system with latent heat recovery is not specified in the proposed design: None. Where the proposed design utilizes a mechanical ventilation system with latent heat recovery:
Dehumidistat type: manual, setpoint = 60% relative humidity.
Dehumidifier: whole-dwelling with integrated energy factor = 1.77 liters/kWh.</td><td>Same as standard reference design.</td></tr>
</table>

	Dehumidifier: whole-dwelling with integrated energy factor = 1.77 liters/kWh	

For SI: 1 square foot = 0.93 m^2, 1 British thermal unit = 1055 J, 1 pound per square foot = 4.88 kg/m^2, 1 gallon (US) = 3.785 L, °C = (°F-32)/1.8, 1 degree = 0.79 rad.

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.

g. For a proposed design the following assumptions shall be made for both the proposed design and standard reference design.

   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 §130.32

h. For residences with conditioned basements, R-2 and R-4 residences, and for townhouse units, 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.

i. 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 Table R405.4.2(1), the standard reference design shall be the same as proposed design.

Reason: This proposal maintains the efficiency of the 2021 IECC with respect to duct location in the performance path. The 2021 IECC performance path standard reference design assumption for duct location matched the “as proposed” location – meaning that builders are neither penalized nor awarded trade-off credit for the location of the ducts. This is a very consistent and logical approach to performance path assumptions for ducts. Unlike with other building components, such as ceiling insulation or fenestration U-factors, which might be adjusted to comply with the energy code, a builder is very unlikely to redesign a home and its systems simply to increase the amount of trade-off credit in the performance path. Yet the draft 2024 IECC treats homes with 100% of ducts inside conditioned space as if duct location is a significant improvement over an arbitrary baseline, and awards unearned trade-off credit as a result. Recent DOE Residential Field Studies of Pennsylvania homes found that, on average, over 73% of supply and return ducts in homes studied are already inside conditioned space. (See https://www.energycodes.gov/sites/default/files/2022-11/Combined_Residential_Energy_Code_Field_Study_Report_Final%20v3.pdf) Yet the Public Comment Draft of the 2024 IECC sets the standard reference design at 50% inside conditioned space – creating instant trade-off credit that will be used to reduce efficiency. This will not lead to more builders designing homes with ducts inside conditioned space. It will simply retroactively award a credit to builders who were already building this way in the first place, and that credit will be used to reduce the efficiency of other building elements. Proposal REPI-122 did not include an adjustment to R405 for duct location until very late in the process, and the proponent did not include any analysis or support for the percentages applied in the baseline. Because these percentages will have a significant impact on actual building energy use, it is critical that the proponent of REPI-122 justify the specific percentages included for the foundation types. Based on analyses conducted in the context of Section R408, the potential credit for duct location could range from 4-20 points (or a 4-20% credit to trade against other building elements), irrespective of whether the ducts already would have been located inside conditioned space. A great deal of work has gone into improving the efficiency of the IECC over decades, and this change to the performance path baseline could upend much of that improvement with no technical basis. This proposal restores the duct location assumption as it is currently in the 2021 IECC in order to reduce the risk of efficiency backsliding in 2024.

Please see attached "Support Letter - EECC Comments" for a list of government representatives and organizations supporting this proposal.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This proposal neither increases nor decreases the cost of construction. This proposal restores the duct location assumption as it is in the 2021 IECC.

Attached Files

- **Support Letter - EECC Comments.pdf**
  https://energy.cdpaccess.com/proposal/1343/2645/files/download/477/

Workgroup Recommendation

RED1-339-22

Proponents: Robert Salcido, representing DOE (victor.salcido@pnnl.gov)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

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 Table R402.1.2.	As proposed
	Solar absorptance = 0.75.	As proposed
	Emittance = 0.90.	As proposed
Basement and crawl space walls	Type: same as proposed.	As proposed
	Gross area: same as proposed.	As proposed
	U-factor: as specified in Table R402.1.2, with the insulation layer on the interior side of the walls.	As proposed
Above-grade floors	Type: wood frame.	As proposed
	Gross area: same as proposed.	As proposed
	U-factor: as specified in Table R402.1.2.	As proposed
Ceilings	Type: wood frame.	As proposed
	Gross area: same as proposed.	As proposed
	U-factor: as specified in Table R402.1.2.	As proposed
Roofs	Type: composition shingle on wood sheathing.	As proposed
	Gross area: same as proposed.	As proposed
	Solar absorptance = 0.75.	As proposed
	Emittance = 0.90.	As proposed
Attics	Type: vented with an aperture of 1 ft^2 per 300 ft^2 of ceiling area.	As proposed
Foundations	Type: same as proposed.	As proposed
	Foundation wall area above and below grade and soil characteristics: same as proposed.	As proposed
Opaque doors	Area: 40 ft^2.	As proposed
	Orientation: North.	As proposed
	U-factor: same as fenestration as specified in Table R402.1.2.	As proposed
Vertical fenestration other than opaque doors	Total area[h] = (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 Table R402.1.2.	As proposed
	SHGC: as specified in Table R402.1.2 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 × SHGC for the standard reference design).	Interior shade fraction: 0.92 – (0.21 × SHGC as proposed)
	External shading: none	As proposed
Skylights	None	As proposed
Thermally isolated sunrooms	None	As proposed
	The air leakage rate at a pressure of 0.2 inch w.g. (50 Pa) shall be Climate Zones 0 through 2: 5.0 air changes per hour. Climate Zones 3 , 4, and 5: 3.0 air changes per hour. Climate Zones 6 through 8: 2.5 air changes per hour.	The measured air exchange rate.[a]
	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 B x M where:	

Air exchange rate	where: B = 0.01 × CFA + 7.5 × (Nbr + 1), cfm. M = 1.0 where the measured air exchange rate is > = 3.0 air changes per hour at 50 Pascals, and otherwise, M = minimum (1.7, Q/B) Q = the proposed mechanical ventilation rate, cfm. CFA = conditioned floor area, ft2. Nbr = number of bedrooms. 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 Section R403.6.1. Heat recovery or energy recovery shall not be modeled for mechanical ventilation where not required by Section R403.6.1.	The mechanical ventilation rate[b] , Q, shall be in addition to the air leakage rate and shall be as proposed.
Mechanical ventilation	Where mechanical ventilation is not specified in the proposed design: None Where mechanical ventilation is specified in the proposed design, the annual vent fan energy use, in units of kWh/yr, shall equal (8.76 × B × M)/ef where: B and M are determined in accordance with the Air Exchange Rate row of this table. e_f = the minimum fan efficacy, as specified in Table 403.6.2, corresponding to the system type at a flow rate of B × M. *CFA* = conditioned floor area, ft^2. N_{br} = number of bedrooms.	As proposed
Internal gains	IGain, in units of Btu/day per dwelling unit, shall equal 17,900 + 23.8 ×*CFA* + 4,104 × N_{br} where: *CFA* = conditioned floor area, ft^2. N_{br} = number of bedrooms.	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[c] but not integral to the building 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 Table R402.1.3, 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[d, e, j, k]	For other than electric heating without a heat pump: as proposed. 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 Section R403.7.	
	Fuel Type/Capacity: Same as proposed design	As proposed
	Product class: Same as proposed design	As proposed
	Efficiencies:	As proposed
	Heat pump: Complying with 10 CFR §430.32	As proposed
	Non-electric furnaces: Complying with 10 CFR §430.32	As proposed
	Non-electric boilers: Complying with 10 CFR §430.32	As proposed
Cooling systems[d, f, k]	As proposed. Capacity: sized in accordance with Section R403.7.	
	Fuel Type: Electric Capacity: Same as proposed design	As proposed
	Efficiencies: Complying with 10 CFR §430.32	As proposed
		As proposed Use, in units of gal/day = 25.5 + (8.5 × N_{br}) × (1 − *HWDS*)

<table>
<tr><td rowspan="6">Service water heating[d, g, k]</td><td>As proposed.
Use, in units of gal/day = 25.5 + (8.5 × N_{br})
where: N_{br} = number of bedrooms.</td><td>(1 − HWDS)
where:
N_{br} = number of bedrooms.
HWDS = factor for the compactness of the hot water distribution system.
<table><tr><th colspan="2">Compactness ratio[i] factor</th><th>HWDS</th></tr><tr><td>1 story</td><td>2 or more stories</td><td></td></tr><tr><td>> 60%</td><td>> 30%</td><td>0</td></tr><tr><td>> 30% to ≤ 60%</td><td>> 15% to ≤ 30%</td><td>0.05</td></tr><tr><td>> 15% to ≤ 30%</td><td>> 7.5% to ≤ 15%</td><td>0.10</td></tr><tr><td>< 15%</td><td>< 7.5%</td><td>0.15</td></tr></table></td></tr>
<tr><td>Fuel Type: Same as proposed design</td><td>As proposed</td></tr>
<tr><td>Rated Storage Volume: Same as proposed design</td><td>As proposed</td></tr>
<tr><td>Draw Pattern: Same as proposed design</td><td>As proposed</td></tr>
<tr><td>Efficiencies: Uniform Energy Factor complying with 10 CFR §430.32</td><td>As proposed</td></tr>
<tr><td>Tank Temperature: 120° F (48.9° C)</td><td>Same as standard reference design</td></tr>
<tr><td rowspan="4">Thermal distribution systems</td><td>Duct location: Conditioned Space
<table><tr><td>~~Foundation Type~~</td><td>~~Slab on grade~~</td><td>~~Unconditioned crawl space~~</td><td>~~Basement or conditioned crawl space~~</td></tr><tr><td>~~Duct location (supply and return)~~</td><td>~~One-story building: 100% in unconditioned attic~~

~~All other: 75% in unconditioned attic and 25% inside conditioned space~~</td><td>~~One-story building: 100% in unconditioned crawlspace~~

~~All other: 75% in unconditioned crawlspace and 25% inside conditioned space~~</td><td>~~50% inside conditioned space~~

~~50% unconditioned attic~~</td></tr></table></td><td>Duct location: as proposed.</td></tr>
<tr><td>Duct insulation: in accordance with Section R403.3.1.</td><td>Duct insulation: as proposed.</td></tr>
<tr><td>Duct system leakage to outside:
For duct systems serving > 1,000ft2 of conditioned floor area, the total duct system leakage ~~to outside~~ rate shall be ~~4~~ 8 cfm (113.3 L/min) per 100 ft2 (9.29 m2) of conditioned floor area.
For duct systems serving ≤ 1,000ft2 of conditioned floor area, the total duct system leakage ~~to outside~~ rate shall be ~~4~~ 80 cfm (1132.7 L/min).</td><td>Duct System Leakage to Outside: The measure total duct system leakage rate shall be entered into the software as the duct system leakage to outside rate.
Exceptions:
<table><tr><td>1.</td><td>When duct system leakage to outside is tested in accordance ANSI/ RESNET/ICC 380 or ASTM E1554, the measured value shall be permitted to be entered.</td></tr><tr><td>2.</td><td>When total duct system leakage is measured without the air handler installed, the simulation value shall be 4 cfm (113.3 L/min) per 100 ft^2 (9.29 m^2) of conditioned floor area.</td></tr></table></td></tr>
<tr><td>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.</td><td>For hydronic systems and ductless systems, DSE shall be as specified in Table R405.4.2(2).</td></tr>
<tr><td>Thermostat</td><td>Type: Manual, cooling temperature setpoint = 75°F;
Heating temperature setpoint = 72°F.</td><td>Same as standard reference design.</td></tr>
<tr><td>Dehumidistat</td><td>Where a mechanical ventilation system with latent heat recovery is not specified in the proposed design: None. Where the proposed design utilizes a mechanical ventilation system with latent heat recovery:
Dehumidistat type: manual, setpoint = 60% relative humidity.
Dehumidifier: whole-dwelling with integrated energy factor = 1.77 liters/kWh.</td><td>Same as standard reference design.</td></tr>
</table>

For SI: 1 square foot = 0.93 m^2, 1 British thermal unit = 1055 J, 1 pound per square foot = 4.88 kg/m^2, 1 gallon (US) = 3.785 L, °C = (°F-32)/1.8, 1 degree = 0.79 rad.

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.

g. For a proposed design the following assumptions shall be made for both the proposed design and standard reference design.

   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 §130.32

h. For residences with conditioned basements, R-2 and R-4 residences, and for townhouse units, 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.

i. 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 Table R405.4.2(1), the standard reference design shall be the same as proposed design.

Reason: Ducts that are located in unconditioned spaces can significantly increase energy use in the home or dwelling unit due to thermal losses and air leakage outside of the building envelope. As proposed, the 2024 IECC would credit ducts located within conditioned space. While locating ducts within conditioned space is indeed best practice, there is a problem in how R405, as proposed, would handle ducts, effectively crediting every system installed *as if it would have otherwise been installed outside of conditioned space.* The consequences of this approach can be severe and were not sufficiently evaluated in previous committee deliberations.
Pacific Northwest National Laboratory (PNNL) has analyzed the impact of moving ducts from unconditioned space into conditioned space and found that the associated energy impact can be up to 18% of whole-building energy use, and corresponding energy costs of almost $400 per year, with the largest impacts experienced in colder climates. In addition to thermal losses, there are many other widely recognized benefits of locating ducts in conditioned space, such as lower risk of moisture issues and increased indoor air quality, among others. The following table depicts the expected energy use reductions across U.S. climate zones.

	HVAC Distribution System	CZ 1	CZ 2	CZ 3	CZ 4	CZ 5	CZ 6	CZ 7	CZ 8
	100 Percent of Ducts In Conditioned Space	3.57%	5.10%	6.65%	9.58%	12.13%	14.04%	16.13%	18.44%
	100 Percent of Ducts In Conditioned Space	$74	$88	$99	$118	$104	$155	$209	$361

The challenge of modeling duct location in performance-based approaches is that it can be difficult to credit positive behaviors (i.e., encouraging ducts to be located within conditioned space) without creating a severe false credit in areas and situations where ducts are already commonly located within conditioned space, which is heavily influenced by geographic location and other design choices (e.g., foundation type and number of floors). The issue of false credit, often referenced as *free ridership*, is especially prominent in colder climate zones. DOE field study data indicates that approximately 25% of homes commonly have 100% of their duct system installed in conditioned space. Over 50% of homes with heated basements, as are common in colder climates, had duct systems located completely within conditioned space. In these areas, the resulting credit is large enough to significantly erode the overall energy efficiency of the home, costing the home owner thousands over the life of the home. This tends to be a binding decision, as duct systems are difficult and costly to relocate after initial design and construction of the home. This challenge of properly rewarding, or penalizing, duct location is a primary reason duct location has not been credited in recent editions of the IECC. As proposed, the 2024 IECC introduces this challenge without appropriate safeguards—and to a magnitude that can dwarf other design choices.

The Committee should reconsider this approach and seek alternatives with lower risk of falsely crediting common design choices. In support of this objective, PNNL is offering two proposals which are intended to function independently or work in tandem; one which specifies ducts within conditioned space as a prescriptive requirement, and the second which addresses duct location in R405. In the latter case, ducts may still be located in unconditioned space, and comply with R405, and the associated (negative) energy impact can be offset through additional energy efficiency achieved elsewhere in the home.

Cost Impact: The code change proposal will increase the cost of construction.
The costs of a prescriptive requirement to have ducts in conditioned space can range from $0 (for the many homes that already commonly include ducts in conditioned space) to $400 for dropped ceiling strategy. A higher cost strategy where ducts are installed in a conditioned attic, which typically involves insulating and sealing the roof deck is estimated at a cost of $3,000. An average cost ranges from $1,000 to $1,300 based on previous research studies. (https://energy.gov/sites/prod/files/2014/01/f6/1_1g_ba_innov_ductsconditionedspace_011713.pdf)

Cost-effectiveness analysis, based on the approach and parameters established by the 2024 IECC development committee, indicates that locating ducts within conditioned space is cost effective across all climate zones and costs up to $1300. Associated paybacks range from 3.8 to 11.0 years, and life-cycle cost savings from $520 to $8,120.

Workgroup Recommendation

Proposal # 1477

RED1-340-22

Proponents: Shannon Corcoran, representing American Gas Association (corcoransm@att.net)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

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 Table R402.1.2.	As proposed
	Solar absorptance = 0.75.	As proposed
	Emittance = 0.90.	As proposed
Basement and crawl space walls	Type: same as proposed.	As proposed
	Gross area: same as proposed.	As proposed
	U-factor: as specified in Table R402.1.2, with the insulation layer on the interior side of the walls.	As proposed
Above-grade floors	Type: wood frame.	As proposed
	Gross area: same as proposed.	As proposed
	U-factor: as specified in Table R402.1.2.	As proposed
Ceilings	Type: wood frame.	As proposed
	Gross area: same as proposed.	As proposed
	U-factor: as specified in Table R402.1.2.	As proposed
Roofs	Type: composition shingle on wood sheathing.	As proposed
	Gross area: same as proposed.	As proposed
	Solar absorptance = 0.75.	As proposed
	Emittance = 0.90.	As proposed
Attics	Type: vented with an aperture of 1 ft^2 per 300 ft^2 of ceiling area.	As proposed
Foundations	Type: same as proposed.	As proposed
	Foundation wall area above and below grade and soil characteristics: same as proposed.	As proposed
Opaque doors	Area: 40 ft^2.	As proposed
	Orientation: North.	As proposed
	U-factor: same as fenestration as specified in Table R402.1.2.	As proposed
Vertical fenestration other than opaque doors	Total area[h] = (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 Table R402.1.2.	As proposed
	SHGC: as specified in Table R402.1.2 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 × SHGC for the standard reference design).	Interior shade fraction: 0.92 – (0.21 × SHGC as proposed)
	External shading: none	As proposed
Skylights	None	As proposed
Thermally isolated sunrooms	None	As proposed
	The air leakage rate at a pressure of 0.2 inch w.g. (50 Pa) shall be Climate Zones 0 through 2: 5.0 air changes per hour. Climate Zones 3 , 4, and 5: 3.0 air changes per hour. Climate Zones 6 through 8: 2.5 air changes per hour.	The measured air exchange rate.[a]
	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 B x M where:	

Air exchange rate	where: B = 0.01 × CFA + 7.5 × (Nbr + 1), cfm. M = 1.0 where the measured air exchange rate is > = 3.0 air changes per hour at 50 Pascals, and otherwise, M = minimum (1.7, Q/B) Q = the proposed mechanical ventilation rate, cfm. CFA = conditioned floor area, ft2. Nbr = number of bedrooms. 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 Section R403.6.1. Heat recovery or energy recovery shall not be modeled for mechanical ventilation where not required by Section R403.6.1.	The mechanical ventilation rate[b], Q, shall be in addition to the air leakage rate and shall be as proposed.
Mechanical ventilation	Where mechanical ventilation is not specified in the proposed design: None Where mechanical ventilation is specified in the proposed design, the annual vent fan energy use, in units of kWh/yr, shall equal (8.76 × B × M)/ef where: B and M are determined in accordance with the Air Exchange Rate row of this table. e_f = the minimum fan efficacy, as specified in Table 403.6.2, corresponding to the system type at a flow rate of B × M. *CFA* = conditioned floor area, ft^2. N_{br} = number of bedrooms.	As proposed
Internal gains	IGain, in units of Btu/day per dwelling unit, shall equal 17,900 + 23.8 ×*CFA* + 4,104 × N_{br} where: *CFA* = conditioned floor area, ft^2. N_{br} = number of bedrooms.	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[c] but not integral to the building 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 Table R402.1.3, 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[d, e, j, k]	For other than electric heating without a heat pump: as proposed. 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 Section R403.7.	
	Fuel Type/Capacity: Same as proposed design	As proposed
	Product class: Same as proposed design	As proposed
	Efficiencies:	As proposed
	Heat pump: Complying with 10 CFR §430.32	As proposed
	~~Non-electric~~ Natural gas, propane and fuel oil furnaces: Complying with 10 CFR §430.32	As proposed
	Non-electric Natural gas, propane and fuel oil boilers: Complying with 10 CFR §430.32	As proposed
Cooling systems[d, f, k]	As proposed. Capacity: sized in accordance with Section R403.7.	
	Fuel Type: Electric Capacity: Same as proposed design	As proposed
	Efficiencies: Complying with 10 CFR §430.32	As proposed
		As proposed Use, in units of gal/day = 25.5 + (8.5 × N_{br}) ×

<table>
<tr>
<td>Service water heating[d, g, k]</td>
<td>As proposed.
Use, in units of gal/day = 25.5 + (8.5 × N_{br})
where: N_{br} = number of bedrooms.</td>
<td>Use, in units of gal/day = 25.5 + (8.5 × N_{br}) × (1 – HWDS)
where:
N_{br} = number of bedrooms.
HWDS = factor for the compactness of the hot water distribution system.
<table>
<tr><th colspan="2">Compactness ratio[i] factor</th><th>HWDS</th></tr>
<tr><td>1 story</td><td>2 or more stories</td><td></td></tr>
<tr><td>> 60%</td><td>> 30%</td><td>0</td></tr>
<tr><td>> 30% to ≤ 60%</td><td>> 15% to ≤ 30%</td><td>0.05</td></tr>
<tr><td>> 15% to ≤ 30%</td><td>> 7.5% to ≤ 15%</td><td>0.10</td></tr>
<tr><td>< 15%</td><td>< 7.5%</td><td>0.15</td></tr>
</table>
</td>
</tr>
<tr><td></td><td>Fuel Type: Same as proposed design</td><td>As proposed</td></tr>
<tr><td></td><td>Rated Storage Volume: Same as proposed design</td><td>As proposed</td></tr>
<tr><td></td><td>Draw Pattern: Same as proposed design</td><td>As proposed</td></tr>
<tr><td></td><td>Efficiencies: Uniform Energy Factor complying with 10 CFR §430.32</td><td>As proposed</td></tr>
<tr><td></td><td>Tank Temperature: 120° F (48.9° C)</td><td>Same as standard reference design</td></tr>
<tr>
<td>Thermal distribution systems</td>
<td>Duct location:
<table>
<tr><td>Foundation Type</td><td>Slab on grade</td><td>Unconditioned crawl space</td><td>Basement or conditioned crawl space</td></tr>
<tr><td>Duct location (supply and return)</td><td>One-story building: 100% in unconditioned attic

All other: 75% in unconditioned attic and 25% inside conditioned space</td><td>One-story building: 100% in unconditioned crawlspace

All other: 75% in unconditioned crawlspace and 25% inside conditioned space</td><td>50% inside conditioned space

50% unconditioned attic</td></tr>
</table>
</td>
<td>Duct location: as proposed.</td>
</tr>
<tr><td></td><td>Duct insulation: in accordance with Section R403.3.1.</td><td>Duct insulation: as proposed.</td></tr>
<tr>
<td></td>
<td>Duct system leakage to outside:
For duct systems serving > 1,000ft2 of conditioned floor area, the duct leakage to outside rate shall be 4 cfm (113.3 L/min) per 100 ft2 (9.29 m2) of conditioned floor area.
For duct systems serving ≤ 1,000ft2 of conditioned floor area, the duct leakage to outside rate shall be 40 cfm (1132.7 L/min).</td>
<td>Duct System Leakage to Outside: The measure total duct system leakage rate shall be entered into the software as the duct system leakage to outside rate.
Exceptions:
<table>
<tr><td>1.</td><td>When duct system leakage to outside is tested in accordance ANSI/ RESNET/ICC 380 or ASTM E1554, the measured value shall be permitted to be entered.</td></tr>
<tr><td>2.</td><td>When total duct system leakage is measured without the air handler installed, the simulation value shall be 4 cfm (113.3 L/min) per 100 ft^2 (9.29 m^2) of conditioned floor area.</td></tr>
</table>
</td>
</tr>
<tr><td></td><td>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.</td><td>For hydronic systems and ductless systems, DSE shall be as specified in Table R405.4.2(2).</td></tr>
<tr><td>Thermostat</td><td>Type: Manual, cooling temperature setpoint = 75°F;
Heating temperature setpoint = 72°F.</td><td>Same as standard reference design.</td></tr>
<tr><td>Dehumidistat</td><td>Where a mechanical ventilation system with latent heat recovery is not specified in the proposed design: None. Where the proposed design utilizes a mechanical ventilation system with latent heat recovery:
Dehumidistat type: manual, setpoint = 60% relative humidity.</td><td>Same as standard reference design.</td></tr>
</table>

	Dehumidifier: whole-dwelling with integrated energy factor = 1.77 liters/kWh.	

For SI: 1 square foot = 0.93 m^2, 1 British thermal unit = 1055 J, 1 pound per square foot = 4.88 kg/m^2, 1 gallon (US) = 3.785 L, °C = (°F-32)/1.8, 1 degree = 0.79 rad.

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.

g. For a proposed design the following assumptions shall be made for both the proposed design and standard reference design.

   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 §130.32

h. For residences with conditioned basements, R-2 and R-4 residences, and for townhouse units, 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.

i. 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 Table R405.4.2(1), the standard reference design shall be the same as proposed design.

Reason: To use proper terminology for the energy source for these appliances

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This does not affect construction costs

Workgroup Recommendation

Proposal # 1309

RED1-341-22

Proponents: Amy Boyce, representing Energy Efficient Codes Coalition (EECC) (amy.boyce@imt.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

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

Portions of table not shown remain unchanged.

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 Table R402.1.2.	As proposed
	Solar absorptance = 0.75.	As proposed
	Emittance = 0.90.	As proposed
Basement and crawl space walls	Type: same as proposed.	As proposed
	Gross area: same as proposed.	As proposed
	U-factor: as specified in Table R402.1.2, with the insulation layer on the interior side of the walls.	As proposed
Above-grade floors	Type: wood frame.	As proposed
	Gross area: same as proposed.	As proposed
	U-factor: as specified in Table R402.1.2.	As proposed
Ceilings	Type: wood frame.	As proposed
	Gross area: same as proposed.	As proposed
	U-factor: as specified in Table R402.1.2.	As proposed
Roofs	Type: composition shingle on wood sheathing.	As proposed
	Gross area: same as proposed.	As proposed
	Solar absorptance = 0.75.	As proposed
	Emittance = 0.90.	As proposed
Attics	Type: vented with an aperture of 1 ft^2 per 300 ft^2 of ceiling area.	As proposed
Foundations	Type: same as proposed.	As proposed
	Foundation wall area above and below grade and soil characteristics: same as proposed.	As proposed
Opaque doors	Area: 40 ft^2.	As proposed
	Orientation: North.	As proposed
	U-factor: same as fenestration as specified in Table R402.1.2.	As proposed
Vertical fenestration other than opaque doors	Total area[h] = (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 Table R402.1.2.	As proposed
	SHGC: as specified in Table R402.1.2 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 × SHGC for the standard reference design).	Interior shade fraction: 0.92 – (0.21 × SHGC as proposed)
	External shading: none	As proposed
Skylights	None	As proposed
Thermally isolated sunrooms	None	As proposed
	The air leakage rate at a pressure of 0.2 inch w.g. (50 Pa) shall be Climate Zones 0 through 2: 5.0 air changes per hour. Climate Zones 3 , 4, and 5: 3.0 air changes per hour. Climate Zones 6 through 8: 2.5 air changes per hour.	The measured air exchange rate.[a]
	The mechanical ventilation rate shall be in addition to the air leakage rate and shall	

Air exchange rate	be the same as in the proposed design, but not greater than B x M where: B = 0.01 × CFA + 7.5 × (Nbr + 1), cfm. M = 1.0 where the measured air exchange rate is > = 3.0 air changes per hour at 50 Pascals, and otherwise, M = minimum (1.7, Q/B) Q = the proposed mechanical ventilation rate, cfm. CFA = conditioned floor area, ft2. Nbr = number of bedrooms. 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 Section R403.6.1. Heat recovery or energy recovery shall not be modeled for mechanical ventilation where not required by Section R403.6.1.	The mechanical ventilation rate[b], Q, shall be in addition to the air leakage rate and shall be as proposed.
Mechanical ventilation	Where mechanical ventilation is not specified in the proposed design: None Where mechanical ventilation is specified in the proposed design, the annual vent fan energy use, in units of kWh/yr, shall equal (8.76 × B × M)/ef where: B and M are determined in accordance with the Air Exchange Rate row of this table. e_f = the minimum fan efficacy, as specified in Table 403.6.2, corresponding to the system type at a flow rate of B × M. *CFA* = conditioned floor area, ft^2. N_{br} = number of bedrooms.	As proposed
Internal gains	IGain, in units of Btu/day per dwelling unit, shall equal 17,900 + 23.8 ×*CFA* + 4,104 × N_{br} where: *CFA* = conditioned floor area, ft^2. N_{br} = number of bedrooms.	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[c] but not integral to the building 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 Table R402.1.3, 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[d, e, j, k]	For other than electric heating without a heat pump: as proposed. 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 Section R403.7.	
	Fuel Type/Capacity: Same as proposed design	As proposed
	Product class: Same as proposed design	As proposed
	Efficiencies:	As proposed
	Heat pump: Complying with 10 CFR §430.32	As proposed
	Non-electric furnaces: Complying with 10 CFR §430.32	As proposed
	Non-electric boilers: Complying with 10 CFR §430.32	As proposed
Cooling systems[d, f, k]	As proposed. Capacity: sized in accordance with Section R403.7.	
	Fuel Type: Electric Capacity: Same as proposed design	As proposed
	Efficiencies: Complying with 10 CFR §430.32	As proposed
		As proposed Use, in units of gal/day = 25.5 + (8.5 × N_{br}) ×

<table>
<tr>
<td rowspan="6">Service water heating[d, g, k]</td>
<td>As proposed.
Use, in units of gal/day = 25.5 + (8.5 × N_{br})
where: N_{br} = number of bedrooms.</td>
<td>(1 – HWDS)
where:
N_{br} = number of bedrooms.
HWDS = factor for the compactness of the hot water distribution system.
<table>
<tr><th colspan="2">Compactness ratio[i] factor</th><th>HWDS</th></tr>
<tr><td>1 story</td><td>2 or more stories</td><td></td></tr>
<tr><td>> 60%</td><td>> 30%</td><td>0</td></tr>
<tr><td>> 30% to ≤ 60%</td><td>> 15% to ≤ 30%</td><td>0.05</td></tr>
<tr><td>> 15% to ≤ 30%</td><td>> 7.5% to ≤ 15%</td><td>0.10</td></tr>
<tr><td>< 15%</td><td>< 7.5%</td><td>0.15</td></tr>
</table>
</td>
</tr>
<tr><td>~~Fuel Type: Same as proposed design~~</td><td>~~As proposed~~</td></tr>
<tr><td>~~Rated Storage Volume: Same as proposed design~~</td><td>~~As proposed~~</td></tr>
<tr><td>~~Draw Pattern: Same as proposed design~~</td><td>~~As proposed~~</td></tr>
<tr><td>~~Efficiencies: Uniform Energy Factor complying with 10 CFR §430.32~~</td><td>~~As proposed~~</td></tr>
<tr><td>~~Tank Temperature: 120° F (48.9° C)~~</td><td>~~Same as standard reference design~~</td></tr>
<tr>
<td rowspan="4">Thermal distribution systems</td>
<td>Duct location:
<table>
<tr><td>Foundation Type</td><td>Slab on grade</td><td>Unconditioned crawl space</td><td>Basement or conditioned crawl space</td></tr>
<tr><td>Duct location (supply and return)</td><td>One-story building: 100% in unconditioned attic

All other: 75% in unconditioned attic and 25% inside conditioned space</td><td>One-story building: 100% in unconditioned crawlspace

All other: 75% in unconditioned crawlspace and 25% inside conditioned space</td><td>50% inside conditioned space

50% unconditioned attic</td></tr>
</table>
</td>
<td>Duct location: as proposed.</td>
</tr>
<tr><td>Duct insulation: in accordance with Section R403.3.1.</td><td>Duct insulation: as proposed.</td></tr>
<tr>
<td>Duct system leakage to outside:
For duct systems serving > 1,000ft2 of conditioned floor area, the duct leakage to outside rate shall be 4 cfm (113.3 L/min) per 100 ft2 (9.29 m2) of conditioned floor area.
For duct systems serving ≤ 1,000ft2 of conditioned floor area, the duct leakage to outside rate shall be 40 cfm (1132.7 L/min).</td>
<td>Duct System Leakage to Outside: The measure total duct system leakage rate shall be entered into the software as the duct system leakage to outside rate.
Exceptions:
<table>
<tr><td>1.</td><td>When duct system leakage to outside is tested in accordance ANSI/ RESNET/ICC 380 or ASTM E1554, the measured value shall be permitted to be entered.</td></tr>
<tr><td>2.</td><td>When total duct system leakage is measured without the air handler installed, the simulation value shall be 4 cfm (113.3 L/min) per 100 ft^2 (9.29 m^2) of conditioned floor area.</td></tr>
</table>
</td>
</tr>
<tr><td>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.</td><td>For hydronic systems and ductless systems, DSE shall be as specified in Table R405.4.2(2).</td></tr>
<tr><td>Thermostat</td><td>Type: Manual, cooling temperature setpoint = 75°F;
Heating temperature setpoint = 72°F.</td><td>Same as standard reference design.</td></tr>
<tr><td>Dehumidistat</td><td>Where a mechanical ventilation system with latent heat recovery is not specified in the proposed design: None. Where the proposed design utilizes a mechanical ventilation system with latent heat recovery:
Dehumidistat type: manual, setpoint = 60% relative humidity.</td><td>Same as standard reference design.</td></tr>
</table>

	Dehumidistat type: manual, setpoint = 60% relative humidity. Dehumidifier: whole-dwelling with integrated energy factor = 1.77 liters/kWh.	

For SI: 1 square foot = 0.93 m^2, 1 British thermal unit = 1055 J, 1 pound per square foot = 4.88 kg/m^2, 1 gallon (US) = 3.785 L, °C = (°F-32)/1.8, 1 degree = 0.79 rad.

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.

g. For a proposed design the following assumptions shall be made for both the proposed design and standard reference design.

   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 §130.32

h. For residences with conditioned basements, R-2 and R-4 residences, and for townhouse units, 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.

i. 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 Table R405.4.2(1), the standard reference design shall be the same as proposed design.

Reason: This proposal will help maintain the efficiency of the 2021 IECC by eliminating performance path trade-off credit for water heating efficiency. Proposal REPI-122, which added performance path trade-off credits for heating, cooling, and water heating equipment, has the potential to sharply reduce the overall efficiency of homes in the 2024 IECC. While we believe proposal REPI-122 should be reversed in its entirety, we recommend at least eliminating the performance trade-off credit for water heater efficiency. This trade-off stands out as problematic because unlike heating and cooling equipment efficiency and sizing, which can be impacted by the efficiency of the building envelope, water heating efficiency is not connected in any way to other building systems. We oppose equipment trade-offs in the performance path in general, but especially for water heating efficiency, because it makes no sense to reduce the efficiency of the envelope (impacting occupant comfort and long-term building performance) simply because a water heater operates more efficiently. Water heaters also have a much shorter useful lifetime than other building components. According to the NAHB Study of Life Expectancy of Home Components, water heaters are expected to be replaced every 10 years. While we would expect each replacement water heater to be as efficient or more efficient than the previous water heater, if water heating efficiency was used to reduce the efficiency of long-term envelope components when the home was constructed, the home will under-perform over its 70-100 year useful life. Water heating efficiency trade-offs have not been allowed in the IECC since the 2009 update, and nearly every state that has adopted the 2009 IECC or more recent edition has eliminated this trade-off. It should not be added to the 2024 IECC performance path.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This proposal will neither increase nor decrease the cost of construction. The proposal restores the water heater efficiency baseline in the performance path standard reference design as it was in the 2021 IECC.

Workgroup Recommendation

Proposal # 1344

RED1-342-22

Proponents: Mark Lyles, representing California IOUs (markl@newbuildings.org); Jennifer Amann, representing ACEEE (jamann@aceee.org); Erin Sherman, representing RMI (esherman@rmi.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

TABLE R408.2 CREDITS FOR ADDITIONAL ENERGY EFFICIENCY

Measure Number	Measure Description	Credit Value								
		Climate Zone 0 & 1	Climate Zone 2	Climate Zone 3	Climate Zone 4	Climate Zone 4C	Climate Zone 5	Climate Zone 6	Climate Zone 7	Climate Zone 8
R408.2.2(15)	Electric Ready Space Heating	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD

R408.2.2 More efficient HVAC equipment ~~performance~~ option. Heating and cooling *equipment* shall meet one or more of the following : ~~efficiencies~~
Centrally Ducted Systems:

Efficient HVAC equipment:

1. Greater than or equal to 16
2. Greater than or equal to 18 SEER (16.9 SEER2) and 14 EER (13.4 EER2) air conditioner.
3. Greater than or equal to 92 AFUE natural gas furnace.
4. Greater than or equal to 95 AFUE natural gas furnace and 15.2 SEER2 in Climate Zones 5, 6 and 7
5. Greater than or equal to 95 AFUE natural gas furnace and 16.0 SEER2 in other Climate Zones for air conditioner.
6. Greater than or equal to 95 AFUE natural gas furnace and 8.5 HSPF2/16.0 SEER2 air source heat pump.
7. Greater than or equal to 96 AFUE natural gas furnace.
8. Greater than or equal to 8.5 HSPF2/16.0 SEER2 air source heat pump.
9. Greater than or equal to 9 HSPF (7.6 HSPF2) /16 SEER (15.2 SEER2) air source heat pump.
10. Greater than or equal to 10 HSPF (8.5 HSPF2) /16SEER (15.2 SEER2) air source heat pump.
11. Greater than or equal to 3.5 COP ground source heat pump.

Ductless Systems:

12. Single Zone: 8.5 HSPF2/16.9 SEER2 variable speed air source heat pump.
13. Multi Zone: 8.5 HSPF2/16.9 SEER2 variable speed air source heat pump (Non-Ducted Indoor Units).
14. Multi Zone: 8.5 HSPF2/15.2 SEER2 variable speed air source heat pump (Ducted or Mixed Indoor Units)

Electric readiness for space heating:

15. Combustion space heating: Where a building has combustion equipment for space heating, the building shall be provided with a designated exterior location(s) in accordance with the following:

1. Natural drainage for condensate from heat pump operation or a condensate drain located within 3 feet (914 mm), and
2. A dedicated branch circuit in compliance with IRC Section E3702.11 based on heat pump space heating equipment sized in accordance with R403.7 and terminating within 3 feet (914 mm) of the location with no obstructions. Both ends of the branch circuit shall be labeled “For Future Heat Pump Space Heater.”

Reason: The objective of this modification is to encourage builders to offer homeowners the option of replacing combustion space heating with electric space heating in the future. Relatively low upfront investments in infrastructure to enable switching reduces retrofit costs for the homeowner.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
NA

Workgroup Recommendation

Proposal # 1256

RED1-343-22

Proponents: Mark Lyles, representing California IOUs (markl@newbuildings.org); Gayathri Vijayakumar, representing Steven Winter Associates, Inc. (gvijayakumar@swinter.com); Vladimir Kochkin, representing NAHB (vkochkin@nahb.org); Jennifer Amann, representing ACEEE (jamann@aceee.org)

2024 International Energy Conservation Code [RE Project]

Add new definition as follows:

BALANCED VENTILATION. Any combination of concurrently operating mechanical exhaust and mechanical supply whereby the total mechanical exhaust airflow rate is within 10 percent of the total mechanical supply airflow rate.

Revise as follows:

TABLE R408.2 CREDITS FOR ADDITIONAL ENERGY EFFICIENCY

Measure Number	Measure Description	Credit Value								
		Climate Zone 0 & 1	Climate Zone 2	Climate Zone 3	Climate Zone 4	Climate Zone 4C	Climate Zone 5	Climate Zone 6	Climate Zone 7	Climate Zone 8
R408.2.5(1)	ERV or HRV installed	TBD	TBD	TBD	TBD	TBD	TBD	0	0	0
R408.2.5(~~1~~ 2)	2 ACH50 ~~air leakage rate~~ with ERV or HRV installed	1	4	5	10	10	13	15	8	8
R408.2.5(~~2~~ 3)	2 ACH50 ~~air leakage rate~~ with ~~balanced ventilation~~ *balanced ventilation*	2	3	2	4	4	5	6	6	6
R408.2.5(~~3~~ 4)	1.5 ACH50 ~~air leakage rated~~ with ERV or HRV installed	2	4	6	12	12	15	18	11	11
R408.2.5(~~4~~ 5)	1 ACH50 ~~air leakage rate~~ with ERV or HRV installed	2	5	6	14	14	17	21	14	14

R408.2.5 Improved air sealing and efficient ventilation system option. ~~The measured air leakage rate 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 m3/min/watt) and shall not use recirculation as a defrost strategy. In addition, the ERV shall be greater than or equal to 50 percent Latent Recovery/Moisture Transfer (LRMT)~~ The measured air leakage rate and ventilation system shall meet ~~be~~ one of the following:

1. ~~Less than or equal to 2.0 ACH50, with e~~ Either an Energy Recovery Ventilator (ERV) or Heat Recovery Ventilator (HRV) installed.
2. Less than or equal to 2.0 ACH50, with either an ERV or HRV installed.
3. ~~2.~~ 3. Less than or equal to 2.0 ACH50, with *balanced ventilation* ~~as defined in Section 202 of the 2021 *International Mechanical Code*~~.
4. ~~3.~~ 4. Less than or equal to 1.5 ACH50, with either an ERV or HRV installed.
5. ~~4.~~ 5. Less than equal to 1.0 ACH50, with either an ERV or HRV installed.

In addition, for measures requiring either an ERV or HRV, ~~M~~ 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^3/min/watt) and shall not use recirculation as a defrost strategy. In addition, the ERV shall be greater than or equal to 50 percent Latent Recovery/ Moisture Transfer (LRMT).

Reason: We propose an additional efficiency option in R408.2.6. The option provides credit for installing ERV/HRV for buildings meeting prescriptive air leakage rates, as defined in Section R402.5.1.3.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
NA

Workgroup Recommendation

Proposal # 1330

RED1-344-22

Proponents: Robert Glass, representing Daikin Comfort Technologies

2024 International Energy Conservation Code [RE Project]

Revise as follows:

TABLE R408.2 CREDITS FOR ADDITIONAL ENERGY EFFICIENCY

Portions of table not shown remain unchanged.

Measure Number	Measure Description	Credit Value								
		Climate Zone 0 & 1	Climate Zone 2	Climate Zone 3	Climate Zone 4	Climate Zone 4C	Climate Zone 5	Climate Zone 6	Climate Zone 7	Climate Zone 8
R408.2.1.1(1)	≥2.5% Reduction in total UA	0	0	0	1	1	1	1	1	1
R408.2.1.1(2)	≥5% reduction in total UA	0	1	1	2	2	3	3	3	3
R408.2.1.1(3)	>7.5% reduction in total UA	0	1	2	2	2	3	3	4	4
R408.2.1.2(1)	0.22 U-factor windows	1	2	2	3	3	4	4	4	5
R408.2.1.2(2)	U-factor and SHGC for windows per Table R408.2.1	1	1	1	0	0	0	0	1	2
R408.2.1.3	Cool Roof	TBD	TBD	TBD	TBD	TBD	0	0	0	0
R408.2.2(1)	High performance cooling system option 1	~~TBD~~ 0	~~TBD~~ 0	~~TBD~~ 0	~~TBD~~ 0	TBD	TBD	TBD	TBD	TBD
R408.2.2(2)	High performance cooling system option 2	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(3)	High performance gas furnace option 1	TBD	TBD	TBD	TBD	~~TBD~~ 0	~~TBD~~ 0	~~TBD~~ 0	~~TBD~~ 0	~~TBD~~ 0
R408.2.2(4)	High performance gas furnace and cooling system option ~~2~~ 1	0	0	0	0	TBD~~0~~	TBD	TBD	TBD	TBD~~0~~
R408.2.2(5)	High performance gas furnace and cooling system option 2	TBD	TBD	TBD	TBD	~~TBD~~ 0	0	0	0	~~TBD~~ 0
R408.2.2(6)	High performance gas furnace and heat pump system option 1	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(7)	High performance gas furnace and heat pump system option 2	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(~~7~~ 8)	High performance gas furnace option 2	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(~~8~~ 9)	High performance heat pump system option 1	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(~~9~~ 10)	High performance heat pump system option 2	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
~~R408.2.2(10)~~	~~High performance heat pump system option 3~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~
R408.2.2(11)	Ground source heat pump	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
~~R408.2.2(12)~~	~~Ductless - Single zone~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~
~~R408.2.2(13)~~	~~Ductless - Multizone (Non-ducted indoor unit)~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~
~~R408.2.2(14)~~	~~Ductless – Multizone (Ducted or Mixed)~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~
R408.2.3(1)	Gas-fired storage water heaters	7	6	5	3	3	2	2	3	1
R408.2.3(2)	Gas-fired instantaneous water heaters	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.3(3)	Electric water heaters	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.3(4)	Electric water heaters	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.3(5)	Solar hot water heating system	4	5	6	6	6	6	5	5	4
R408.2.3(6)	Compact hot water distribution	2	2	2	2	2	2	2	2	2
R408.2.4(1)	More efficient distribution system	4	6	7	10	10	12	13	15	16
R408.2.4(2)	100% of ducts in conditioned space	4	6	8	12	12	15	17	19	20
R408.2.4(3)	Reduced total duct leakage	1	1	1	1	1	1	2	2	2
[illegible]	2 ACH50 air leakage rate with ERV or	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

R408.2.5(1)	HRV installed	1	4	5	10	10	13	15	8	8
R408.2.5(2)	2 ACH50 air leakage rate with balanced ventilation	2	3	2	4	4	5	6	6	6
R408.2.5(3)	1.5 ACH50 air leakage rated with ERV or HRV installed	2	4	6	12	12	15	18	11	11
R408.2.5(4)	1 ACH50 air leakage rate with ERV or HRV installed	2	5	6	14	14	17	21	14	14
R408.2.6	Energy efficient appliances	9	8	8	7	7	5	5	5	4
R408.2.7	Renewable energy measures	17	16	17	11	11	9	8	7	4
R408.2.9	Demand responsive thermostat	1	1	1	1	1	1	1	1	1

R408.2.2 More efficient HVAC equipment performance option. Heating and cooling *equipment* shall meet one of the following efficiencies : ~~Centrally Ducted Systems:~~

1. Greater than or equal to 16.0 SEER2 air conditioner.

2. Greater than or equal to ~~18 SEER (~~16.9 SEER2~~) and 14 EER (13.4 EER2)~~ air conditioner.

3. Greater than or equal to 92 AFUE natural gas furnace.

4. Greater than or equal to 95 AFUE natural gas furnace and ~~15.2~~ 16.0 SEER2 air conditioner ~~in Climate Zones 5, 6 and 7~~

5. Greater than or equal to 9~~5~~ 2 AFUE natural gas furnace and ~~16.0~~ 16.9 SEER2 air conditioner ~~in other Climate Zones for air conditioner~~.

6. Greater than or equal to 95 AFUE natural gas furnace and 8.~~5~~ 1 HSPF2/16.0 SEER2 air source heat pump.

7. Greater than or equal to 95 AFUE natural gas furnace and 8.5 HSPF2/16.9 SEER2 air source heat pump.

~~7.~~ 8. Greater than or equal to 9~~6~~ 5 AFUE natural gas furnace.

~~8.~~ 9. Greater than or equal to 8.~~5~~ 1 HSPF2/16.0 SEER2 air source heat pump.

~~9.~~ 10. Greater than or equal to ~~9~~ 8.5 ~~HSPF (7.6~~ HSPF2~~)~~ /16 .9 ~~SEER (15.2~~ SEER2~~)~~ air source heat pump.

~~10. Greater than or equal to 10 HSPF (8.5 HSPF2) /16SEER (15.2 SEER2) air source heat pump.~~

11. Greater than or equal to 3.5 COP ground source heat pump.

~~Ductless Systems:~~

~~12. Single Zone: 8.5 HSPF2/16.9 SEER2 variable speed air source heat pump.~~

~~13. Multi Zone: 8.5 HSPF2/16.9 SEER2 variable speed air source heat pump (Non-Ducted Indoor Units).~~

~~14. Multi Zone: 8.5 HSPF2/15.2 SEER2 variable speed air source heat pump (Ducted or Mixed Indoor Units)~~

Reason: The changes in Table R408.2 reflect the changes noted in Section 408.2.2 as a part of this Public Comment. The values in the table corresponding to each of these credits needs to be populated by PNNL for public review as some of these options may change based on the simulations conducted by PNNL. No need to distinguish between Centrally Ducted and Ductless products in this section, both title have been deleted.
R408.2.2(1) - This item was not complete in the Public Review Draft #1 and this proposal completes the thought. Recommend using a higher SEER2 rated air conditioner than current Energy Star levels as they will probably increase by +1 SEER (eg. 15.2 SEER2 to 16.0 SEER2) with the minimum efficiency levels going +1 SEER effective 1/1/2023. This is within the time period that the 2024 IECC will be adopted.

R408.2.2(2) - SEER/EER/HSPF are no longer active after 1/1/2023 (for newly manufactured products), so SEER2/EER2/HSPF2 should ONLY be shown. EER/EER2 values potentially restrict more efficient options and are primarily used for peak load determination by utilities – not directly related to measuring efficiency levels that consumers can make effective selections from. Higher EER/EER2 values require more refrigerant charge and this is counter-productive to GHG reduction goals. Recommend removing EER requirements from the products covered in this HVAC section.

R408.2.2(3) - No changes

R408.2.2(4) - Gas furnace/air conditioner option should match furnace alone and air conditioner alone options as noted. (colder climate zones). Recommend using a higher SEER2 rated air conditioner as the Energy Star levels will probably increase by +1 SEER (eg. 15.2 SEER2 to 16.0 SEER2) with the minimum efficiency levels going +1 SEER effective 1/1/2023. This is within the time period that the 2024 IECC will be adopted.

R408.2.2(5) - Gas furnace/air conditioner option should match furnace alone and air conditioner alone options as noted. (warmer climate zones). Recommend using a higher SEER2 rated air conditioner as the Energy Star levels will probably increase by +1 SEER (eg. 15.2 SEER2 to 16.0 SEER2) with the minimum efficiency levels going +1 SEER effective 1/1/2023. This is within the time period that this IECC will be adopted.

R408.2.2(6) - Since it is extremely unlikely that a customer in the warmer climate zones will install BOTH a gas furnace and heat pump, this dual-fuel option is only being addressed for colder climate zones – Tier 1.

New R408.2.2(7) - Added this option to create a Tier 2 option using a higher efficiency heat pump. Since it is extremely unlikely that a customer in the warmer climate zones will install BOTH a gas furnace and heat pump, this dual-fuel option is only being addressed for colder climate zones – Tier 2.

R408.2.2(8) - 95 AFUE furnace recommended as this equates to current Energy Star level. While it is true that DOE looks to finalize a new ECS for gas furnaces at a level of 95 AFUE, this will not come into effect until late 2028 or early 2029 (~5 years after being published in the Federal Register). As such, minimum efficiency models will continue to be sold until that time. The next code cycle of the IECC (2027) can address efficiency levels of gas furnaces better at that time to reflect the changes in minimum efficiency and potential Energy Star changes.

R408.2.2(9) - Matches air source heat pump levels from #6 as Tier 1.

R408.2.2(10) - Matches air source heat pump level from #7 as Tier 2.

Old R408.2.2(10) - Delete in its entirety as there is no reason to include a Tier 3.

R408.2.2(11) - No changes

R408.2.2(12) - Delete in its entirety as Ductless heat pumps are adequately address through the air source heat pump option 1 and 2.

R408.2.2(13) - Delete in its entirety as Ductless heat pumps are adequately address through the air source heat pump option 1 and 2.

R408.2.2(14) - Delete in its entirety as Ductless heat pumps are adequately address through the air source heat pump option 1 and 2.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This proposal will not increase nor decrease the cost of construction as this purely addresses above code credits.

Workgroup Recommendation

RED1-345-22

Proponents: Douglas Presley, representing Dandelion Energy (dpresley@dandelionenergy.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

TABLE R408.2 CREDITS FOR ADDITIONAL ENERGY EFFICIENCY

Portions of table not shown remain unchanged.

Measure Number	Measure Description	Credit Value								
		Climate Zone 0 & 1	Climate Zone 2	Climate Zone 3	Climate Zone 4	Climate Zone 4C	Climate Zone 5	Climate Zone 6	Climate Zone 7	Climate Zone 8
R408.2.2(11)	Ground source heat pump	~~TBD~~ 9	~~TBD~~ 9	~~TBD~~ 8	~~TBD~~ 8	~~TBD~~ 8	~~TBD~~ 10	~~TBD~~ 13	~~TBD~~ 13	~~TBD~~ 13

Reason: Section R408 requires that residential buildings following the prescriptive pathway (Section R401.2.2) must incorporate at least two additional efficiency measures, for a total of at least 10 credits, as detailed in Table R408.2. The values for heating and cooling systems are left as "TBD" in the public comment draft, and the Residential Consensus Committee should ensure that the final draft provides geothermal heat pump systems with sufficient credits across all climate zones to adequately reflect their energy efficiency value. Based on other systems currently reflected in the table, Dandelion recommends the above values for geothermal heat pumps in Table 408.2.

Geothermal heat pump systems have a critical role to play in driving energy efficiency and transitioning to an economy run on clean energy, as geothermal is among the most efficient ways to heat and cool buildings, according to the U.S. Environmental Protection Agency. It is also the lowest operating cost way for homeowners to heat and cool their homes. As such, geothermal heat pumps represent a key technology for advancing energy affordability and value. Geothermal heat pump systems have the potential to reduce energy usage in new construction residential homes by over 70%.
These values would appropriately credit geothermal heat pumps for the significant energy savings as compared to other measures such as Energy Efficient Appliances (R408.2.6, 4-9 credits), Solar Hot Water Heating System (R408.2.3(5), 4-6 credits), and placing ducts in conditioned space (R408.2.4(2), 4-20 credits).

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
No impact on cost.

Workgroup Recommendation

Proposal # 1264

RED1-346-22

Proponents: Steven Rosenstock, representing Edison Electric Institute (srosenstock@eei.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R408.2.2 More efficient HVAC equipment performance option. Heating and cooling *equipment* shall meet one of the following efficiencies
Centrally Ducted Systems:

1. Greater than or equal to 16
2. Greater than or equal to 18 SEER (16.9 SEER2) and 14 EER (13.4 EER2) air conditioner.
3. Greater than or equal to 92 AFUE natural gas furnace.
4. Greater than or equal to 95 AFUE natural gas furnace and 15.2 SEER2 in Climate Zones 5, 6 and 7
5. Greater than or equal to 95 AFUE natural gas furnace and 16.0 SEER2 in other Climate Zones for air conditioner.
6. Greater than or equal to 95 AFUE natural gas furnace and 8.5 HSPF2/16.0 SEER2 air source heat pump.
7. Greater than or equal to 96 AFUE natural gas furnace.
8. Greater than or equal to 8.5 HSPF2/16.0 SEER2 air source heat pump.
9. Greater than or equal to 9 HSPF (7.6 HSPF2) /16 SEER (15.2 SEER2) air source heat pump.
10. Greater than or equal to 10 HSPF (8.5 HSPF2) /16SEER (15.2 SEER2) air source heat pump.
11. Greater than or equal to 3.5 COP <u>/ 16.0 EER</u> ground source heat pump.

Ductless Systems:

12. Single Zone: 8.5 HSPF2/16.9 SEER2 variable speed air source heat pump.
13. Multi Zone: 8.5 HSPF2/16.9 SEER2 variable speed air source heat pump (Non-Ducted Indoor Units).
14. Multi Zone: 8.5 HSPF2/15.2 SEER2 variable speed air source heat pump (Ducted or Mixed Indoor Units)

Reason: As shown on the following web sites:
https://www.energystar.gov/products/heating_cooling/heat_pumps_geothermal/key_product_criteria
https://www.energystar.gov/products/energy_star_most_efficient_2020/geothermal_heat_pumps
https://www.sobieskiinc.com/blog/cop-and-eer-how-geothermal-system-efficiency-measured/
The efficiency of high-efficiency ground source heat pumps can vary significantly for heating COP (3.0 to over 5.0) and cooling EER (13 to well over 30). For this credit, it is suggested to present a cooling efficiency minimum value and align it with the minimum value shown for any type of Energy Star unit shown on the EPA Energy Star web site.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
A significant percentage or majority of ground source heat pumps already meet this criteria.

Workgroup Recommendation

Proposal # 1427

RED1-347-22

Proponents: Mark Lyles, representing California IOUs (markl@newbuildings.org); Jennifer Amann, representing ACEEE (jamann@aceee.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R408.2.2 More efficient HVAC equipment performance option. Heating and cooling *equipment* shall meet one of the following efficiencies: ~~Centrally Ducted Systems:~~

1. Greater than or equal to ~~95 AFUE natural gas furnace and 16 SEER (15.2 SEER2) and 12 EER (11.5 EER2) air conditioner.~~ 15.2 SEER2 air conditioner.

2. Greater than or equal to ~~18 SEER (~~16.9 SEER2~~) and 14 EER (13.4 EER2)~~ air conditioner.

~~3.~~ ~~Greater than or equal to 92 AFUE natural gas furnace.~~

~~4~~ 3. Greater than or equal to ~~95~~ 96 AFUE natural gas furnace and 15.2 SEER2 in Climate Zones 5, 6 and 7

~~5~~ 4. Greater than or equal to ~~95~~ 96 AFUE natural gas furnace and 16.0 SEER2 in other Climate Zones for air conditioner.

~~6~~ 5. Greater than or equal to ~~95~~ 96 AFUE natural gas furnace and 8.5 HSPF2~~/~~ and 16.0 SEER2 air source heat pump.

~~7~~ 6. Greater than or equal to 96 AFUE natural gas furnace.

~~8.~~ ~~Greater than or equal to 8.5 HSPF2/16.0 SEER2 air source heat pump.~~

~~9~~ 7. Greater than or equal to ~~9 HSPF (7.6~~ 8.1 HSPF2~~) /~~ and ~~16 SEER (~~15.2 SEER2~~)~~ air source heat pump.

8. Greater than or equal to 8.5 HSPF2 and 15.2 SEER2 air source heat pump.

~~10~~ 9. Greater than or equal to ~~10 HSPF (~~8.5 HSPF2~~) /~~ and ~~1618 SEER (15.2~~ 16.9 SEER2~~)~~ air source heat pump.

10. Greater than or equal to 8.5 HSPF2 and 18.7 SEER2 air source heat pump.

11. Greater than or equal to 3.5 COP ground source heat pump.

~~Ductless Systems:~~

~~12. Single Zone: 8.5 HSPF2/16.9 SEER2 variable speed air source heat pump.~~

~~13. Multi Zone: 8.5 HSPF2/16.9 SEER2 variable speed air source heat pump (Non-Ducted Indoor Units).~~

~~14. Multi Zone: 8.5 HSPF2/15.2 SEER2 variable speed air source heat pump (Ducted or Mixed Indoor Units)~~

Reason:

1. Public Comment Draft #1, Options 1 and 2: Add an air condition only option for climate zones with limited heating hours. Table R408.2 “Credits for Additional Energy Efficiency” will only include points for the relevant climate zones.
2. Public Comment Draft #1 Option 3: Remove Option 3 as the proposed level of 92 AFUE is below the minimum Energy Conservation Standard (ECS) proposed in DOE’s current consumer furnace rulemaking which DOE agreed to wrap up by September 2023. The intention of R408 is to go beyond minimum performance and thus we cannot support levels that are likely below levels under consideration for minimum ECS.
3. Public Comment Draft #1 Options 4, 5 and 6: Update gas furnace efficiency from 95 AFUE to 96 AFUE to keep the option above DOE minimum levels, which are expected to be set at 95 AFUE.
4. Public Comment Draft #1 Option 7: No change is proposed. We note that the intention of this option is to credit high performance furnaces in furnace only applications in climate zones with limited cooling hours. Table R408.2 “Credits for Additional Energy Efficiency” will only include points for the relevant climate zones.
5. Public Comment Draft #1 Option 8: Overall, we recommend simplifying the HVAC options offered in Section R408.2.2 by making all options technology neutral and removing the delineation between centrally ducted and ductless systems. Since the energy modeling analysis does not account for duct configurations, energy savings or points will not vary across these technology types. Specifically related to Public Comment Draft #1 Option 8, we propose to merge this option (8.5 HSPF2 and 16 SEER2 multi-zone , centrally ducted air source heat pump) with Public Comment Draft #1 Option 14 (8.5 HSPF2 and 15.2 SEER2 variable speed heat pump for multi-zone ductless applications) such that the proposed Option 8 is technology neutral and aligns with Energy Star levels of 8.5 HSPF2 and 15.2 SEER2 for Heat Pump Split (Non-Ducted) system.
6. Public Comment Draft #1 Option 9: Update Public Comment Draft #1 Option 9, proposed Option 7, from 7.6 HSPF2 and 15.2 SEER2 to 8.1 HSPF2 and 15.2 SEER2 to align with Energy Star ducted cold climate heat pump levels established in Specification v. 6.1(revised January 2022, effective January 1, 2023).
7. Proposed Option 8: See note 5.
8. Public Comment Draft #1 Option 10: Update Public Comment Draft #1 Option 10 from 8.5 HSPF2/15.2 SEER2 to 8.5 HSPF2/16.9 SEER2 to offer an intermediate option for air source heat pump between proposed Options 8 and 10.
9. Proposed Option 10: Introduce an additional option 8.5 HSPF2 and 18.7 SEER2 to align withEnergy Star Most Efficient levels for Ductless CAC or heat pumps(effective January 1, 2023).

10. Public Comment Draft #1 Option 12, 13 and 14: Remove Public Comment Draft Options 12, 13 and 14. See note 5. The efficiency levels in Public Comment Draft Options 12 and 13 are reflected in the updated Public Comment Draft #1 Option 10.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
NA

Workgroup Recommendation

Proposal # 1062

RED1-348-22

Proponents: Douglas Presley, representing Dandelion Energy (dpresley@dandelionenergy.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R408.2.2 More efficient HVAC equipment performance option. Heating and cooling *equipment* shall meet one of the following efficiencies
~~Centrally Ducted Systems:~~

1. Greater than or equal to 16
2. Greater than or equal to 18 SEER (16.9 SEER2) and 14 EER (13.4 EER2) air conditioner.
3. Greater than or equal to 92 AFUE natural gas furnace.
4. Greater than or equal to 95 AFUE natural gas furnace and 15.2 SEER2 in Climate Zones 5, 6 and 7
5. Greater than or equal to 95 AFUE natural gas furnace and 16.0 SEER2 in other Climate Zones for air conditioner.
6. Greater than or equal to 95 AFUE natural gas furnace and 8.5 HSPF2/16.0 SEER2 air source heat pump.
7. Greater than or equal to 96 AFUE natural gas furnace.
8. Greater than or equal to 8.5 HSPF2/16.0 SEER2 air source heat pump.
9. Greater than or equal to 9 HSPF (7.6 HSPF2) /16 SEER (15.2 SEER2) air source heat pump.
10. Greater than or equal to 10 HSPF (8.5 HSPF2) /16SEER (15.2 SEER2) air source heat pump.
11. Greater than or equal to 3.5 COP ground source heat pump.

~~Ductless Systems:~~

12. Single Zone: 8.5 HSPF2/16.9 SEER2 variable speed air source heat pump.
13. Multi Zone: 8.5 HSPF2/16.9 SEER2 variable speed air source heat pump (Non-Ducted Indoor Units).
14. Multi Zone: 8.5 HSPF2/15.2 SEER2 variable speed air source heat pump (Ducted or Mixed Indoor Units)

Reason: Measure 408.2.2(11) currently lists ground source heat pump systems only under the "Centrally Ducted" category, while measures 408.2.2(12) through 408.2.2(14) establish HSPF2 and SEER2 requirements for ductless air source heat pump systems. New technologies for geothermal heat pumps currently offer geothermal variable refrigerant flow heat pumps for ductless systems as well, and these systems should be included as eligible measures for ductless designs. The 2024 Residential IECC should remove the distinction between ducted and ductless systems to allow more flexibility in technology options while still maintaining efficiency requirements. Removing the distinction between ducted and ductless systems would seamlessly allow for the incorporation of new technologies such as ductless geothermal systems.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
No impact on cost.

Workgroup Recommendation

Proposal # 1267

RED1-349-22 Part I

Proponents: Tom Ortiz, representing National Propane Gas Association (tortiz@npga.org); Bruce Swiecicki, representing National Propane Gas Association (bswiecicki@npga.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R408.2.2 More efficient HVAC equipment performance option. Heating and cooling *equipment* shall meet one of the following efficiencies
Centrally Ducted Systems:

1. Greater than or equal to 16
2. Greater than or equal to 18 SEER (16.9 SEER2) and 14 EER (13.4 EER2) air conditioner.
3. Greater than or equal to 92 AFUE natural <u>or propane</u> gas furnace.
4. Greater than or equal to 95 AFUE natural gas <u>or propane</u> furnace and 15.2 SEER2 in Climate Zones 5, 6 and 7
5. Greater than or equal to 95 AFUE natural <u>or propane</u> gas furnace and 16.0 SEER2 in other Climate Zones for air conditioner.
6. Greater than or equal to 95 AFUE natural <u>or propane</u> gas furnace and 8.5 HSPF2/16.0 SEER2 air source heat pump.
7. Greater than or equal to 96 AFUE natural <u>or propane</u> gas furnace.
8. Greater than or equal to 8.5 HSPF2/16.0 SEER2 air source heat pump.
9. Greater than or equal to 9 HSPF (7.6 HSPF2) /16 SEER (15.2 SEER2) air source heat pump.
10. Greater than or equal to 10 HSPF (8.5 HSPF2) /16SEER (15.2 SEER2) air source heat pump.
11. Greater than or equal to 3.5 COP ground source heat pump.

Ductless Systems:

12. Single Zone: 8.5 HSPF2/16.9 SEER2 variable speed air source heat pump.
13. Multi Zone: 8.5 HSPF2/16.9 SEER2 variable speed air source heat pump (Non-Ducted Indoor Units).
14. Multi Zone: 8.5 HSPF2/15.2 SEER2 variable speed air source heat pump (Ducted or Mixed Indoor Units)

Reason: Are LPG systems included in the definition of “natural gas”? If not, must be included.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
There will be no effect on the cost of construction.

Workgroup Recommendation

Proposal # 1261

RED1-349-22 Part II

Proponents: Tom Ortiz, representing National Propane Gas Association (tortiz@npga.org); Bruce Swiecicki, representing National Propane Gas Association (bswiecicki@npga.org)

2024 ENERGY Chapter11

Revise as follows:

N1108.2.2 More efficient HVAC equipment performance option. Heating and cooling *equipment* shall meet one of the following efficiencies
Centrally Ducted Systems:

1. Greater than or equal to 16SEER (15.2 SEER2) and 12 EER (11.5 EER2) air conditioner.
2. Greater than or equal to 18 SEER (16.9 SEER2) and 14 EER (13.4 EER2) air conditioner.
3. Greater than or equal to 92 AFUE natural or propane gas furnace.
4. Greater than or equal to 95 AFUE natural or propane gas furnace and 15.2 SEER2 in Climate Zones 5, 6 and 7.
5. Greater than or equal to 95 AFUE natural or propane gas furnace and 16.0 SEER2 in other Climate Zones for air conditioner.
6. Greater than or equal to 95 AFUE natural or propane gas furnace and 8.5 HSPF2/16.0 SEER2 air source heat pump.
7. Greater than or equal to 96 AFUE natural or propane gas furnace.
8. Greater than or equal to 8.5 HSPF2/16.0 SEER2 air source heat pump.
9. Greater than or equal to 9 HSPF (7.6 HSPF2)/16 SEER (15.2 SEER2) air source heat pump
10. Greater than or equal to 10 HSPF (8.5 HSPF2)/ 18 SEER (16.9 SEER2) air source heat pump.
11. Greater than or equal to 3.5 COP ground source heat pump.

Ductless Systems:

12. Single Zone: 8.5 HSPF2/16.9 SEER2 variable speed air source heat pump
13. Multi Zone: 8.5 HSPF2/16.9 SEER2 variable speed air source heat pump (Non-Ducted Indoor Units)
14. Multi Zone: 8.5 HSPF2/15.2 SEER2 variable speed air source heat pump (Ducted or Mixed Indoor Units)

Reason: Propane gas systems provide the same efficiencies as natural gas systems do.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
There will be no change to the cost of construction.

Workgroup Recommendation

Proposal # 1297

RED1-350-22

Proponents: Steven Rosenstock, representing Edison Electric Institute (srosenstock@eei.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R408.2.2 More efficient HVAC equipment performance option. Heating and cooling *equipment* shall meet one of the following efficiencies
Centrally Ducted Systems:

1. Greater than or equal to 16
2. Greater than or equal to 17.2 SEER2 (18 SEER) ~~(16.9 SEER2)~~ and 13.4 EER2 (14 EER) ~~(13.4 EER2)~~ air conditioner.
3. Greater than or equal to 92 AFUE natural gas furnace.
4. Greater than or equal to 95 AFUE natural gas furnace and 15.2 SEER2 (16.0 SEER) in Climate Zones 5, 6 and 7
5. Greater than or equal to 95 AFUE natural gas furnace and 16.0 SEER2 (16.8 SEER) in other Climate Zones for air conditioner.
6. Greater than or equal to 95 AFUE natural gas furnace and 8.5 HSPF2 (10.0 HSPF) /16.0 SEER2 (16.8 SEER) air source heat pump.
7. Greater than or equal to 96 AFUE natural gas furnace.
8. Greater than or equal to 8.5 HSPF2 (10.0 HSPF) /16.0 SEER2 (16.8 SEER) air source heat pump.
9. Greater than or equal to 7.6 HSPF2 (9.0 HSPF) ~~(7.6 HSPF2)~~ / 15.2 SEER2 (16.0 SEER) ~~(15.2 SEER2)~~ air source heat pump.
10. Greater than or equal to 8.5 HSPF2 (10.0 HSPF) ~~(8.5 HSPF2)~~ / 15.2 SEER2 (16.0 SEER) ~~(15.2 SEER2)~~ air source heat pump.
11. Greater than or equal to 3.5 COP ground source heat pump.

Ductless Systems:

12. Single Zone: 8.5 HSPF2/16.9 SEER2 variable speed air source heat pump.
13. Multi Zone: 8.5 HSPF2/16.9 SEER2 variable speed air source heat pump (Non-Ducted Indoor Units).
14. Multi Zone: 8.5 HSPF2/15.2 SEER2 variable speed air source heat pump (Ducted or Mixed Indoor Units)

Reason: This is an editorial change to update the placement and significant digits of efficiency values in this section, along with a correction.
As of January 1, 2023, all heat pumps manufactured for sale and use in the United States will be tested and rated for heating efficiency using the HSPF2 metric, replacing the HSPF metric. For these units, HSPF2 will be the only heating efficiency rating shown on specifications and the yellow FTC "Energy Guide" labels. On the cooling side, the only efficiency ratings shown for traditional heat pumps and air conditioners will be SEER2 and EER2, replacing SEER and EER.

Since units manufactured prior to January 1, 2023, can still be sold in the US, the proposal suggests moving EER, SEER, and HSPF values to inside the parentheses, to show that it is a secondary/backup value that could be used in certain situations.

Another option would be to just show SEER2, EER2, and HSPF2 values, since units with the older metrics will not appear on the market within 2-3 years.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This is an editorial change that has no impact on the cost of construction.

Bibliography: https://learnmetrics.com/seer2-rating-minimum-seer-rating-in-2023/
https://learnmetrics.com/hspf2-rating/

Workgroup Recommendation

RED1-351-22

Proponents: Mary Koban, representing AHRI (mkoban@ahrinet.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R408.2.2 More efficient HVAC equipment performance option. Heating and cooling *equipment* shall meet one of the following efficiencies. In situations where multiple heating or cooling systems of the same type are installed (two ducted or ductless heat pumps for example) credit shall be given for the lowest efficiency product meeting the level specified.

Centrally Ducted Systems:

1. High Performance Cooling (Option 1)-Greater than or equal to ~~16~~ 15.2 SEER2 and 12 EER2 air conditioner in all Climate Zones
2. High Performance Cooling (Option 2)-Greater than or equal to ~~18 SEER (~~16.~~9~~0SEER2~~)~~ and ~~14 EER (13.4~~ 12 EER2~~)~~ air conditioner in all Climate Zones.

3a. High Performance Gas Furnace (Option 1)- Greater than or equal to 9~~2~~ 5 % AFUE natural gas furnace in Climate Zones 4A, 4C, 5, 6, 7, and 8.

3b. High Performance Gas Furnace (Option 1)-Greater than or equal to 90% AFUE natural gas furnace in Climate Zones 0,1,2,3 and 4B

4a. High Performance Gas Furnace and Cooling (Option 1) -Greater than or equal to 95 % AFUE natural gas furnace and 15.2 SEER2 / 12 EER2 in Climate Zones 4A,4C, 5, 6 ~~and~~ 7 and 8.

4b High Performance Gas Furnace and Cooling (Option 1)- Greater than or equal to 90% AFUE natural gas furnace and 15.2 SEER2/ 10 EER2 in climate zones 0, 1, 2, 3, and 4B for air conditioner

5a. High Performance Gas Furnace and Cooling (Option 2)-Greater than or equal to 9~~5~~ 7 % AFUE natural gas furnace and 16.0 SEER2 /12 EER ~~in other Climate Zones~~ for air conditioner in Climate Zones 4A, 4C, 5,6,7 and 8.

5b. High Performance Gas Furnace and Cooling (Option 2) - Greater than or equal to 95% AFUE and 16 SEER2/10 EER2 air conditioner in climate zones 0, 1, 2, 3, and 4B

6a. High Performance Gas Fornace and HP (Option 1)- Greater than or equal to 95 % AFUE natural gas furnace and 8.~~5~~ 1 HSPF2/~~16.0~~ 15.2 SEER2 air source heat pump in Climate Zones 4A, 4C, 5,6,7,and 8.

6b. High Performance Gas Furnace and HP (Option 1) - Greater than or equal to 90% AFUE furnace and 7.8 HSPF2 / 15.2 SEER2/10.0 EER2 air source heat pump in Climate Zones 0, 1,2,3, and 4B

7a. High Performance Gas Furnace (Option 2) -Greater than or equal to 9~~6~~ 7 % in AFUE natural gas furnace inc Climate Zones 4A, 4C, 5, 6, 7 and 8.

7b High Performance Gas Furnace (Option 2)- Greater than or equal to 95% AFUE natural gas furnace in Climate Zones 0, 1, 2, 3, and 4B.

8a. High Performance HP (Option 1)-Greater than or equal to 8.~~5~~ 1 HSPF2/~~16.0~~ 15.2 SEER2 air source heat pump in Climate Zones 4A, 4C, 5, 6,7 and 8.

8b High Performance HP (Option 1)– Greater than or equal to 7.8 HSPF2/ 15.2 SEER2/ 11.7 EER2 air source heat pump in Climate Zones 0, 1, 2, 3, and 4B

9a. High Performance HP (Option 2)- Greater than or equal to ~~9 HSPF (7.6~~ 8.5 HSPF2) /~~16 SEER (~~15.2SEER2 /~~12 EER2)~~ air source heat pump in Climate Zones 4A,4C,5,6,7 and 8.

~~10.~~ 9b High Performance HP (Option 2)-Greater than or equal to ~~10 HSPF (~~8.~~5~~ 2 HSPF2 / ~~)~~ /~~16SEER (15.2~~ 16.9 SEER2 /12 EER2 ~~)~~ air source heat pump in Climate Zones 0,1,2,3, and 4B.

~~11.~~ 10. Ground source HP-Greater than or equal to 16.1 EER/ 3.~~5~~ 1 COP ground source heat pump.

Ductless Systems:

1~~2~~ 1a. Single Zone: Greater than or equal to 8.5 HSPF2/~~16.9~~ 15.2 SEER2 variable speed air source heat pump in Climate Zones 4A, 4C, 5, 6, 7 and 8.

11b. Single Zone: Greater than or equal to 7.8 HSPF2/15.2 SEER2 / 11.7 EER2 variable spped air source heat pump in climate zones 0, 1, 2, 3, and 4B.

1~~3~~ 2. Multi Zone: 8.5 HSPF2/16.9 SEER2 variable speed air source heat pump (Non-Ducted Indoor Units).

1~~4~~ 3. Multi Zone: 8.5 HSPF2/15.2 SEER2 variable speed air source heat pump (~~Ducted or~~ Mixed Indoor Units)

TABLE R408.2 CREDITS FOR ADDITIONAL ENERGY EFFICIENCY

Portions of table not shown remain unchanged.

Measure Number	Measure Description	Credit Value										
		Climate Zone 0 & 1	Climate Zone 1	Climate Zone 2	Climate Zone 3	Climate Zone 4A	Climate Zone 4B	Climate Zone 4C	Climate Zone 5	Climate Zone 6	Climate Zone 7	Climate Zone 8
R408.2.2(1)	High performance cooling system option 1	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(2)	High performance cooling system option 2	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(3a)	High performance gas furnace option 1	0	0	0	0	TBD	0	TBD	TBD	TBD	TBD	TBD
R408.2.2(3b)	High performance gas furnace option 2	TBD	TBD	TBD	TBD	0	TBD	0	0	0	0	0
R408.2.2(4a)	High peformance gas furnace and cooling option 1	0	0	0	0	TBD	0	TBD	TBD	TBD	TBD	TBD
R408.2.2(4b)	High performance gas furnace and cooling system option 21	TBD	TBD	TBD	TBD	0	TBD	0	0	0	0	0
R408.2.2(5a)	High performance gas furnace and cooling system option 2	0	0	0	0	TBD	0	TBD	TBD	TBD	TBD	TBD
R408.2.2(5b)	High performance gas furnace and cooling system option 2	TBD	TBD	TBD	TBD	0	TBD	0	0	0	0	0
R408.2.2(6a)	High performance gas furnace and heat pump system option 1	0	0	0	0	TBD	0	TBD	TBD	TBD	TBD	TBD
R408.2.2.(6b)	High performance gas furnace and HP option 1	TBD	TBD	TBD	TBD	0	TBD	0	0	0	0	0
R408.2.2(7a)	High performance gas furnace option 2	0	0	0	0	TBD	0	TBD	TBD	TBD	TBD	TBD
R408.2.2(7b)	High performance gas furnace option 2	TBD	TBD	TBD	TBD	0	TBD	0	0	0	0	0
R408.2.2(8a)	High performance heat pump system option 1	0	0	0	0	TBD	T0	TBD	TBD	TBD	TBD	TBD
R408.2.2.(8b)	High performance heat pump system option 1	TBD	TBD	TBD	TBD	0	TBD	0	0	0	0	0
R408.2.2(9a)	High performance heat pump system option 2	0	0	0	0	TBD	0	TBD	TBD	TBD	TBD	TBD
R408.2.2(9b)	High performance heat pump system option 32	TBD	TBD	TBD	TBD	0	TBD	0	0	0	0	0
R408.2.2(10)	Ground source heat pump	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(11a)	Ductless - Single zone	0	0	0	0	TBD	0	TBD	TBD	TBD	TBD	TBD
R408.2.2(11b)	Ductless Single Zone option 2	TBD	TBD	TBD	TBD	0	TBD	0	0	0	0	0
R408.2.2(12)	Ductless - Multizone (Non-ducted indoor unit)	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(13)	Ductless – Multizone (Mixed)	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD

Reason: Dear IECC Residential SC and Committee Members, we noted that Table 408.2 was difficult to update in cdpaccess. We did truncate the table and only concentrated on the HVAC portion for the submission. However, cdpaccess still did not capture our edits clearly. Therefore, we are attaching a spreadsheet (PDF) for your reference so you can see what we did. We provded more energy efficient product options by climate zones matched with potential credits.This caused us to add rows 3b, 4b, 5b, 6b, 7b, 8b, and 11b. (The concept in 9b was already captured in the original table.) We also split out Climate zones 4A, 4B, and 4C since credits are noted by granularity of climate zone 4. We also split out climate zones 0, 1 as we are still waiting for analysis from PNNL. Therefore, climate zones 0 and 1 may be different.

On August 16, 2022, President Joe Biden signed the Inflation Reduction Act (IRA) into law. The Act, which contains dozens of provisions related to

climate change and prescription drug prices, includes measures that provide federal income tax credits for high efficiency HVAC and water heater products. This proposal aligns Additional Energy Credits with the IRA, provides even more energy credits for higher-efficiency equipment, and will encourage homeowners and builders to install efficient water heater products. Therefore, AHRI members suggest to align with Energy Star product specifications and CEE tiers when defining efficiency levels for HVAC options in R408.2.2. AHRI notes that the following sections of R408.2.2 align with these sections of either Energy Star v5.0 or CEE Tier 2 or 3. AHRI members note that aligning with these options provide the industry at large multiple product options that provide energy benefits and potentially provide tax credits.
AHRI reiterates that data from PNNL was not available. Therefore, AHRI felt it was prudent to provide multiple options/scenarios to ensure energy-efficient options are available to the marketplace based on the current energy efficiency levels noted by Energy Star and CEE.

- **R408.2.2.1 –** The proposal aligns with Energy Star
- **R408.2.2.2**- The proposal aligns with CEE Tier 2
- **R408.2.2.3a**- The proposal aligns with Energy Star
- **R408.2.2.3b**- The proposal aligns with Energy Star
- **R408.2.2.4a-** The proposal aligns with Energy Star
- **R408.2.2.4b-** The proposal aligns with Modified Energy Star due to lack of exact equipment type under Energy Star
- **R408.2.2.5a-** The proposal aligns with CEE Tier 3/ CEE Tier 2
- **R408.2.2.5b-** The proposal aligns with Modified CEE Tier 2 due to lack of exact equipment type under Energy Star
- **R408.2.2.6a-** The proposal aligns with Energy Star
- **R408.2.2.6b-** The proposal aligns with Modified Energy Star due to lack of exact equipment type under Energy Star
- **R408.2.2.7a-** The proposal aligns with CEE Tier 3
- **R408.2.2.7b-** The proposal aligns with CEE Tier 2
- **R408.2.2.8a-** The proposal aligns with Energy Star
- **R408.2.2.8b-** The proposal aligns with Energy Star
- **R408.2.2.9a-** The proposal aligns with Energy Star Most Efficient
- **R408.2.2.9b-** The proposal aligns with Energy Star Most Efficient
- **R408.2.2.10**- The proposal aligns with Energy Star
- **R408.2.2.11a-** The proposal aligns with Energy Star
- **R408.2.2.11b-** The proposal aligns with Energy Star

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This code change is not expected to increase or decrease the cost of construction. This code will enable more architects, builders and consumers to use energy efficient products due to potential Tax Incentives provided by the Inflation Reduction Act. Therefore, since there are more energy efficient HVAC options available, which may shorten lead time to complete residential build, this code may actually result in decreased construction costs.

Bibliography: AHRI notes that the Tax Provisions in the Inflation Reduction Act of 2022 can be found at this link https://crsreports.congress.gov/product/pdf/R/R47202
For convenience, AHRI also provided AHRI's review of the Inflation Reduction Act.

Workgroup Recommendation

RED1-352-22

Proponents: Shannon Corcoran, representing American Gas Association (corcoransm@att.net)

2024 International Energy Conservation Code [RE Project]

Delete without substitution:

~~**R408.2.2 More efficient HVAC equipment performance option.** Heating and cooling *equipment* shall meet one of the following efficiencies~~
~~Centrally Ducted Systems:~~

1. ~~Greater than or equal to 16~~
2. ~~Greater than or equal to 18 SEER (16.9 SEER2) and 14 EER (13.4 EER2) air conditioner.~~
3. ~~Greater than or equal to 92 AFUE natural gas furnace.~~
4. ~~Greater than or equal to 95 AFUE natural gas furnace and 15.2 SEER2 in Climate Zones 5, 6 and 7~~
5. ~~Greater than or equal to 95 AFUE natural gas furnace and 16.0 SEER2 in other Climate Zones for air conditioner.~~
6. ~~Greater than or equal to 95 AFUE natural gas furnace and 8.5 HSPF2/16.0 SEER2 air source heat pump.~~
7. ~~Greater than or equal to 96 AFUE natural gas furnace.~~
8. ~~Greater than or equal to 8.5 HSPF2/16.0 SEER2 air source heat pump.~~
9. ~~Greater than or equal to 9 HSPF (7.6 HSPF2) /16 SEER (15.2 SEER2) air source heat pump.~~
10. ~~Greater than or equal to 10 HSPF (8.5 HSPF2) /16SEER (15.2 SEER2) air source heat pump.~~
11. ~~Greater than or equal to 3.5 COP ground source heat pump.~~

~~Ductless Systems:~~

12. ~~Single Zone: 8.5 HSPF2/16.9 SEER2 variable speed air source heat pump.~~
13. ~~Multi Zone: 8.5 HSPF2/16.9 SEER2 variable speed air source heat pump (Non-Ducted Indoor Units).~~
14. ~~Multi Zone: 8.5 HSPF2/15.2 SEER2 variable speed air source heat pump (Ducted or Mixed Indoor Units)~~

Reason: The proposal sets limits above those specified by the Federal Government. EPCA does not permit states to adopt levels that are either higher or lower than the Federal minimum.
The proposal limits gas-fired furnace options for new residential build.

The proposal does not guarantee energy savings.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
Reverting to the current requirements in the 2021 edition of the code will not increase or decrease the cost of construction.

Workgroup Recommendation

Proposal # 1462

RED1-353-22

Proponents: Robert OBrien, representing NORA (robrien@noraweb.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R408.2.2 More efficient HVAC equipment performance option. Heating and cooling *equipment* shall meet one of the following efficiencies
Centrally Ducted Systems:

1. Greater than or equal to 16
2. Greater than or equal to 18 SEER (16.9 SEER2) and 14 EER (13.4 EER2) air conditioner.
3. Greater than or equal to 92 AFUE natural gas furnace.
4. Greater than or equal to 95 AFUE natural gas furnace and 15.2 SEER2 in Climate Zones 5, 6 and 7
5. Greater than or equal to 95 AFUE natural gas furnace and 16.0 SEER2 in other Climate Zones for air conditioner.
6. Greater than or equal to 95 AFUE natural gas furnace and 8.5 HSPF2/16.0 SEER2 air source heat pump.
7. Greater than or equal to 96 AFUE natural gas furnace.
8. Greater than or equal to 8.5 HSPF2/16.0 SEER2 air source heat pump.
9. Greater than or equal to 9 HSPF (7.6 HSPF2) /16 SEER (15.2 SEER2) air source heat pump.
10. Greater than or equal to 10 HSPF (8.5 HSPF2) /16SEER (15.2 SEER2) air source heat pump.
11. Greater than or equal to 3.5 COP ground source heat pump.

12 Greater than or equal to 85 AFUE liquid fuel furnace rated for B20

13 Greater than or equal to 85 AFUE liquid fuel furnace rated for B20 and 15.2 SEER2 in Climate Zones 5,6 and 7

14 Greater than or equal to 85 AFUE liquid fuel furnace rated for B20 and 8.5 HSPF2/16.0 SEER2 air source heat pump

Ductless Systems:

12. Single Zone: 8.5 HSPF2/16.9 SEER2 variable speed air source heat pump.
13. Multi Zone: 8.5 HSPF2/16.9 SEER2 variable speed air source heat pump (Non-Ducted Indoor Units).
14. Multi Zone: 8.5 HSPF2/15.2 SEER2 variable speed air source heat pump (Ducted or Mixed Indoor Units)

Hydronic Systems

1. Greater than or equal to 87 AFUE liquid fuel hot water boiler rated for B20

Reason: All pathways to efficiency and carbon reduction should be options, utilizing B20 will reduce carbon output by 15%. Vastly more than incremental single digit increases in AFUE.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This proposal will have no impact on construction cost, there is no incremental cost for B20 rated appliances

Workgroup Recommendation

RED1-354-22

Proponents: Alex Smith, representing NAHB (asmith@nahb.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R408.2.3 Reduced energy use in service water-heating options. For measure numbers R408.2.3 (1) through R408.2.3 (5), the 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 (6), the hot water system shall comply with R408.2.3.1.
~~To field or plan review verify that the system meets the prescribed limit, one of the following must be done:~~

1. ~~At plan review, referencing ounces of water per foot of tube on plans as per Table R403.5.4.~~
2. ~~At rough in (plumbing), referencing ounces of water per foot of tube installed as per Table R403.5.4.~~
3. ~~At final inspection. In accordance with Department of Energy's Zero Energy Ready Home National Specification (Rev. 07 or higher) footnote on Hot water delivery systems.~~

R408.2.3.1 Compact hot water distribution. For Compact Hot Water Distribution system credit, the volume shall store not more than 16 ounces of water in the nearest source of heated water and the termination of the fixture supply pipe when calculated using section R403.5.4. When the hot water source is the nearest primed plumbing loop or trunk, this must be primed with an on-demand recirculation pump and must run a dedicated ambient return line from the furthest fixture or end of loop to the water heater. In order to claim this credit, the dwelling must have a minimum of 1.5 bathrooms.
To field or plan review, verify that the system meets the prescribed limit, one of the following must be done:

1. At plan review, referencing ounces of water per foot of tube on plans as per Table R403.5.4.~~1~~
2. At rough in (plumbing), referencing ounces of water per foot of tube installed as per Table R403.5.4.~~1~~
3. At final inspection, in accordance with Department of Energy's Zero Energy Ready Home National Specification (Rev. 07 or higher) footnote on Hot water delivery systems.

Reason: This proposal removes redundant language which already exists in Section R408.2.3.1. These additional verification requirements (Items 1-3) apply only to the compact hot water distribution measure addressed in Section R408.2.3.1. In addition, this proposal corrects a table reference.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
The change does not effect the cost of construction.

Workgroup Recommendation

Proposal # 999

RED1-355-22

Proponents: Ted Williams, representing ONE Gas (ngdllc@outlook.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

TABLE R408.2.3 Service water-heating efficiencies

Measure Number	Water Heater	Size and Draw Pattern	Type	Efficiency
R408.2.3(1)	Gas-fired storage water heaters	~~≤ 55 gallons, Medium~~	~~UEF ≥0.81~~	
≤ 55 gallons, High	UEF ≥0.86			
>55 gallons, Medium or High	UEF ≥0.86			
R408.2.3 (2)	Gas-fired instantaneous water heaters	Medium or High	UEF ≥0.95	
R408.2.3 (3)	Electric water heaters	Low, Medium, or High	Integrated HPWH	UEF ≥ 3.30
R408.2.3 (4)	Electric water heaters	Low, Medium, or High	Integrated HPWH, 120 Volt/15 Amp Circuit	UEF ≥ 2.20
Low, Medium, or High	Split-system HPWH	UEF ≥ 2.20		
R408.2.3 (5)	Solar water heaters	Electric backup	SUEF ≥ 3.00	
Gas backup	SUEF ≥ 1.80			

Reason: The AHRI Directory lists no gas-fired storage water heaters with <55 gallons DOE rated storage with a Medium draw pattern at or above 0.81 UEF rated efficiency. Rather than propose replacement specifications, clarification of the reasoning behind the proposal for the efficiency threshold for these products is sought.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
Elimination of this measure will not affect cost of construction.

Workgroup Recommendation

Proposal # 1417

RED1-356-22

Proponents: Eric Tate, representing Atmos Energy (eric.tate@atmosenergy.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

TABLE R408.2.3 Service water-heating efficiencies

Measure Number	Water Heater	Size and Draw Pattern	Type	Efficiency
R408.2.3(1)	Gas-fired storage water heaters	~~≤ 55 gallons, Medium~~	~~UEF ≥0.81~~	
≤ 55 gallons, High	UEF ≥0.86			
>55 gallons, Medium or High	UEF ≥0.86			
R408.2.3 (2)	Gas-fired instantaneous water heaters	Medium or High	UEF ≥0.95	
R408.2.3 (3)	Electric water heaters	Low, Medium, or High	Integrated HPWH	UEF ≥ 3.30
R408.2.3 (4)	Electric water heaters	Low, Medium, or High	Integrated HPWH, 120 Volt/15 Amp Circuit	UEF ≥ 2.20
Low, Medium, or High	Split-system HPWH	UEF ≥ 2.20		
R408.2.3 (5)	Solar water heaters	Electric backup	SUEF ≥ 3.00	
Gas backup	SUEF ≥ 1.80			

Reason: The AHRI Directory lists no gas-fired storage water heaters with <55 gallons DOE rated storage with a Medium draw pattern at or above 0.81 UEF rated efficiency. Rather than propose replacement specifications, clarification of the reasoning behind the proposal for the efficiency threshold for these products is sought.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
The proposed change would not affect cost of construction.

Workgroup Recommendation

Proposal # 1467

RED1-357-22

Proponents: Steven Rosenstock, representing Edison Electric Institute (srosenstock@eei.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

TABLE R408.2.3 Service water-heating efficiencies

Measure Number	Water Heater	Size and Draw Pattern	Type	Efficiency
R408.2.3(1)	Gas-fired storage water heaters	≤ 55 gallons, Medium	UEF ≥0.81	
≤ 55 gallons, High	UEF ≥0.86			
>55 gallons, Medium or High	UEF ≥0.86			
R408.2.3 (2)	Gas-fired instantaneous water heaters	All storage volumes, Medium or High	UEF ≥0.95	
R408.2.3 (3)	Electric water heaters	All storage volumes, Low, Medium, or High	Integrated HPWH	UEF ≥ 3.30
R408.2.3 (4)	Electric water heaters	All storage volumes, Low, Medium, or High	Integrated HPWH, 120 Volt/15 Amp Circuit	UEF ≥ 2.20
All storage volumes, Low, Medium, or High	Split-system HPWH	UEF ≥ 2.20		
R408.2.3 (5)	Solar water heaters All storage volumes, all draw patterns	Electric backup	SUEF ≥ 3.00	
Gas backup	SUEF ≥ 1.80			

Reason: This change is to help clarify the column of size and draw patterns for different water heaters. Currently, the table appears to be incomplete.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
These are editorial additions to a table that do not affect the cost of construction.

Workgroup Recommendation

Proposal # 1075

RED1-358-22

Proponents: Mary Koban, representing AHRI (mkoban@ahrinet.org); Mark Lyles, representing California IOUs (markl@newbuildings.org)

2024 International Energy Conservation Code [RE Project]

Delete and substitute as follows:

~~**TABLE R408.2.3 Service water-heating efficiencies**~~

~~Measure Number~~	~~Water Heater~~	~~Size and Draw Pattern~~	~~Type~~	~~Efficiency~~
~~R408.2.3(1)~~	~~Gas-fired storage water heaters~~	~~≤ 55 gallons, Medium~~		~~UEF ≥0.81~~
		~~≤ 55 gallons, High~~		~~UEF ≥0.86~~
		~~>55 gallons, Medium or High~~		~~UEF ≥0.86~~
~~R408.2.3 (2)~~	~~Gas-fired instantaneous water heaters~~	~~Medium or High~~		~~UEF ≥0.95~~
~~R408.2.3 (3)~~	~~Electric water heaters~~	~~Low, Medium, or High~~	~~Integrated HPWH~~	~~UEF ≥ 3.30~~
~~R408.2.3 (4)~~	~~Electric water heaters~~	~~Low, Medium, or High~~	~~Integrated HPWH, 120 Volt/15 Amp Circuit~~	~~UEF ≥ 2.20~~
		~~Low, Medium, or High~~	~~Split-system HPWH~~	~~UEF ≥ 2.20~~
~~R408.2.3 (5)~~	~~Solar water heaters~~		~~Electric backup~~	~~SUEF ≥ 3.00~~
			~~Gas backup~~	~~SUEF ≥ 1.80~~

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		UEF≥0.81
R408.2.3(1)(b)	Gas-fired storage water heaters (option 2)	≤ 55 gallons; Medium		UEF≥0.81
		≤ 55 gallons; High		UEF≥0.86
		>55 gallons; Medium or High		UEF≥0.86
R408.2.3(2)(a)	Gas-fired instantaneous water heaters (option 1)	Medium or High		UEF≥0.92
R408.2.3(2)(b)	Gas-fired instantaneous water heater (option 2)	Medium or High		UEF≥0.95
R408.2.3(3)(a)	Electric water heaters (option 1)	Low, Medium or High	Integrated HPWH	UEF≥3.30
R408.2.3(3)(b)	Electric water heaters (option 2)	Low, Medium or High	Integrated HPWH	UEF≥3.75
R408.2.3(4)	Electric water heaters (option 3)	Low, Medium or High	Integrated HPWH, 120 Volt/15 Amp Circuit	UEF≥2.20
R408.2.3(5)(a)	Electric water heaters (option 4)	Low, Medium or High	Split-system HPWH	UEF≥2.20
R408.2.3(5)(b)	Electric water heaters (option 5)	Low, Medium or High	Split-system HPWH	UEF≥3.75
R408.2.3(6)(a)	Solar water heaters (option 1)	_	Electric backup	SUEF≥3.00
R408.2.3(6)(b)	Solar water heaters (option 2)	_	Gas backup	SUEF≥1.80

Reason: Dear IECC Residential Sub-Committee and Committee members, please note that the cdpacess system did not allow me to edit the existing table. Therefore, I attached the code modification in track changes to this proposal. Please note we only changed a few items and not the entire table as it appears in the code proposal.
This table comes from aligning process for former code proposals (RECPI-10, REPI-18, REPI-33).

AHRI further notes that we made these changes due to new potential tax incentives. On August 16, 2022, President Joe Biden signed the Inflation Reduction Act (IRA) into law. The Act contains dozens of provisions related to climate change and prescription drug prices. It includes measures that provide federal income tax credits for high-efficiency HVAC and water heater products. This proposal aligns Additional Energy Credits with the IRA, provides even more energy credits for higher-efficiency equipment, and will encourage homeowners and builders to install efficient water heater products. Therefore, AHRI members suggest aligning with Energy Star product specifications and CEE tiers when defining efficiency levels for HVAC options in R408.2. AHRI notes that the following sections of R408.2.3 align with Energy Star and CEE tiers

R408.2.3(1)(a)- this is the proposed CEE level for all draw patterns, baseline condensing type WH. R408.2.3(1)(b)- this is aligned with Energy Star v5.0

R408.2.3(2)(a)- this is a baseline condensing level well above the minimum in the market and will probably align with utility incentives.

R408.2.3(2)(b)- this is aligned with Energy Star v5.0, but it is also important to note that this level is well above current products on the market.

R408.2.3(3)(a)-aligns with Energy Star v5.0

R408.2.3(3)(b)-aligns with CEE levels

R408.2.3(4)-aligns with both CEE levels and Energy Star v5.0

R408.2.3.(5)(a)-aligns with Energy Star v5.0

R408.2.3(5)(b)-aligns with CEE levels

R408.2.3.6(a)-aligns with Energy Star v5.0

R408.2.3.(6)-aligns with Energy Star v5.0 and may qualify for federal tax incentives

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This code change is not expected to increase or decrease the cost of construction. This code will enable more architects, builders and consumers to use energy efficient products due to potential Tax Incentives provided by the Inflation Reduction Act.

Bibliography: AHRI notes that the Tax Provisions in the Inflation Reduction Act of 2022 can be found at this link https://crsreports.congress.gov/product/pdf/R/R47202
AHRI provides the following link to Energy Star version 5.0 https://www.energystar.gov/sites/default/files/asset/document/ENERGY%20STAR%20Residential%20Water%20Heaters%20Version%205.0%20Specification%20and%20Partner%20Commitments.pdfAHRI provides the following link to the CEE Residential Water Heating Specification https://library.cee1.org/content/cee-residential-water-heating-specification/

Workgroup Recommendation

Proposal # 1228

RED1-359-22

Proponents: Greg Johnson, representing National Multifamily Housing Council (gjohnsonconsulting@gmail.com)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

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

1. ~~100 percent of~~ The ductless thermal distribution system or hydronic thermal distribution system is located completely inside the *building thermal envelope*.
2. ~~100 percent of~~ The duct thermal distribution system is located completely in *conditioned space* as defined by Section R403.3.2.
3. ~~When~~ Where ducts are located outside conditioned space, the total leakage of the ducts, measured in accordance with R403.3.5, ~~shall be in accordance with~~ is one of the following:

    3.1 Where the air handler 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^2) of conditioned floor area.

    3.2 Where the air handler 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^2) of conditioned floor area.

Reason: Editorial.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
Editorial.

Workgroup Recommendation

Proposal # 1432

RED1-360-22

Proponents: Mark Lyles, representing California IOUs (markl@newbuildings.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

TABLE R408.2.6 MINIMUM EFFICIENCY REQUIREMENTS: APPLIANCE S ~~SPECIFICATION REFERENCE DOCUMENT~~

Appliance	Efficiency Improvement	Test Procedure
Refrigerator	~~Energy Star Program Requirements, Product Specification for Consumer Refrigeration Products, Version 5.1 (08/05/2021)~~ Maximum Annual Energy Consumption (AEC), No greater than 620 kWh/yr	10 CFR 430, Subpart B, Appendix A
Dishwasher	~~Energy Star Program Requirements for Residential Dishwashers, Version 6.0 (01/29/2016)~~ Maximum Annual Energy Consumption (AEC), No greater than 270 kWh/yr	10 CFR 430, Subpart B, Appendix C1
~~Clothes dryer~~	~~Energy Star Program Requirements, Product Specification for Clothes Dryers, Version 1.1 (05/05/2017)~~	
Clothes Washer and Clothes Dryer	~~Energy Star Program Requirements, Product Specification for Clothes Washers, Version 8.1 (02/05/2018)~~ Maximum Annual Energy Consumption (AEC) for Clothes Washer [a], No greater than 130 kWh/yr, Integrated Modified Energy Factor (IMEF) > 1.84 cu.ft/kWh/cycle	10 CFR 430 Subpart B, Appendix J2 and 10 CFR 430, Subpart B, Appendices D1 and D2

a. Credit for Clothes Washer and Clothes Dryer pair is based on Clothes Washer efficiency

R408.2.6 Energy efficient appliances. Appliances installed in a dwelling unit shall meet the product energy efficiency specifications listed in Table R408.2.6, or equivalent energy efficiency specifications. Not less than three appliance types from Table R408.2.6 shall be installed for compliance with this section.

Reason: The objective of Section R408.2.5 was to encourage installation of appliances meeting ENERGY STAR criteria. Unfortunately, IECC does not allow direct reference to ENERGY STAR product specifications. The intent of the proposed change is to specify requirements which will meet the Energy Star product specification criteria in a way that is easily confirmed by a code official. Specifically, the proposed changes remove the reference to Energy Star program requirements and introduce maximum Annual Energy Consumption requirements for Refrigerators, Dishwashers and Clothes Washers and Clothes Dryers. Code officials will be able to readily confirm compliance by comparing the Annual Energy. Consumption listed on the Energy Guide label of products in the building with these maximum Annual Energy Consumption requirements.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
NA

Workgroup Recommendation

Proposal # 1067

RED1-361-22

Proponents: Steven Rosenstock, representing Edison Electric Institute (srosenstock@eei.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

RE102.1 . 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 and/or lighting that uses any fossil fuel ~~fuel gas or fuel oil~~.
EQUIPMENT. Piping, ducts, vents, control devices and other components of systems other than appliances 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.
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).

Reason: This proposed change will provide clarity and avoid confusion and conflicts between different definitions.
The term "fuel gas" has multiple definitions. The proposed definition shown (from the IMC) is different from definitions used by the US federal government. From EPA: "Fuel gas means gas generated at a petroleum refinery or petrochemical plant and that is combusted separately or in any combination with any type of gas" (source: https://www3.epa.gov/carbon-footprintcalculator/tool/definitions/fuel-gas.html).

In addition, the US Energy Information Administration defines gas as "A non-solid, non-liquid combustible energy source that includes natural gas, coke-oven gas, blast-furnace gas, and refinery gas." EIA also defines fuel oil as "A liquid petroleum product less volatile than gasoline, used as an energy source. Fuel oil includes distillate fuel oil (No. 1, No. 2, and No. 4), and residual fuel oil (No. 5 and No.6)." (source: https://www.eia.gov/tools/glossary/index.php?id=F).

Using the EPA definition "fuel gas and fuel oil" creates a narrow definition that could easily exclude appliances and equipment using natural gas, propane, coal, and gasoline equipment in many jurisdictions. Therefore, replacing the phrase with the more encompassing term of "fossil fuel" will ensure that all combustion equipment will be properly treated in this appendix.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This proposal is just updating a definition in the appendix and will not have any impact on the cost of constructing an all-electric residential building.

Workgroup Recommendation

Proposal # 1114

RED1-363-22

Proponents: **Glen Brand, representing Solar United Neighbors (glen@solarunitedneighbors.org)**

2024 International Energy Conservation Code [RE Project]

Add new definition as follows:

POTENTIAL SOLAR ZONE AREA. The combined area of any steep-sloped roofs oriented between 90 degrees and 300 degrees of true north and any low-sloped roofs where the annual solar access is 70 percent or greater.

ANNUAL SOLAR ACCESS. 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 building shall not be included in the determination of annual solar access. Shading from existing permanent natural or person-made obstructions that are external to the building, including but not limited to trees, hills, and adjacent structures, shall be considered for annual solar access calculations.

Add new text as follows:

R404.4 On-site renewable energy. The building shall comply with the requirements of R404.4.1 or R404.4.2.

R404.4.1 One- and two- family dwellings and townhouses and other R-3 Occupancies. Install an on-site renewable energy system with a nameplate DC power rating measured under standard test conditions, of no less than 2kW

Exceptions:

1. A building with a permanently installed domestic solar water heating system with a solar savings fraction of not less than 0.5.
2. A building in climate zone 4C, 5C or 8.
3. A building where the potential solar zone area is less than 300 square feet.

R404.4.2 Group R2 and R4 Occupancies. Install an on-site renewable energy system with a rated capacity of not less than 0.75 W/ft^2 multiplied by the gross conditioned floor area

Exceptions:

1. A building with a permanently installed domestic solar water heating system with a solar savings fraction of not less than 0.5.
2. A building in climate zone 8.
3. A building where the potential solar zone area is less than 300 square feet

R404.4.3 Renewable energy certificate (REC) documentation. . Where RECs are associated with renewable energy power production required by Section R404.4.1 or R404.4.2, documentation shall comply with Section R404.5.

Revise as follows:

TABLE R405.2 REQUIREMENTS FOR SIMULATED BUILDING PERFORMANCE

SECTION[a]	TITLE
General	
R401.2.5	Additional energy efficiency
R401.3	Certificate
Building Thermal Envelope	
R402.1.1	Vapor retarder
R402.2.3	Attic knee or pony wall
R402.2.4	Eave baffle
R402.2.5.1	Access hatches and doors
R402.2.9	Basement walls
R402.2.9.1	Basement wall insulation installation
R402.2.10.1	Slab-on-grade floor insulation installation
R402.2.11.1	Crawl space wall insulation installations
R402.5.1.1	Installation
R402.5.1.2	Testing
R402.5.2	Fireplaces
R402.5.3	Fenestration air leakage
R402.5.4	Room containing fuel burning applicances
R402.5.5	Recessed lighting
R402.5.6	Air-sealed electrical and communication outlet boxes
R402.6	Maximum fenestration *U*-factor and SHGC
Mechanical	
R403.1	Controls
R403.2	Hot water boiler temperature reset
R403.3	Duct systems
R403.4	Mechanical system piping insulation
R403.5 except Section R403.5.2 (staff note: this needs to be fixed with hot water pipe insulation)	Service hot water system
R403.5.2	Hot water pipe insulation
R403.6	Mechanical ventilation
R403.7, except Section R403.7.1	Equipment sizing and efficiency rating
R403.8	Systems serving multiple dwelling units
R403.9	Snow melt and ice system controls
R403.11	Energy consumption of pools and spas
R403.12	Portable spas
R403.13	Residential pools and permanent residential spas
Electrical Power and Lighting Systems	
R404.1	Lighting equipment
R404.2	Interior lighting controls
R404.4	On-site renewable energy
R404.5	Electric readiness
R404.6	Renewable energy infrastructure
R404.7	Electric Vehicle power transfer infrastructure

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

TABLE R406.2 REQUIREMENTS FOR ENERGY RATING INDEX

SECTION[a]	TITLE
General	
R401.3	Certificate
Building Thermal Envelope	
R402.1.1	Vapor retarder
R402.2.4	Eave baffle
R402.2.5.1	Access hatches and doors
R402.2.9	Basement walls
R402.2.9.1	Basement wall insulation installation
R402.2.10.1	Slab-on-grade floor insulation installation
R402.2.11.1	Crawl space wall insulation installation
R402.5.1.1	Installation
R402.5.1.2	Testing
R402.5.2	Fireplaces
R402.5.3	Fenestration air leakage
R402.5.4	Rooms containing fuel burning appliances
R402.5.5	Recessed lighting
R402.5.6	Air-sealed electrical and communication outlet boxes(air sealed boxes)
R406.3	Building thermal envelope
Mechanical	
R403.1	Controls
R403.2	Hot water boiler temperature reset
R403.3	Duct systems
R403.4	Mechanical system piping insulation
R403.5 except Section R403.5.2(staff note: this needs to be fixed with hot water pipe insulation)	Service hot water systems
R403.5.2	Hot water pipe insulation
R403.6	Mechanical ventilation
R403.7, except Section R403.7.1	Equipment sizing and efficiency rating
R403.8	Systems serving multiple dwelling units
R403.9	Snow melt and ice system controls
R403.11	Energy consumption of pools and spas
R403.12	Portable spas
R403.13	Residential pools and permanent residential spas
Electrical Power and Lighting Systems	
R404.1	Lighting equipment
R404.2	Interior lighting controls
R404.4	On-site renewable energy
R404.5	Electric readiness
R404.6	Renewable energy infrastructure
R404.7	Electric Vehicle power transfer infrastructure

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

Reason: The proposed amendment, which would require new residential buildings to be constructed with on-site renewable energy such as rooftop solar, would help build the homes that reduce greenhouse gas emissions and save consumers money.

Greatly expanding local solar and storage is the most cost-effective way to build a clean energy grid. Additionally, installing solar at the time of construction can be more cost effective for consumers.

This proposed amendment would pair strong energy efficiency standards of the IECC with on-site renewable energy that can make our electric grid more efficient while helping consumers save money on their utility bills.

The cost of rooftop solar has rapidly declined in the past decade making it more cost effective. Leading states like California already require solar on new construction, showing that solar on new construction is a cost-effective way to build homes of the future that contribute to electric bill savings and a clean resilient electric grid. New York recently proposed a solar requirement in the state's stretch code.

In order to meet the climate goals of reducing greenhouse gas emissions by 50% by 2030, policies must be put in place to make on-site renewable energy standard on new construction.

Cost Impact: The code change proposal will increase the cost of construction.
This proposal was previously found to be cost effective in all low-rise multifamily buildings and most single and one and two room townhouses according to an analysis done by PNNL.

Workgroup Recommendation

Proposal # 1497

REPCD1-1-22

Proponents: David Forde, representing PGW

2024 International Energy Conservation Code [RE Project]

SECTION R405
SIMULATED BUILDING PERFORMANCE

R405.1 Scope. This section establishes criteria for compliance using simulated building performance analysis. Such analysis shall include heating, cooling, mechanical ventilation and service water-heating energy only.

R405.2 Simulated performance compliance. Compliance based on total building performance requires that a *proposed design* meets all of the following:

1. The requirements of the sections indicated within Table R405.2.
2. The proposed total building thermal envelope UA, which is the sum of the 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 1.08 in Climate Zones 0, 1, and 2, and 1.15 in Climate Zones 3 through 8 in accordance with Equation 4-2. The area-weighted maximum fenestration SHGC permitted in Climate Zones 0 through 3 shall be 0.30.

(Equation 4-2)

$$\text{For Climate Zones 0-2: } UA_{\text{Proposed design}} \leq 1.08 \times UA_{\text{Prescriptive reference design}}$$
$$\text{For Climate Zones 3-8: } UA_{\text{Proposed design}} \leq 1.15 \times UA_{\text{Prescriptive reference design}}$$

3. For buildings without a fuel burning appliance for space heating or water heating, the annual energy cost of the proposed design that is less than or equal to 85 percent of the annual energy cost of the *standard reference design*. For buildings with a fuel burning appliance for space heating or water heating, the annual energy cost of the proposed design that is less than or equal to 80 percent of the annual energy cost of the standard reference design. For dwelling units with greater than 5,000 square feet (465 m^2) of living space floor area located above grade plane, the annual energy cost of the proposed design shall be reduced by an additional 5 percent of annual energy cost of the standard reference design. Energy prices shall be taken from a source *approved* by the *code official*, such as the Department of Energy, 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 multipliers for all energy sources shall be obtained from ASHRAE Standard 105 (Tables K2, K4, or K8) or from another data source approved by the *code official*.
    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 for an all-electric building with on-site renewable energy installed.

Reason: Simulated Building Performance – Code R405
Philadelphia Gas Works ("PGW") located in the Northeast is the largest municipally owned gas utility in the country, employing over 1,600 workers in Philadelphia and distributing natural gas for both heating and non-heating purposes to an estimated 1.6 million residents and businesses across the City (roughly 484,000 residential customers, 25,000 commercial customers and 700 industrial customer accounts.

Philadelphia is the nation's poorest big city in America with a poverty rate of roughly 23 percent or nearly 400,000 residents: disproportionately affecting black and brown communities, and vulnerable senior populations.

Philadelphian households on average spend around 6.7% of their income on energy, about double the national average, making Philadelphia one of the most energy-burdened cities in the United States.

PGW is committed to continuously working to identify and implement new opportunities for additional environmental benefits, including, increased energy efficiency and Greenhouse Gas emission reduction targets; and a diverse energy supply, providing carbon reduction opportunities to combat climate change.

However, Code R405 Simulated Building Performance challenges both Philadelphia residents' already prohibitive energy burden and housing cost burden; it also does not guarantee energy savings for end-users. Approximately 80 percent of Philadelphia relies on natural gas to heat their homes, and many are not in a financial position to cover the high costs that would be required to retrofit their homes and would not benefit from the proposed performance savings.

Cost Impact: The code change proposal will decrease the cost of construction.
Overall cost of the project will decrease without requiring upgrades from this analysis.

Workgroup Recommendation

Proposal # 1424

REPCD1-2-22

Proponents: Alisa McMahon, representing self (mcmahon.gbac@cox.net), **Anthony Floyd, representing self (antf@scottsdaleaz.gov)**

2024 International Energy Conservation Code [RE Project]

SECTION R406
ENERGY RATING INDEX COMPLIANCE ALTERNATIVE

Reason: See attached.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
Comment only.

Attached Files

- **ERI.pdf**
  https://energy.cdpaccess.com/proposal/1493/2850/files/download/495/

Workgroup Recommendation

Proposal # 1493

REPCD1-3-22

Proponents: Paul Demers, representing **Region VI Code development team (paul.a.demers@maine.gov)**

2024 International Energy Conservation Code [RE Project]

R408.1 Scope. This section establishes additional efficiency credits to achieve additional energy efficiency in accordance with Section R401.2.5.

R401.2 Application . Residential buildings shall comply witheither Sections 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.

Reason: As Section R401.2.5 is referenced in the scoping of Section R408.1 and it does not appear that Section R401.2.5 is included in the Draft #1 it will cause significant confusion. If the intent of Section R408 is to be included in the code as a more Robust option similar to a "stretch code" frequently offered in some jurisdictions, then it should be offered strictly in an Appendix format and not the main body of the code. If that is not the intent, significant explanation of its purpose should be provided/reviewed or eliminated the section R408 from the code.
Comment: ICC Council Policy 7 – Committees and Members, Section 9.1 – Scope of Work states *The work of each committee shall be:*

9.1.1 In accordance with the committee's scope and objectives statement,
9.1.2 In accordance with any instructions subsequently issued by the ICC Board, and
9.1.3 Consonant with the objectives of the ICC.

Additionally, The Scope and Intent were provided to the Committee and posted on the International Energy Conservation Code (IECC) Residential Consensus Committee webpage as the "Committee Procedures". The intent of the Residential Energy Provisions – IECC, R101.3 (page 2-3 of the Committee Procedures), and the intent of the Residential Energy Provision – Chapter 11 of the IRC, N1101.2 (page 3 of the Committee Procedures), state;

"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 non-mandatory appendices incorporating additional energy efficiency and greenhouse gas reduction resources developed by the Code Council and others."

The Goals & Objectives were also provided to the Committee and posted on the International Energy Conservation Code (IECC) Residential Consensus Committee webpage as the "Committee Procedures". The Goals & Objectives (page 3 of the Committee Procedures), state;

The goals and objectives in the "Intent" provisions above note the following for inclusion in the code:

- *Optional requirements that lead to achievement of zero energy buildings, presently, and through glidepaths that achieve zero energy buildings by 2030.*

- *The code may include non-mandatory appendices incorporating additional energy efficiency and greenhouse gas reduction resources.*

These performance objectives are intended to provide jurisdictions with an adoptable set of provisions to achieve net-zero energy by 2030.

And, the ICC Board did not issue any further instructions, but prior to the Committee work, the ICC Board did approved "LEADING THE WAY TO ENERGY EFFICIENCY A Path Forward on Energy and Sustainability to Confront a Changing Climate", which is referenced and linked in the "Committee Procedures"(Page 2). The last principle in the list of principles (located on page 5 of "LEADING THE WAY TO ENERGY EFFICIENCY A Path Forward on Energy and Sustainability to Confront a Changing Climate".) that govern the work of the committee it states:

The committee should develop supplemental requirements reflecting the diversity of energy efficiency goals made by adopting jurisdictions and the federal government. These shall include minimum requirements and optional requirements aimed at achieving zero energy buildings over multiple timeframes (e.g., through use of the current edition of the code, by 2030 and by 2050).

Furthermore, on page 7 of "LEADING THE WAY TO ENERGY EFFICIENCY A Path Forward on Energy and Sustainability to Confront a Changing Climate" it states;

Building off the success of the IECC and IgCC, the Code Council will develop a layered approach that provides communities with a menu of technical and policy resources, which integrate with the I-Codes, to address their energy efficiency and GHG reduction goals, including those goals *identified by the Energy and Carbon Advisory Council. The IECC will remain the minimum requirement.*

The <u>resources are intended to be useable independently and adopted alongside the baseline code</u> to support the policies of a community in specific areas. For example, a community could adopt the 2021 IECC with provisions from the Code Council resources developed for electric vehicles or electrification.

It is clear that the ICC Board's instructions were that provisions for electric vehicle-ready, solar renewable energy-ready and other greenhouse gas and zero energy building goals should be in supplemental, optional, non-mandatory appendices or resources, and NOT in the baseline code.

Point 1: This section requires infrastructure, but code does not require the equipment or systems that the infrastructure is to support. The intent is far-reaching, requiring all dwelling units to comply not only with this section about also Appendix CB, while providing exceptions only for those dwellings already providing the infrastructure or purchase of a <u>15 year</u> contract with a renewable energy company.

Point 2:

This section does not provide adequate minimums or maximum to guide the size and quality of the infrastructure to be provided. It does not take into account the size of the building, location, climate and microclimates, and creates a disproportional additional cost for a system the code doesn't require.

Point 3:

This section does not take into account tiny homes and other non-traditional dwellings.

Point 4

: This section does not take into account local and regional infrastructure limitations, and doesn't provide any exceptions to accommodate real-world conditions.

Cost Impact: The code change proposal will increase the cost of construction.
If Section R408 is not identified in Section R401 then it will generate confusion that may prove costly in terms of time and effort to determine its meaning. This type of confusion complicates the direction and intent of the code which is not within the scope or intent.

See Reason statement reference to ICC Board guidelines.

Workgroup Recommendation

Proposal # 1483

REPCD1-4-22

Proponents: Shannon Corcoran, representing American Gas Association (corcoransm@att.net)

2024 International Energy Conservation Code [RE Project]

TABLE R408.2 CREDITS FOR ADDITIONAL ENERGY EFFICIENCY

Reason: When will the values marked “TBD” be determined?
How will the values marked “TBD” be determined?

Who will make the determination for these values?

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
The questions are for clarification on how these values will be determined, and should not affect construction costs.

Workgroup Recommendation

Proposal # 1311

REPCD1-5-22

Proponents: Adam Berry, representing Colorado Energy Office (adam.berry@state.co.us)

2024 International Energy Conservation Code [RE Project]

TABLE R408.2 CREDITS FOR ADDITIONAL ENERGY EFFICIENCY

2024 ENERGY Chapter11

Revise as follows:

TABLE N1108.2 CREDITS FOR ADDITIONAL ENERGY EFFICIENCY

Reason: As point values have not yet been determined, I would suggest the point values for the high performance heat pump options and the electric and solar water heater options should be set at a level that would incentivize their selection over high efficiency gas or other fossil fuel systems in order to meet the additional efficiency requirements. Electric options are much more cost effective to install at construction than during future retrofits, so investments in those options should be prioritized in new buildings over gas infrastructure that will phase out over the coming years and will continue to have volatile price impacts on households as fuel prices fluctuate.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
N/A

Workgroup Recommendation

Proposal # 1334

REPCD1-6-22

Proponents: Adam Berry, representing Colorado Energy Office (adam.berry@state.co.us)

2024 International Energy Conservation Code [RE Project]

TABLE R408.2.6 APPLICANCE SPECIFICATION REFERENCE DOCUMENT

2024 ENERGY Chapter11

TABLE N1108.2.6 APPLICANCE SPECIFICATION REFERENCE DOCUMENT

Reason: Energy Star most efficient appliances, where applicable, should be required here as opposed to standard Energy Star appliances. Energy Star most efficient appliances are often not at a substantial cost differential from standard Energy Star appliances, and yet can provide significant energy savings from refrigeration, dishwashers, and clothes dryers and washers. As these measures are intended to provide further efficiency above the baseline in previous sections of the code, Energy Star most efficient appliances can provide significant energy savings over Energy Star appliances with a relatively small cost impact.

Cost Impact: The code change proposal will increase the cost of construction.
This proposal would increase the cost of construction by the amount of the cost differential between Energy Star and Energy Star most efficient appliances.

Workgroup Recommendation

Proposal # 1336

REPCD1-7-22

Proponents: David Forde, representing PGW

2024 International Energy Conservation Code [RE Project]

APPENDIX RE
ALL-ELECTRIC RESIDENTIAL BUILDINGS

Reason: Appendix RE
Philadelphia Gas Works ("PGW") located in the Northeast is the largest municipally owned gas utility in the country, employing over 1,600 workers in Philadelphia and distributing natural gas for both heating and non-heating purposes to an estimated 1.6 million residents and businesses across the City (roughly 484,000 residential customers, 25,000 commercial customers and 700 industrial customer accounts.

Philadelphia is the nation's poorest big city in America with a poverty rate of roughly 23 percent or nearly 400,000 residents: disproportionately affecting black and brown communities, and vulnerable senior populations.

Philadelphian households on average spend around 6.7% of their income on energy, about double the national average, making Philadelphia one of the most energy-burdened cities in the United States.

PGW is committed to continuously working to identify and implement new opportunities for additional environmental benefits, including, increased energy efficiency and Greenhouse Gas emission reduction targets; and a diverse energy supply, providing carbon reduction opportunities to combat climate change.

However, Appendix RE exacerbates both Philadelphia residents' already challenging energy burden and housing cost burden. Shifting natural gas consumption to sell as higher costelectricity; ormoving new construction away from gas;or incentivizing homeowners to switch toother alternativestoohastily, through policies and incentives, willforce many customers to keep their homes at unsafe temperaturesand disproportionallyleavelower income customers with steadily rising energy costs.

Cost Impact: The code change proposal will decrease the cost of construction.
Allowing for greater diversity in energy options for residential buildings allows for greater savings in construction.

Workgroup Recommendation

Proposal # 1426

REPCD1-8-22

Proponents: Paul Demers, representing **Region VI Code development team (paul.a.demers@maine.gov)**

2024 ENERGY Chapter11

N1104.6.1 One- and two- family dwellings and townhouses . One- and two-family dwellings and townhouses shall comply with Sections N1104.6.1.1 through N1104.6.1.4.
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^2) of roof area oriented between 110 degrees and 270 degrees of true north.
3. A dwelling unit with less than 500 square feet (46m^2) of roof area oriented between 110 degrees and 270 degrees of true north.
4. Dwelling units where 50 percent of the solar-ready area is shaded from direct-beam sunlight by natural objects or by structures that are not part of the building for more than 2500 annual hours between 8:00 a.m. and 4:00 p.m.
5. A dwelling unit that complies with Appendix AX.
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 whole-building electric use on an annual basis.
7. A dwelling unit less than or equal to 1,500 square feet of living space floor area located above grade plane.

N1104.6.1.1 Solar-ready zone area. The total area of the solar-ready zone shall not be less than 250 square feet (23.2 m^2) 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^2) 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^2) per dwelling shall be permitted to have a solar-ready zone area of not less than 150 square feet (14 m^2).

N1104.6.1.2 Obstructions. Solar-ready zones shall be free from obstructions, including but not limited to vents, chimneys, and roof-mounted equipment.

N1104.6.1.3 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 Solar Electric.” The reserved space shall be at the opposite (load) end of the busbar from the primary energy source.

N1104.6.1.4 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 minimum 1 inch (25 mm) nonflexible metallic conduit or permanently installed wire as approved by the code official. Where the interconnection terminates in the attic, location shall be no less than 12 inches (35 mm) above ceiling insulation. Both ends of the interconnection shall be labeled “For Future Solar Electric”.

Reason: <u>Recommendation:</u> The entire section should be removed from the body of the code to a non-mandatory appendix per Committee Procedures, and reworked to clarify how and what compliance would look like. Likewise, definitions and Section N1104.6 that coordinates with the IECC should be relocated or removed.
ICC Council Policy 7 – Committees and Members, Section 9.1 – Scope of Work states *The work of each committee shall be:*

9.1.1 In accordance with the committee's scope and objectives statement,
9.1.2 In accordance with any instructions subsequently issued by the ICC Board, and
9.1.3 Consonant with the objectives of the ICC.

Additionally, The Scope and Intent were provided to the Committee and posted on the International Energy Conservation Code (IECC) Residential Consensus Committee webpage as the “Committee Procedures”. The intent of the Residential Energy Provisions – IECC, R101.3 (page 2-3 of the Committee Procedures), and the intent of the Residential Energy Provision – Chapter 11 of the IRC, N1101.2 (page 3 of the Committee Procedures), state;

“<u>Additionally</u>, the code provides jurisdictions with <u>optional supplemental</u> 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 <u>non-mandatory appendices</u> incorporating additional energy efficiency and greenhouse gas reduction resources developed by the Code Council and others.”

The Goals & Objectives were also provided to the Committee and posted on the International Energy Conservation Code (IECC) Residential Consensus Committee webpage as the “Committee Procedures”. The Goals & Objectives (page 3 of the Committee Procedures), state;

The goals and objectives in the “Intent” provisions above note the following for inclusion in the code:

- *<u>Optional</u> requirements that lead to achievement of zero energy buildings, presently, and through glidepaths that achieve zero energy buildings by 2030.*

- *The code may include <u>non-mandatory appendices</u> incorporating additional energy efficiency and greenhouse gas reduction resources.*

These performance objectives are intended to provide jurisdictions with <u>an adoptable set</u> of provisions to achieve net-zero energy by 2030.

And, the ICC Board did not issue any further instructions, but prior to the Committee work, the ICC Board did approved “LEADING THE WAY TO ENERGY EFFICIENCY A Path Forward on Energy and Sustainability to Confront a Changing Climate”, which is referenced and linked in the “Committee Procedures”(Page 2). The last principle in the list of principles (located on page 5 of “LEADING THE WAY TO ENERGY EFFICIENCY A Path Forward on Energy and Sustainability to Confront a Changing Climate”.) that govern the work of the committee it states:

The committee should develop <u>supplemental requirements</u> reflecting the diversity of energy efficiency goals made by adopting jurisdictions and the federal government. These shall include minimum requirements and <u>optional requirements</u> aimed at achieving zero energy buildings over multiple timeframes (e.g., through use of the current edition of the code, by 2030 and by 2050).

Furthermore, on page 7 of “LEADING THE WAY TO ENERGY EFFICIENCY A Path Forward on Energy and Sustainability to Confront a Changing Climate” it states;

Building off the success of the IECC and IgCC, <u>the Code Council will develop a layered approach</u> that provides communities with <u>a menu of technical and policy resources</u>, which <u>integrate with the I-Codes</u>, to address their energy efficiency and GHG reduction goals, including those goals identified by the Energy and Carbon Advisory Council. The IECC will remain the minimum requirement.

The <u>resources are intended to be useable independently and adopted alongside the baseline code</u> to support the policies of a community in specific areas. For example, a community could adopt the 2021 IECC with provisions from the Code Council resources developed for electric vehicles or electrification.

It is clear that the ICC Board’s instructions were that provisions for electric vehicle-ready, solar renewable energy-ready and other greenhouse gas and zero energy building goals should be in supplemental, optional, non-mandatory appendices or resources, and NOT in the baseline code.

Point 1: This section requires infrastructure, but code does not require the equipment or systems that the infrastructure is to support. The intent is far-reaching, requiring all dwelling units to comply not only with this section about also Appendix CB, while providing exceptions only for those dwellings already providing the infrastructure or purchase of a <u>15 year</u> contract with a renewable energy company.

Point 2:

This section does not provide adequate minimums or maximum to guide the size and quality of the infrastructure to be provided. It does not take into account the size of the building, location, climate and microclimates, and creates a disproportional additional cost for a system the code doesn’t require.

Point 3:

This section does not take into account tiny homes and other non-traditional dwellings.

Point 4

: This section does not take into account local and regional infrastructure limitations, and doesn’t provide any exceptions to accommodate real-world conditions.

Cost Impact: The code change proposal will increase the cost of construction.

The proposal as presented in the draft will add to the cost of construction for installation or increased structural requirements for an "anticipated use" that may not be a system that the homeowner may be able to afford or wish to use. Further, the anticipated progress in the technology may make any of these improvements obsolete before they are mainstream enough to be utilized.

Hence the recommendation to either remove this from the code or at a minimum relocate to an appendix to allow for local jurisdictions to control the requirement rather than mandate in the body of the code. This appears outside of the scope.

Workgroup Recommendation

Proposal # 1479

REPCD1-9-22

Proponents: Paul Demers, representing **Region VI Code development team (paul.a.demers@maine.gov)**

2024 ENERGY Chapter11

N1104.7 Electric Vehicle Power Transfer Infrastructure. New automobile parking spaces for one- and two-family dwellings and townhouses shall be provided in accordance with Sections N1104.7.1 through N1104.7.5.

N1104.7.1 Quantity. New one- and two-family dwellings and townhouses with a designated attached or detached garage or other onsite private parking provided adjacent to the dwelling unit shall be provided with one EV-capable, EV-ready, or EVSE installed space per dwelling unit.

N1104.7.2 EV Capable Spaces. Each EV capable space used to meet the requirements of Section N1104.7.1 shall comply with all of the following:

1. A continuous raceway or cable assembly shall be installed between an enclosure or outlet located within 3 feet (914 mm) of the EV capable space and a suitable panelboard or other onsite electrical distribution equipment.
2. Installed raceway or cable assembly shall be sized and rated to supply a minimum circuit capacity in accordance with N1104.7.4.
3. The electrical distribution equipment to which the raceway or cable assembly connects shall have sufficient dedicated space and spare electrical capacity for a 2-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)."

N1104.7.3 EV Ready Spaces. Each branch circuit serving EV ready spaces shall comply with all of the following:

1. Terminate at an outlet or enclosure, located within 3 feet (914 mm) of each EV ready space it serves.
2. Have a minimum circuit capacity in accordance with N1104.7.4.
3. The panelboard or other electrical distribution equipment directory shall designate the branch circuit as "For electric vehicle supply equipment (EVSE)" and the outlet or enclosure shall be marked "For electric vehicle supply equipment (EVSE)."

N1104.7.4 Circuit Capacity. For one- and two-family dwellings and townhouses, the capacity of electrical infrastructure serving each EV capable space, EV ready space and EVSE space shall have a rated capacity not less than 8.3 kVA (or 40A at 208/240V) for each EV capable space, EV ready space or EVSE space it serves. Where a circuit is shared or managed it shall be in accordance with NFPA 70.
Exceptions:

1. Where the local electric distribution entity has certified in writing that it is not able to provide 100% of the necessary distribution capacity within 2 years after the estimated date of the certificate of occupancy. The required EV charging infrastructure shall be reduced based on the available existing electric distribution capacity.
2. Where substantiation has been approved that meeting the requirements of Section N1104.7.4.1 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 $400.00 per dwelling unit.

N1104.7.4.1 Circuit capacity management. The capacity of each branch circuit serving multiple EVSE spaces, EV ready space or EV capable spaces designed to be controlled by an energy management system providing load management in accordance with NFPA 70, shall have a capacity of not less than 2.7 kVA per space.

N1104.7.5 EVSE installation. For one- and two-family dwellings and townhouses, EVSE shall be installed in accordance with NFPA 70 and shall be listed and labeled in accordance with UL 2202 or UL 2594. For R-2 occupancies, EVSE shall be installed in accordance with NFPA 70 and Section N1104.7.5.1 and shall be listed and labeled in accordance with UL 2202 and UL 2594.

N1104.7.5.1 EVSE minimum charging rate. Each installed EVSE shall comply with one of the following:

1. Be capable of charging at a rate of not less than 6.2 kVA (or 30A at 208/240V).
2. Where serving EVSE spaces allowed to have a circuit capacity of not less than 2.7 kVA in accordance with N1104.7.4.1 and controlled by an energy management system providing load management, be capable of simultaneously charging each EVSE space at a rate of not less than 2.1 kVA.

Reason: Recommendation: The entire section should be removed from the body of the code to a non-mandatory appendix per Committee Procedures, if not eliminated completely. Likewise, definitions and Section N1104.7 that coordinates with the IECC should be relocated or removed. ICC Council Policy 7 – Committees and Members, Section 9.1 – Scope of Work states *The work of each committee shall be:*

9.1.1 In accordance with the committee's scope and objectives statement,
9.1.2 In accordance with any instructions subsequently issued by the ICC Board, and

9.1.3 Consonant with the objectives of the ICC.

Additionally, The Scope and Intent were provided to the Committee and posted on the International Energy Conservation Code (IECC) Residential Consensus Committee webpage as the "Committee Procedures". The intent of the Residential Energy Provisions – IECC, R101.3 (page 2-3 of the Committee Procedures), and the intent of the Residential Energy Provision – Chapter 11 of the IRC, N1101.2 (page 3 of the Committee Procedures), state;

"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 non-mandatory appendices incorporating additional energy efficiency and greenhouse gas reduction resources developed by the Code Council and others."

The Goals & Objectives were also provided to the Committee and posted on the International Energy Conservation Code (IECC) Residential Consensus Committee webpage as the "Committee Procedures". The Goals & Objectives (page 3 of the Committee Procedures), state;

The goals and objectives in the "Intent" provisions above note the following for inclusion in the code:

- *Optional requirements that lead to achievement of zero energy buildings, presently, and through glidepaths that achieve zero energy buildings by 2030.*

- *The code may include non-mandatory appendices incorporating additional energy efficiency and greenhouse gas reduction resources.*

These performance objectives are intended to provide jurisdictions with an adoptable set of provisions to achieve net-zero energy by 2030.

And, the ICC Board did not issue any further instructions, but prior to the Committee work, the ICC Board did approved "LEADING THE WAY TO ENERGY EFFICIENCY A Path Forward on Energy and Sustainability to Confront a Changing Climate", which is referenced and linked in the "Committee Procedures"(Page 2). The last principle in the list of principles (located on page 5 of "LEADING THE WAY TO ENERGY EFFICIENCY A Path Forward on Energy and Sustainability to Confront a Changing Climate".) that govern the work of the committee it states:

The committee should develop supplemental requirements reflecting the diversity of energy efficiency goals made by adopting jurisdictions and the federal government. These shall include minimum requirements and optional requirements aimed at achieving zero energy buildings over multiple timeframes (e.g., through use of the current edition of the code, by 2030 and by 2050).

Furthermore, on page 7 of "LEADING THE WAY TO ENERGY EFFICIENCY A Path Forward on Energy and Sustainability to Confront a Changing Climate" it states;

Building off the success of the IECC and IgCC, the Code Council will develop a layered approach that provides communities with a menu of technical and policy resources, which integrate with the I-Codes, to address their energy efficiency and GHG reduction goals, including those goals identified by the Energy and Carbon Advisory Council. The IECC will remain the minimum requirement.

The resources are intended to be useable independently and adopted alongside the baseline code to support the policies of a community in specific areas. For example, a community could adopt the 2021 IECC with provisions from the Code Council resources developed for electric vehicles or electrification.

It is clear that the ICC Board's instructions were that provisions for electric vehicle-ready, solar renewable energy-ready and other greenhouse gas and zero energy building goals should be in supplemental, optional, non-mandatory appendices or resources, and NOT in the baseline code.

Point 1:

This section requires infrastructure for Electric Vehicles, but code does not require the equipment or systems that the infrastructure is to support, and EV are outside the scope of the code.

Point 2:

This section does not take into account the rapid development of technology and technological obsolescence and creates an unnecessary additional cost to all residential buildings.

Point 3:

This section does not take into account that cars are not mandatory for home ownership, and wrongfully assumes every home owner and renter owns a car during a time when local municipalities and the federal government are trying to encourage public transportation.

Point 4:

This section does not take into account local and regional infrastructure limitations, and doesn't provide any exceptions to accommodate real-world conditions.

Cost Impact: The code change proposal will increase the cost of construction.
The proposed code in Draft #1 adds to the cost of construction or limits some use of the structure to include items that may never be utilized by the homeowner and further, technology may advance to a point where the items required may be obsolete before they may become mainstream enough to be of value.

Hence the suggested option to either delete from the code or relocate these previsions and their associated definitions into an appendix open to local adoption rather than a mandate in the body of the code.

Workgroup Recommendation

Proposal # 1480

REPCD1-10-22

Proponents: Stacy Miller, representing City of Minneapolis (stacy.miller@minneapolismn.gov)

2024 International Energy Conservation Code [RE Project]

R404.5 Electric readiness. Systems using fossil fuel: water heaters, household clothes dryers, conventional cooking tops or conventional ovens shall comply with the requirements of Sections R404.5.1 through R404.5.4

R404.5.1 Cooking products. An individual branch circuit outlet with a rating not less than 250-volts, 40-amperes shall be installed, and terminate within three feet of conventional cooking tops, conventional ovens or cooking products combining both.
Exception: Cooking products not installed in an individual dwelling unit.

R404.5.2 Household Clothes Dryers. An individual branch circuit outlet with a rating not less than 240-volts, 30-amperes shall be installed, and terminate within three feet (304 mm) of each household clothes dryer.
Exception: Clothes dryers that serve more than one dwelling unit and are located outside of a dwelling unit.

R404.5.3 Water heaters. An individual branch circuit outlet with a rating not less than either 240-volts, 30-amperes or 120V, 20-amperes shall be installed, and terminate within three feet (304 mm) of each fossil fuel water heater. **Exception:** Water heaters in a centralized water heating system serving multiple dwelling units in a R-2 occupancy.

R404.5.4 Electrification-ready circuits. The unused conductors required by Sections R404.5.1 through R404.5.3 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 R404.5.1 through R404.5.3 shall be included in the load calculations of the original installation.

R404.6 Renewable energy infrastructure. The building shall comply with the requirements of R404.6.1 or R404.6.2.

R404.6.1 One- and two- family dwellings and townhouses . One- and two-family dwellings and townhouses shall comply with Sections R404.6.1.1 through R404.6.1.4.
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^2) of roof area oriented between 110 degrees and 270 degrees of true north.
3. A dwelling unit with less than 500 square feet (46m^2) of roof area oriented between 110 degrees and 270 degrees of true north.
4. Dwelling units where 50 percent of the solar-ready area is shaded from direct-beam sunlight by natural objects or by structures that are not part of the building for more than 2500 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 whole-building electric use on an annual basis.
7. A dwelling unit less than or equal to 1,500 square feet (139 m^2) of living space floor area located above grade plane.

R404.6.1.1 Solar-ready zone area. The total area of the solar-ready zone shall not be less than 250 square feet (23.2 m^2) 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^2) 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^2) per dwelling shall be permitted to have a solar-ready zone area of not less than 150 square feet (14 m^2).

R404.6.1.3 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 Solar Electric." The reserved space shall be at the opposite (load) end of the busbar from the primary energy source.

R404.6.1.4 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 minimum 1 inch (25 mm) nonflexible metallic conduit or permanently installed wire as approved by the code official. Where the interconnection terminates in the attic, location shall be no less than 12 inches (35 mm) above ceiling insulation. Both ends of the interconnection shall be labeled "For Future Solar Electric".

R404.7 Electric Vehicle Power Transfer Infrastructure. New automobile parking spaces for one- and two-family dwellings and townhouses shall be provided in accordance with Sections R404.7.1 through R404.7.5. New residential automobile parking spaces for R-2 occupancies shall be provided with electric vehicle power transfer infrastructure in accordance with Sections R404.7.1 through R404.7.5.

R404.7.3 EV Ready Spaces. Each branch circuit serving EV ready spaces shall comply with all of the following:

2. Terminate at an outlet or enclosure, located within 3 feet (914 mm) of each EV ready space it serves.
3. Have a minimum circuit capacity in accordance with R404.7.4.
4. The panelboard or other electrical distribution equipment directory shall designate the branch circuit as "For electric vehicle supply equipment (EVSE)" and the outlet or enclosure shall be marked "For electric vehicle supply equipment (EVSE)."

Reason: December 16, 2022
Residential Consensus Committee

International Code Council

500 New Jersey Avenue, NW, 6th Floor

Washington, DC 20001

Re: Public Comment Draft #1 of the IECC-Residential Code

Dear Residential Consensus Committee Members:

The City of Minneapolis thanks the Residential Consensus Committee ("Committee") for developing the draft Residential 2024 International Energy Conservation Code (IECC-R).

The City of Minneapolis has municipal goals for greenhouse gas reductions consistent with the Paris Agreement and is committed to doing our share to mitigate climate change. However, we are constrained by the IECC-based Minnesota Energy Code, which local government requirements may not exceed in our state. It is imperative that the final 2024 IECC-R result in high performing homes that are both more comfortable and more affordable for occupants so that the jurisdictions that rely on ICC for their codes can more readily update their energy codes for the benefit of the residents they serve.

For these reasons, we strongly support the following provisions within the Draft:

- **Electric readiness for hot water heaters, cooking appliances, and clothes dryers**. Electric-readiness will help facilitate the move to electrify during the life of the home and save money.
- **Electric vehicle charging-ready infrastructure in most homes and multifamily buildings**. Minneapolis alone has thousands of multi-family residential units being built every year and this provision will reduce the need for expensive retrofits.
- **Solar-ready roofs**. In some markets, one in five homes have rooftop solar. Solar-readiness will facilitate homeowners and renters desire to invest in solar energy during the life of the home.

However, parts of the Public Comment Draft #1 are not well aligned with federal, state, and local energy and climate policy goals. Specifically, we strongly urge the Committee to reject all proposals that weaken the 2021 IECC-R, which the City of Minneapolis participated in. To preserve the confidence of your governmental members, ICC's new committee process must not undermine the progress made within the 2021 IECC.

Governmental members participate to promote the public interest and work hard to balance what is technically feasible with what will benefit the public we serve. Allowing progress made in the 2021 IECC-R to be reversed would be a disservice to the public. It would also be inconsistent with assurances from ICC that the 2021 IECC-R would be a benchmark for future codes when the board made the decision to transition to the new committee-based development system.

The City of Minneapolis requests the Committee make changes to accomplish the following:

- **Protect the progress made in building envelope efficiency standards.**

Equipment trade-offs in Table R405.4.2(1) should be removed consistent with the ICC's practice since 2009. The Draft's inclusion of trade-offs for fossil fuel equipment efficiency is not in the public interest and will lead to unnecessary wasted money and energy for generations of occupants in the home. Please reject inclusion of trade-offs that sacrifice building envelope efficiency.

Similarly, Section R408.2.9 of the draft allows for a more lenient U-factor in wood frame walls in exchange for installing heat pumps or renewables. However, the renewable energy and efficiency benefits of heat pumps and other appliances will go further when the building envelope is more efficient.

- **Preserve ducts being in conditioned spaces as the standard reference design.** The proposed modification in Table R405.4.2(1) to locate the ducts outside of conditioned space is a step backward and inconsistent with common building best practices. The change will either lead to unnecessary added heating and cooling costs when a builder chooses to follow the newly proposed standard or artificial credit as a tradeoff for a lack of efficiency elsewhere in the home. This change is a step backward and not in the public interest.

· **Preserve the higher R-Value ceiling insulation requirements from 2021.** Investing in appropriate levels of insulation is a simple, no-regrets efficiency measure. The Draft proposal to reduce ceiling insulation requirements within Tables R402.1.2 and R402.1.3 should be rejected.

The Minneapolis Sustainability Division joined their peers in the Community Planning and Economic Development Department by becoming members of ICC in 2019 because modern, climate-responsive energy codes are a health and safety priority and essential for creating more sustainable communities. While the IECC development has been moved to a committee process, we maintain our ICC membership to support the organization's mission to protect people, including protection from climate change and excess operating expenses.

Thank you for the opportunity to comment on the 2024 Residential International Energy Conservation Code and for your consideration of our comments. We are available for questions should the Committee wish to discuss any of our recommendations further.

Sincerely,

C. Scott Anderson, AIA, CBO

Building Plan Review Supervisor

City of Minneapolis

C.Scott.Anderson@minneapolismn.gov

Kim W. Havey, AICP, LEED AP

Director, Division of Sustainability

City of Minneapolis

kim.havey@minneapolismn.gov

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
Comments of the City of Minneapolis

Workgroup Recommendation

Proposal # 1465

REPCD1-11-22

Proponents: David Forde, representing PGW

2024 International Energy Conservation Code [RE Project]

R404.5 Electric readiness. Systems using fossil fuel: water heaters, household clothes dryers, conventional cooking tops or conventional ovens shall comply with the requirements of Sections R404.5.1 through R404.5.4

Reason: Electric Ready – Code R404.5
Philadelphia Gas Works (“PGW”) located in the Northeast is the largest municipally owned gas utility in the country, employing over 1,600 workers in Philadelphia and distributing natural gas for both heating and non-heating purposes to an estimated 1.6 million residents and businesses across the City (roughly 484,000 residential customers, 25,000 commercial customers and 700 industrial customer accounts.

Philadelphia is the nation’s poorest big city in America with a poverty rate of roughly 23 percent or nearly 400,000 residents: disproportionately affecting black and brown communities, and vulnerable senior populations.

Philadelphian households on average spend around 6.7% of their income on energy, about double the national average, making Philadelphia one of the most energy-burdened cities in the United States.

PGW is committed to continuously working to identify and implement new opportunities for additional environmental benefits, including, increased energy efficiency and Greenhouse Gas emission reduction targets; and a diverse energy supply, providing carbon reduction opportunities to combat climate change.

However, Code R404.5 Electric Ready exacerbates Philadelphia residents' already challenging energy burden and housing cost burden. Electric Ready also potentially creates stranded assets in homes and small businesses like electrical wiring, panel upgrades, larger transformers – which could introduce a multitude of safety concerns.

Cost Impact: The code change proposal will decrease the cost of construction.
The cost of construction will be reduced by removing requirements for outlets and equipment.

Workgroup Recommendation

Proposal # 1419

REPCD1-12-22

Proponents: Paul Demers, representing **Region VI Code development team (paul.a.demers@maine.gov)**

2024 International Energy Conservation Code [RE Project]

R404.6 Renewable energy infrastructure. The building shall comply with the requirements of R404.6.1 or R404.6.2.

R404.6.1 One- and two- family dwellings and townhouses . One- and two-family dwellings and townhouses shall comply with Sections R404.6.1.1 through R404.6.1.4.
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^2) of roof area oriented between 110 degrees and 270 degrees of true north.
3. A dwelling unit with less than 500 square feet (46m^2) of roof area oriented between 110 degrees and 270 degrees of true north.
4. Dwelling units where 50 percent of the solar-ready area is shaded from direct-beam sunlight by natural objects or by structures that are not part of the building for more than 2500 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 whole-building electric use on an annual basis.
7. A dwelling unit less than or equal to 1,500 square feet (139 m^2) of living space floor area located above grade plane.

R404.6.1.1 Solar-ready zone area. The total area of the solar-ready zone shall not be less than 250 square feet (23.2 m^2) 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^2) 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^2) per dwelling shall be permitted to have a solar-ready zone area of not less than 150 square feet (14 m^2).

R404.6.1.2 Obstructions. Solar-ready zones shall be free from obstructions, including but not limited to vents, chimneys, and roof-mounted equipment.

R404.6.1.3 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 Solar Electric.” The reserved space shall be at the opposite (load) end of the busbar from the primary energy source.

R404.6.1.4 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 minimum 1 inch (25 mm) nonflexible metallic conduit or permanently installed wire as approved by the code official. Where the interconnection terminates in the attic, location shall be no less than 12 inches (35 mm) above ceiling insulation. Both ends of the interconnection shall be labeled “For Future Solar Electric”.

Reason: Recommendation: The entire section should be removed from the body of the code to a non-mandatory appendix per Committee Procedures, and reworked to clarify how and what compliance would look like. Likewise, definitions and Section N1104.6 that coordinates with the IECC should be relocated or removed.

ICC Council Policy 7 – Committees and Members, Section 9.1 – Scope of Work states *The work of each committee shall be:*
9.1.1 In accordance with the committee's scope and objectives statement,
9.1.2 In accordance with any instructions subsequently issued by the ICC Board, and
9.1.3 Consonant with the objectives of the ICC.

Additionally, The Scope and Intent were provided to the Committee and posted on the International Energy Conservation Code (IECC) Residential Consensus Committee webpage as the “Committee Procedures”. The intent of the Residential Energy Provisions – IECC, R101.3 (page 2-3 of the Committee Procedures), and the intent of the Residential Energy Provision – Chapter 11 of the IRC, N1101.2 (page 3 of the Committee Procedures), state;

“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 non-mandatory appendices incorporating additional energy efficiency and greenhouse gas reduction resources developed by the Code Council and others.”

The Goals & Objectives were also provided to the Committee and posted on the International Energy Conservation Code (IECC) Residential Consensus Committee webpage as the “Committee Procedures”. The Goals & Objectives (page 3 of the Committee Procedures), state;

The goals and objectives in the “Intent” provisions above note the following for inclusion in the code:

- *Optional requirements that lead to achievement of zero energy buildings, presently, and through glidepaths that achieve zero energy buildings by 2030.*

- *The code may include non-mandatory appendices incorporating additional energy efficiency and greenhouse gas reduction resources.*

These performance objectives are intended to provide jurisdictions with an adoptable set of provisions to achieve net-zero energy by 2030.

And, the ICC Board did not issue any further instructions, but prior to the Committee work, the ICC Board did approved “LEADING THE WAY TO ENERGY EFFICIENCY A Path Forward on Energy and Sustainability to Confront a Changing Climate”, which is referenced and linked in the “Committee Procedures”(Page 2). The last principle in the list of principles (located on page 5 of “LEADING THE WAY TO ENERGY EFFICIENCY A Path Forward on Energy and Sustainability to Confront a Changing Climate”.) that govern the work of the committee it states:

The committee should develop supplemental requirements reflecting the diversity of energy efficiency goals made by adopting jurisdictions and the federal government. These shall include minimum requirements and optional requirements aimed at achieving zero energy buildings over multiple timeframes (e.g., through use of the current edition of the code, by 2030 and by 2050).

Furthermore, on page 7 of “LEADING THE WAY TO ENERGY EFFICIENCY A Path Forward on Energy and Sustainability to Confront a Changing Climate” it states;

Building off the success of the IECC and IgCC, the Code Council will develop a layered approach that provides communities with a menu of technical and policy resources, which integrate with the I-Codes, to address their energy efficiency and GHG reduction goals, including those goals identified by the Energy and Carbon Advisory Council. The IECC will remain the minimum requirement.

The resources are intended to be useable independently and adopted alongside the baseline code to support the policies of a community in specific areas. For example, a community could adopt the 2021 IECC with provisions from the Code Council resources developed for electric vehicles or electrification.

It is clear that the ICC Board’s instructions were that provisions for electric vehicle-ready, solar renewable energy-ready and other greenhouse gas and zero energy building goals should be in supplemental, optional, non-mandatory appendices or resources, and NOT in the baseline code.

Point 1: This section requires infrastructure, but code does not require the equipment or systems that the infrastructure is to support. The intent is far-reaching, requiring all dwelling units to comply not only with this section about also Appendix CB, while providing exceptions only for those dwellings already providing the infrastructure or purchase of a 15 year contract with a renewable energy company.

Point 2:

This section does not provide adequate minimums or maximum to guide the size and quality of the infrastructure to be provided. It does not take into account the size of the building, location, climate and microclimates, and creates a disproportional additional cost for a system the code doesn’t require.

Point 3:

This section does not take into account tiny homes and other non-traditional dwellings.

Point 4

: This section does not take into account local and regional infrastructure limitations, and doesn’t provide any exceptions to accommodate real-world conditions.

Cost Impact: The code change proposal will decrease the cost of construction.
Removing this requirement will reduce the cost of construction as it will not require the extra design and planning requirements for a potential project that may never be built or added to the structure.

Workgroup Recommendation

Proposal # 1412

REPCD1-13-22

Proponents: Michele DeFrance, representing City of Portland Maine (mdefrance@portlandmaine.gov)

2024 International Energy Conservation Code [RE Project]

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.

R404.6 Renewable energy infrastructure. The building shall comply with the requirements of R404.6.1 or R404.6.2.

R404.6.1 One- and two- family dwellings and townhouses . One- and two-family dwellings and townhouses shall comply with Sections R404.6.1.1 through R404.6.1.4.
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^2) of roof area oriented between 110 degrees and 270 degrees of true north.
3. A dwelling unit with less than 500 square feet (46m^2) of roof area oriented between 110 degrees and 270 degrees of true north.
4. Dwelling units where 50 percent of the solar-ready area is shaded from direct-beam sunlight by natural objects or by structures that are not part of the building for more than 2500 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 whole-building electric use on an annual basis.
7. A dwelling unit less than or equal to 1,500 square feet (139 m^2) of living space floor area located above grade plane.

R404.6.1.1 Solar-ready zone area. The total area of the solar-ready zone shall not be less than 250 square feet (23.2 m^2) 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^2) 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^2) per dwelling shall be permitted to have a solar-ready zone area of not less than 150 square feet (14 m^2).

R404.6.1.2 Obstructions. Solar-ready zones shall be free from obstructions, including but not limited to vents, chimneys, and roof-mounted equipment.

R404.6.1.3 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 Solar Electric.” The reserved space shall be at the opposite (load) end of the busbar from the primary energy source.

R404.6.1.4 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 minimum 1 inch (25 mm) nonflexible metallic conduit or permanently installed wire as approved by the code official. Where the interconnection terminates in the attic, location shall be no less than 12 inches (35 mm) above ceiling insulation. Both ends of the interconnection shall be labeled “For Future Solar Electric”.

R404.6.2 Group R occupancies. Buildings in Group R-2, R-3 and R-4 shall comply with Appendix CB.

2024 ENERGY Chapter11

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

N1104.6 Renewable energy infrastructure. The building shall comply with the requirements of N1104.6.1 or N1104.6.2.

N1104.6.1 One- and two- family dwellings and townhouses . One- and two-family dwellings and townhouses shall comply with Sections N1104.6.1.1 through N1104.6.1.4.
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^2) of roof area oriented between 110 degrees and 270 degrees of true north.
3. A dwelling unit with less than 500 square feet (46m^2) of roof area oriented between 110 degrees and 270 degrees of true north.

4. Dwelling units where 50 percent of the solar-ready area is shaded from direct-beam sunlight by natural objects or by structures that are not part of the building for more than 2500 annual hours between 8:00 a.m. and 4:00 p.m.
5. A dwelling unit that complies with Appendix AX.
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 whole-building electric use on an annual basis.
7. A dwelling unit less than or equal to 1,500 square feet of living space floor area located above grade plane.

N1104.6.1.1 Solar-ready zone area. The total area of the solar-ready zone shall not be less than 250 square feet (23.2 m^2) 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^2) 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^2) per dwelling shall be permitted to have a solar-ready zone area of not less than 150 square feet (14 m^2).

N1104.6.1.2 Obstructions. Solar-ready zones shall be free from obstructions, including but not limited to vents, chimneys, and roof-mounted equipment.

N1104.6.1.4 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 minimum 1 inch (25 mm) nonflexible metallic conduit or permanently installed wire as approved by the code official. Where the interconnection terminates in the attic, location shall be no less than 12 inches (35 mm) above ceiling insulation. Both ends of the interconnection shall be labeled "For Future Solar Electric".

N1104.6.2 Group R occupancies. Buildings in Group R-2, R-3 and R-4 shall comply with *International Energy Conservation Code* Commercial Appendix CB.

Reason: ICC Council Policy 7 – Committees and Members, Section 9.1 – Scope of Work states *The work of each committee shall be:*
9.1.1 In accordance with the committee's scope and objectives statement,

9.1.2 In accordance with any instructions subsequently issued by the ICC Board, and

9.1.3 Consonant with the objectives of the ICC.

Additionally, The Scope and Intent were provided to the Committee and posted on the International Energy Conservation Code (IECC) Residential Consensus Committee webpage as the "Committee Procedures". The intent of the Residential Energy Provisions – IECC, R101.3 (page 2-3 of the Committee Procedures), and the intent of the Residential Energy Provision – Chapter 11 of the IRC, N1101.2 (page 3 of the Committee Procedures), state;

"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 non-mandatory appendices incorporating additional energy efficiency and greenhouse gas reduction resources developed by the Code Council and others."

The Goals & Objectives were also provided to the Committee and posted on the International Energy Conservation Code (IECC) Residential Consensus Committee webpage as the "Committee Procedures". The Goals & Objectives (page 3 of the Committee Procedures), state;

The goals and objectives in the "Intent" provisions above note the following for inclusion in the code:

- *Optional requirements that lead to achievement of zero energy buildings, presently, and through glidepaths that achieve zero energy buildings by 2030.*

- *The code may include non-mandatory appendices incorporating additional energy efficiency and greenhouse gas reduction resources.*

These performance objectives are intended to provide jurisdictions with an adoptable set of provisions to achieve net-zero energy by 2030.

And, the ICC Board did not issue any further instructions, but prior to the Committee work, the ICC Board did approved “LEADING THE WAY TO ENERGY EFFICIENCY A Path Forward on Energy and Sustainability to Confront a Changing Climate”, which is referenced and linked in the “Committee Procedures”(Page 2). The last principle in the list of principles (located on page 5 of “LEADING THE WAY TO ENERGY EFFICIENCY A Path Forward on Energy and Sustainability to Confront a Changing Climate”.) that govern the work of the committee it states:

The committee should develop supplemental requirements reflecting the diversity of energy efficiency goals made by adopting jurisdictions and the federal government. These shall include minimum requirements and optional requirements aimed at achieving zero energy buildings over multiple timeframes (e.g., through use of the current edition of the code, by 2030 and by 2050).

Furthermore, on page 7 of “LEADING THE WAY TO ENERGY EFFICIENCY A Path Forward on Energy and Sustainability to Confront a Changing Climate” it states;

Building off the success of the IECC and IgCC, the Code Council will develop a layered approach that provides communities with a menu of technical and policy resources, which integrate with the I-Codes, to address their energy efficiency and GHG reduction goals, including those goals identified by the Energy and Carbon Advisory Council. The IECC will remain the minimum requirement.

The resources are intended to be useable independently and adopted alongside the baseline code to support the policies of a community in specific areas. For example, a community could adopt the 2021 IECC with provisions from the Code Council resources developed for electric vehicles or electrification.

It is clear that the ICC Board’s instructions were that provisions for electric vehicle-ready, solar renewable energy-ready and other greenhouse gas and zero energy building goals should be in supplemental, optional, non-mandatory appendices or resources, and NOT in the baseline code.

Point 1: This section requires infrastructure, but code does not require the equipment or systems that the infrastructure is to support. The intent is far-reaching, requiring all dwelling units to comply not only with this section about also Appendix CB, while providing exceptions only for those dwellings already providing the infrastructure or purchase of a 15 year contract with a renewable energy company.

Point 2:

This section does not provide adequate minimums or maximum to guide the size and quality of the infrastructure to be provided. It does not take into account the size of the building, location, climate and microclimates, and creates a disproportional additional cost for a system the code doesn’t require.

Point 3:

These section does not take into account tiny homes and other non-traditional dwellings.**Point 4** : This section does not take into account local and regional infrastructure limitations, and doesn’t provide any exceptions to accommodate real-world conditions.

Recommendation: The entire section should be removed from the body of the code to a non-mandatory appendix per Committee Procedures, and reworked to clarify how and what compliance would look like. Likewise, definitions and Section N1104.6 in the 2024 IRC, that coordinates with the IECC should be relocated or removed.

Cost Impact: The code change proposal will decrease the cost of construction.
This is a language move from the body of the code to the appendix that would eliminate the requirement of infrastructure for systems not required by code. This will reduce the cost of construction.

Workgroup Recommendation

Proposal # 1435

REPCD1-14-22

Proponents: Paul Demers, representing **Region VI Code development team (paul.a.demers@maine.gov)**

2024 International Energy Conservation Code [RE Project]

R404.7 Electric Vehicle Power Transfer Infrastructure. New automobile parking spaces for one- and two-family dwellings and townhouses shall be provided in accordance with Sections R404.7.1 through R404.7.5. New residential automobile parking spaces for R-2 occupancies shall be provided with electric vehicle power transfer infrastructure in accordance with Sections R404.7.1 through R404.7.5.

R404.7.1 Quantity. New one- and two-family dwellings and townhouses with a designated attached or detached garage or other onsite private parking provided adjacent to the dwelling unit shall be provided with one EV-capable, EV-ready, or EVSE installed space 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 EVSE space for 40 percent of each dwelling units or automobile parking spaces, whichever is less.

R404.7.2 EV Capable Spaces. Each EV capable space used to meet the requirements of Section R404.7.1 shall comply with all of the following:

1. A continuous raceway or cable assembly shall be installed between an enclosure or outlet located within 3 feet (914 mm) of the EV capable space and a suitable panelboard or other onsite electrical distribution equipment.
2. Installed raceway or cable assembly shall be sized and rated to supply a minimum circuit capacity in accordance with R404.7.4
3. The electrical distribution equipment to which the raceway or cable assembly connects shall have sufficient dedicated space and spare electrical capacity for a 2-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)."

R404.7.3 EV Ready Spaces. Each branch circuit serving EV ready spaces shall comply with all of the following:

1. Terminate at an outlet or enclosure, located within 3 feet (914 mm) of each EV ready space it serves.
2. Have a minimum circuit capacity in accordance with R404.7.4.
3. The panelboard or other electrical distribution equipment directory shall designate the branch circuit as "For electric vehicle supply equipment (EVSE)" and the outlet or enclosure shall be marked "For electric vehicle supply equipment (EVSE)."

R404.7.4 Circuit Capacity. For one- and two-family dwellings and townhouses, the capacity of electrical infrastructure serving each EV capable space, EV ready space and EVSE space shall have a rated capacity not less than 8.3 kVA (or 40A at 208/240V) for each EV capable space, EV ready space or EVSE space it serves. Where a circuit is shared or managed it shall be in accordance with NFPA 70. For R-2 occupancies, the capacity of electrical infrastructure serving each EV capable space, EV ready space and EVSE space shall comply with one of the following:

1. A branch circuit shall have a rated capacity not less than 8.3kVA (or 40A at 208/240V) for each EV capable space, EV ready space or EVSE space it serves. Where a circuit is shared or managed it shall be in accordance with NFPA 70.
2. The requirements of R404.7.4.1.

Exceptions:

1. Where the local electric distribution entity has certified in writing that it is not able to provide 100 percent of the necessary distribution capacity within 2 years after the estimated date of the certificate of occupancy. The required EV charging infrastructure shall be reduced based on the available existing electric distribution capacity.
2. Where substantiation has been approved that meeting the requirements of Section R404.7.4.1 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 $400.00 per dwelling unit.

R404.7.4.1 Circuit capacity management. The capacity of each branch circuit serving multiple EVSE spaces, EV ready space or EV capable spaces designed to be controlled by an energy management system providing load management in accordance with NFPA 70, shall have a capacity of not less than 2.7 kVA per space.

R404.7.5 EVSE installation. For one- and two-family dwellings and townhouses, EVSE shall be installed in accordance with NFPA 70 and shall be listed and labeled in accordance with UL 2202 or UL 2594. For R-2 occupancies, EVSE shall be installed in accordance with NFPA 70 and Section R404.7.5.1 and shall be listed and labeled in accordance with UL 2202 and UL 2594.

R404.7.5.1 EVSE minimum charging rate. Each installed EVSE shall comply with one of the following:

1. Be capable of charging at a rate of not less than 6.2 kVA (or 30A at 208/240V).

2. Where serving EVSE spaces allowed to have a circuit capacity of not less than 2.7 kVA in accordance with R404.7.4.1 and controlled by an energy management system providing load management, be capable of simultaneously charging each EVSE space at a rate of not less than 2.1 kVA.

Reason: Recommendation: The entire section should be removed from the body of the code to a non-mandatory appendix per Committee Procedures, if not eliminated completely. Likewise, definitions and Section N1104.7 that coordinates with the IECC should be relocated or removed.

ICC Council Policy 7 – Committees and Members, Section 9.1 – Scope of Work states *The work of each committee shall be:*
9.1.1 In accordance with the committee's scope and objectives statement,

9.1.2 In accordance with any instructions subsequently issued by the ICC Board, and

9.1.3 Consonant with the objectives of the ICC.

Additionally, The Scope and Intent were provided to the Committee and posted on the International Energy Conservation Code (IECC) Residential Consensus Committee webpage as the "Committee Procedures". The intent of the Residential Energy Provisions – IECC, R101.3 (page 2-3 of the Committee Procedures), and the intent of the Residential Energy Provision – Chapter 11 of the IRC, N1101.2 (page 3 of the Committee Procedures), state;

"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 non-mandatory appendices incorporating additional energy efficiency and greenhouse gas reduction resources developed by the Code Council and others."

The Goals & Objectives were also provided to the Committee and posted on the International Energy Conservation Code (IECC) Residential Consensus Committee webpage as the "Committee Procedures". The Goals & Objectives (page 3 of the Committee Procedures), state;

The goals and objectives in the "Intent" provisions above note the following for inclusion in the code:

- *Optional requirements that lead to achievement of zero energy buildings, presently, and through glidepaths that achieve zero energy buildings by 2030.*

- *The code may include non-mandatory appendices incorporating additional energy efficiency and greenhouse gas reduction resources.*

These performance objectives are intended to provide jurisdictions with an adoptable set of provisions to achieve net-zero energy by 2030.

And, the ICC Board did not issue any further instructions, but prior to the Committee work, the ICC Board did approved "LEADING THE WAY TO ENERGY EFFICIENCY A Path Forward on Energy and Sustainability to Confront a Changing Climate", which is referenced and linked in the "Committee Procedures"(Page 2). The last principle in the list of principles (located on page 5 of "LEADING THE WAY TO ENERGY EFFICIENCY A Path Forward on Energy and Sustainability to Confront a Changing Climate".) that govern the work of the committee it states:

The committee should develop supplemental requirements reflecting the diversity of energy efficiency goals made by adopting jurisdictions and the federal government. These shall include minimum requirements and optional requirements aimed at achieving zero energy buildings over multiple timeframes (e.g., through use of the current edition of the code, by 2030 and by 2050).

Furthermore, on page 7 of "LEADING THE WAY TO ENERGY EFFICIENCY A Path Forward on Energy and Sustainability to Confront a Changing Climate" it states;

Building off the success of the IECC and IgCC, the Code Council will develop a layered approach that provides communities with a menu of technical and policy resources, which integrate with the I-Codes, to address their energy efficiency and GHG reduction goals, including those goals identified by the Energy and Carbon Advisory Council. The IECC will remain the minimum requirement.

The resources are intended to be useable independently and adopted alongside the baseline code to support the policies of a community in specific areas. For example, a community could adopt the 2021 IECC with provisions from the Code Council resources developed for electric vehicles or *electrification.*

It is clear that the ICC Board's instructions were that provisions for electric vehicle-ready, solar renewable energy-ready and other greenhouse gas and zero energy building goals should be in supplemental, optional, non-mandatory appendices or resources, and NOT in the baseline code.

Point 1:

This section requires infrastructure for Electric Vehicles, but code does not require the equipment or systems that the infrastructure is to support, and EV are outside the scope of the code.

Point 2:

This section does not take into account the rapid development of technology and technological obsolescence and creates an unnecessary additional cost to all residential buildings.

Point 3:

This section does not take into account that cars are not mandatory for home ownership, and wrongfully assumes every home owner and renter owns a car during a time when local municipalities and the federal government are trying to encourage public transportation.

Point 4:

This section does not take into account local and regional infrastructure limitations, and doesn't provide any exceptions to accommodate real-world conditions.

Cost Impact: The code change proposal will decrease the cost of construction.
By removal or placing this section into an appendix, the cost of construction will be reduced by the fact this is creating infrastructure that may not ever be utilized and cost the owner for unnecessary items.

Workgroup Recommendation

Proposal # 1445

REPCD1-15-22

Proponents: Renee Lani, representing American Public Gas Association (rlani@apga.org)

2024 International Energy Conservation Code [RE Project]

R404.7 Electric Vehicle Power Transfer Infrastructure. New automobile parking spaces for one- and two-family dwellings and townhouses shall be provided in accordance with Sections R404.7.1 through R404.7.5. New residential automobile parking spaces for R-2 occupancies shall be provided with electric vehicle power transfer infrastructure in accordance with Sections R404.7.1 through R404.7.5.

R404.7.1 Quantity. New one- and two-family dwellings and townhouses with a designated attached or detached garage or other onsite private parking provided adjacent to the dwelling unit shall be provided with one EV-capable, EV-ready, or EVSE installed space 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 EVSE space for 40 percent of each dwelling units or automobile parking spaces, whichever is less.

R404.7.2 EV Capable Spaces. Each EV capable space used to meet the requirements of Section R404.7.1 shall comply with all of the following:

1. A continuous raceway or cable assembly shall be installed between an enclosure or outlet located within 3 feet (914 mm) of the EV capable space and a suitable panelboard or other onsite electrical distribution equipment.
2. Installed raceway or cable assembly shall be sized and rated to supply a minimum circuit capacity in accordance with R404.7.4
3. The electrical distribution equipment to which the raceway or cable assembly connects shall have sufficient dedicated space and spare electrical capacity for a 2-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)."

R404.7.3 EV Ready Spaces. Each branch circuit serving EV ready spaces shall comply with all of the following:

1. Terminate at an outlet or enclosure, located within 3 feet (914 mm) of each EV ready space it serves.
2. Have a minimum circuit capacity in accordance with R404.7.4.
3. The panelboard or other electrical distribution equipment directory shall designate the branch circuit as "For electric vehicle supply equipment (EVSE)" and the outlet or enclosure shall be marked "For electric vehicle supply equipment (EVSE)."

APPENDIX RB
SOLAR-READY PROVISIONS—DETACHED ONE- AND TWO-FAMILY DWELLINGS AND TOWNHOUSES

SECTION RB101
SCOPE

RB101.1 General. These provisions shall be applicable for new construction where solar-ready provisions are required.

R404.6 Renewable energy infrastructure. The building shall comply with the requirements of R404.6.1 or R404.6.2.

R404.6.1 One- and two- family dwellings and townhouses . One- and two-family dwellings and townhouses shall comply with Sections R404.6.1.1 through R404.6.1.4.
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^2) of roof area oriented between 110 degrees and 270 degrees of true north.
3. A dwelling unit with less than 500 square feet (46m^2) of roof area oriented between 110 degrees and 270 degrees of true north.
4. Dwelling units where 50 percent of the solar-ready area is shaded from direct-beam sunlight by natural objects or by structures that are not part of the building for more than 2500 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 whole-building electric use on an annual basis.
7. A dwelling unit less than or equal to 1,500 square feet (139 m^2) of living space floor area located above grade plane.

R404.6.1.1 Solar-ready zone area. The total area of the solar-ready zone shall not be less than 250 square feet (23.2 m^2) 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^2) 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^2) per dwelling shall be permitted to have a solar-ready zone area of not less than 150 square feet (14 m^2).

R404.6.2 Group R occupancies. Buildings in Group R-2, R-3 and R-4 shall comply with Appendix CB.

Reason: Consistent with our comments in earlier code cycles, the American Public Gas Association (APGA) opposes mandatory provisions in the base IECC that do not guarantee energy savings, as is the case for electric vehicle (EV) related charging equipment. Requiring EV charging equipment or necessary equipment to enable future EV charging adds costs to construction while failing to guarantee an increase in efficiency, which is required to be included in the base code. While EV charging equipment may be helpful to grid management, such goals are not within the base code scope of the IECC.
This rationale extends to all provisions that do not guarantee increased energy efficiency of the building, such as solar-ready. If included at all, such provisions should be in non-mandatory appendices - currently the only appropriate place for such proposals, as the base code of the IECC must only contain provisions that increase a building's efficiency.

APGA supports goals to reduce greenhouse gas emissions in the United States, including through building energy codes and energy efficiency. However, in reaching these ambitious targets, APGA cautions against misguided electrification proposals, including in building energy codes, that put all our “eggs in one basket” by eliminating Americans’ ability to choose the energy source best fit for their needs and budget. As with energy efficiency, there is not guarantee that these types of provisions would guarantee a reduction in greenhouse gas emissions. In fact, in some areas of the country, such a requirement could be counter to these goals because of the electric generation mix.

Cost Impact: The code change proposal will decrease the cost of construction.
Not requiring the installation of EV charging-related equipment will decrease the cost of construction.

Workgroup Recommendation

Proposal # 1487

REPCD1-16-22

Proponents: Renee Lani, representing American Public Gas Association (rlani@apga.org)

2024 International Energy Conservation Code [RE Project]

APPENDIX RE
ALL-ELECTRIC RESIDENTIAL BUILDINGS

RE101
GENERAL

RE101.1 Intent. The intent of this Appendix 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.

RE101.2 Scope. This appendix applies to new residential buildings.

Reason: APGA supports goals to reduce greenhouse gas emissions in the United States, including through building energy codes, such as the IECC, and energy efficiency. As a cost-effective, reliable, and efficient energy source, consumers value the ability to choose natural gas as an energy solution that works best for their budgets and lifestyles. Given its growing domestic supply and safe, reliable, and efficient delivery system reaching almost every home and business in America, the direct use of natural gas in buildings is an important part of our country's energy future and a pathway to addressing global warming. In fact, natural gas has been a big driver behind our country's declines in carbon emissions- notably, America's gas utilities have added 30 million residential customers since 1970 with virtually no increases in emissions. *See* American Gas Association, "Implications of Policy-Driven Residential Electrification," https://www.aga.org/research/reports/implications-of-policy-driven-residential-electrification.
However, in reaching these ambitious targets, APGA cautions against misguided electrification proposals, such as this appendix proposal, that put all our "eggs in one basket" by eliminating Americans' ability to choose the energy source best fit for their needs and budget. An electrification model could increase average residential household energy-related costs by between $750 and $910 per year, or about 38 to 46 percent — a large financial burden for many who already struggle to pay their bills each month, such as low-income communities and seniors on a fixed income.

The IECC should continue to promote not just energy efficiency, but the efficient use and transportation of energy associated with the buildings they govern. The IECC should also remain flexible enough to be utilized by the broadest range of jurisdictions. Supplemental building energy code resources, such as the International Green Construction Code, already exist for jurisdictions or individuals with the resources and capability to pursue certain stretch code provisions. However, every jurisdiction has different resources and needs to serve, so overly prescriptive code language, including electric-ready, will not only be economically burdensome to some communities but might also miss the mark on decarbonization goals if all aspects of an energy source's life-cycle analysis are not taken into consideration.

Even though this is a non-mandatory appendix, APGA does not believe it is appropriate for inclusion in the IECC. The IECC is a fuel neutral code, and as described above, favoring one energy source over another without consideration of life-cycle emissions may actually be counter to the intended goals of this proposal.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This proposal will allow consumers to build their homes to meet their needs and energy choice but would not necessarily impact the cost of construction.

Workgroup Recommendation

Proposal # 1488

REPCD1-17-22

Proponents: James Guinan, representing Guinan Associates (GuinanAssociates@gmail.com)

2024 International Energy Conservation Code [RE Project]

BIOMASS WASTE. Organic non-fossil material of biological origin that is a byproduct or a discarded product. Biomass waste includes municipal solid waste from biogenic sources, landfill gas, sludge waste, agricultural crop byproducts, straw, and other biomass solids, liquids, and biogases; but excludes wood and wood-derived fuels (including black liquor), biofuel feedstock, biodiesel, and fuel ethanol.

Reason: The US is in a housing crisis. Housing costs are rising, making it difficult for “average” people to pay rent or purchase a house. There is insufficient supply of low income housing. Many people are becoming homeless.
The proposed 2024 IECC will substantially increase the cost of a new home. New requirements will also increase the cost of renovating existing homes. This will result in people living in old, drafty homes since renovations (with new requirements) will not be affordable. The result will be no improvement to the existing homes, and less construction of new homes.

The effect will not be “green”, but “brown” since energy usage will increase, not decrease.

I have previously comment on the provisions which increase construction costs. Below are my comments on the NBI proposals to the 2024 IECC.

Comments on Proposed 2024 IECC which were submitted by BNI (New Buildings Institute)
12/15/22

1. <u>Biomass Waste</u>: Residential properties should not collect or compost biomass waste due to odor, rats, and health issues. This should be left to commercial facilities who could have a proper facility and staff qualified to operate it in a sanitary manner.

The IECC applies to Residential and Commercial **BUILDINGS.** It does not regulate processes, such as composting, which may be part of a commercial business. These are regulated by state and local codes, and local Board of Health.

Recommendation: Reject this NBI Recommendation.

2. <u>Appliance Energy Efficiency (R408)</u>: These are already regulated by the DOE Energy Star program. Individual appliance energy consumption will vary by the utilization of the appliance.

For example a refrigerator in a un-air conditioned home (like mine) will run more and use more energy. Air conditioning the entire home will use much more energy than would be saved by the refrigeration.

Recommendation: Reject this NBI Recommendation.

3. <u>Energy Efficiency Guidelines for HVAC Equipment (R408):</u> These are already set by the DOE with input from the industry and manufacturers on what is practical and can be manufactured at reasonable cost.

Different standards from different organizations will confuse the industry and the consumers.

Recommendation: Reject this NBI Recommendation

4. Electric Readiness for Space Heating Option in R408:

a. Condensate drainage: Many homes have basement floors which are below the sewer (or septic system) pipe. These cannot be “Naturally Drained” but must be piped. Condensate is usually acidic, and may not be permitted in the sewer or septic system.

b. <u>Dedicated branch circuit for heat pump system #15</u>: The heat pump system will have substantial power requirements (amperage). This will increase the size of the feeders to the house (provided by the electrical utility) and the cost of wiring inside the house. This increases the cost of building a new home or renovating an existing home.

Recommendation: Reject this NBI Recommendation

5. Renewable Energy Contract Length: The building codes regulate building construction, not contracts.

The energy contract is between the supplier and the consumer. Factors include energy cost, reliability, ability of the supplier to provide adequate energy, and service to the consumer. Requiring a 15 year contract allows the energy supplier to provide expensive, unreliable energy, with lousy service.

Also, some towns are now providing town-wide renewable energy plans for the residents. The plan allows residents to cancel (and switch back to a non-renewable supplier) if they are not happy with cost or service. This contract term requirement will discourage consumers from trying renewable energy, and hurt the renewable industry.

Recommendation: Reject this NBI Recommendation

6. RENEWABLE ENERGY RESOURCES and Renewable FUEL:

The building codes regulate **BUILDING COCSTRUCTION**, and not the source of energy supplied to the building.

This section is not appropriate in the Building Code.

In California the definition is in the California Air resource Board, not in the Building Code.

Recommendation: Reject this NBI Recommendation

7. Solar Ready System: These requirements are redundant, and conflict with the purchase of independently supplied renewable power, community solar systems serving low-income housing (which is planned in my community) and/or municipally provided renewable power.

Also, the State building codes regulate what additional building construction information (for example insulation) is posted near the electrical panel. Nothing extra is allowed inside the electrical panel except Panel Directory and Operating Instructions.

Recommendation: Reject this NBI Recommendation

8. <u>Substantial Energy Alteration</u>:

This applies to alterations to EXISTING BUILDINGS, which is addresses in the Existing Building Code, not the Building Code.

It is not appropriate in the Building Code, which applies to New Construction.

Recommendation: Reject this NBI Recommendation

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
No cost information provided

Workgroup Recommendation

Proposal # 1494

REPCD1-18-22

Proponents: Alisa McMahon, representing self (mcmahon.gbac@cox.net)

2024 International Energy Conservation Code [RE Project]

R402.2.8 Floors. Floor *insulation* shall comply with one 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.
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.
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 *R*-values of the cavity and continuous insulation components or the R-value of continuous insulation only shall equal the required insulation component *R*-values for floors. Cavity insulation shall extend from the bottom to the top of all perimeter floor framing members and the framing members shall be air sealed.

Revise as follows:

TABLE R402.5.1.1 AIR BARRIER, AIR SEALING AND INSULATION INSTALLATION[a]

Portions of table not shown remain unchanged.

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
Floors, including cantilevered floors and floors above garages	The air barrier shall be installed at any exposed edge of insulation.	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.

Reason: Clarifications Requested

No changes have been made to sections above.

R402.2.8(1):
"**Installation** shall be installed"? Should this be "Insulation shall be installed"?

Is (1) met if readily filling the available cavity space does not achieve the required R-value?

Should (1) say framing members are required to be air sealed (as required in (2) and (3))?

Should (1) say insulation is required to extend from the bottom to the top of all perimeter floor framing members (as required in (2) and (3))?

R402.2.8(3) and using Climate Zone 2 as an example:

If 5 ci is used on the bottom, what R-value of cavity insulation is required from the bottom to the top of all perimeter floor framing members?

If 10 ci is used on the bottom, is cavity insulation required from the bottom to the top of all perimeter floor framing members, and if so, what R-value?

Table R402.5.1.1

Please make table comport with R402.2.8

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
Clarifications requested to make the intent of the code section clear.

Workgroup Recommendation

REPCD1-19-22

Proponents: Amanda Hickman, representing Leading Builders of America (amanda@thehickmangroup.com)

2024 International Energy Conservation Code [RE Project]

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 frame 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 R408.2.2.
2. All installed water heaters are heat pumps that meet one of the efficiencies in 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 R408.2.7.

Reason:
Leading Builders of America (LBA), submits this comment to affirm our complete and total support for the approved package of proposals known as the Omnibus. This proposal is a strong validation of the steps the ICC has taken to make the IECC a truly consensus-based document. The Omnibus successfully balances competing viewpoints in a pragmatic approach that is rooted in sound data, good building practices and consumer protection. Most significantly, the Omnibus accomplishes these goals without diminishing energy savings.

The Omnibus ensures that the 2024 IECC will meet climate change goals, including moving towards net zero, while promoting flexibility and protecting affordability for consumers. LBA is committed to supporting the Omnibus in its entirety throughout the remainder of the development process.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
No change to the code.

Workgroup Recommendation

Proposal # 1245

REPCD1-20-22

Proponents: David Forde, representing PGW

2024 International Energy Conservation Code [RE Project]

R408.2.2 More efficient HVAC equipment performance option. Heating and cooling *equipment* shall meet one of the following efficiencies
Centrally Ducted Systems:

1. Greater than or equal to 16
2. Greater than or equal to 18 SEER (16.9 SEER2) and 14 EER (13.4 EER2) air conditioner.
3. Greater than or equal to 92 AFUE natural gas furnace.
4. Greater than or equal to 95 AFUE natural gas furnace and 15.2 SEER2 in Climate Zones 5, 6 and 7
5. Greater than or equal to 95 AFUE natural gas furnace and 16.0 SEER2 in other Climate Zones for air conditioner.
6. Greater than or equal to 95 AFUE natural gas furnace and 8.5 HSPF2/16.0 SEER2 air source heat pump.
7. Greater than or equal to 96 AFUE natural gas furnace.
8. Greater than or equal to 8.5 HSPF2/16.0 SEER2 air source heat pump.
9. Greater than or equal to 9 HSPF (7.6 HSPF2) /16 SEER (15.2 SEER2) air source heat pump.
10. Greater than or equal to 10 HSPF (8.5 HSPF2) /16SEER (15.2 SEER2) air source heat pump.
11. Greater than or equal to 3.5 COP ground source heat pump.

Ductless Systems:

12. Single Zone: 8.5 HSPF2/16.9 SEER2 variable speed air source heat pump.
13. Multi Zone: 8.5 HSPF2/16.9 SEER2 variable speed air source heat pump (Non-Ducted Indoor Units).
14. Multi Zone: 8.5 HSPF2/15.2 SEER2 variable speed air source heat pump (Ducted or Mixed Indoor Units)

Reason: Additional Efficiency Requirements – Code R408.2.2
Philadelphia Gas Works ("PGW") located in the Northeast is the largest municipally owned gas utility in the country, employing over 1,600 workers in Philadelphia and distributing natural gas for both heating and non-heating purposes to an estimated 1.6 million residents and businesses across the City (roughly 484,000 residential customers, 25,000 commercial customers and 700 industrial customer accounts.

Philadelphia is the nation's poorest big city in America with a poverty rate of roughly 23 percent or nearly 400,000 residents: disproportionately affecting black and brown communities, and vulnerable senior populations.

Philadelphian households on average spend around 6.7% of their income on energy, about double the national average, making Philadelphia one of the most energy-burdened cities in the United States.

PGW is committed to continuously working to identify and implement new opportunities for additional environmental benefits, including, increased energy efficiency and Greenhouse Gas emission reduction targets; and a diverse energy supply, providing carbon reduction opportunities to combat climate change.

However, Code R408.2.2 Additional Efficiency Requirements challenges Philadelphia residents' access to more affordable energy options. Shifting natural gas consumption to sell as higher costelectricity; ormoving new construction away from gas;or incentivizing homeowners to switch toother alternativestoohastily, through policies and incentives, willforce many customers to keep their homes at unsafe temperaturesand disproportionallyleavelower income customers with steadily rising energy costs.

Cost Impact: The code change proposal will decrease the cost of construction.
Less requirements would lead to greater options that are potentially less expensive.

Workgroup Recommendation

REPCD1-21-22

Proponents: Glen Brand, representing Solar United Neighbors (glen@solarunitedneighbors.org)

2024 International Energy Conservation Code [RE Project]

APPENDIX RB
SOLAR-READY PROVISIONS—DETACHED ONE- AND TWO-FAMILY DWELLINGS AND TOWNHOUSES

SECTION RB101
SCOPE

RB101.1 General. These provisions shall be applicable for new construction where solar-ready provisions are required.

Reason: Dear Consensus Committee members,
We appreciate the opportunity to provide comments on the residential International Energy Conservation Code (IECC) public comment draft #1.
We strongly encourage members of the Consensus Committee to support the inclusion of a solar requirement in the appendix of the code.
In 2021, President Biden announced a target of a 50% reduction in national emissions by 2030. Residential buildings make up 21% of total energy consumption in the United States. This means that the residential IECC has a particularly important role to play in reaching the nation's emissions goals.
Quickly expanding the use of local solar and battery storage is the most cost-effective way to create a clean electricity grid. According to a study from Local Solar for All, a clean energy grid (i.e., one that transmits 95% clean electricity) that maximizes the expansion of local solar and storage could produce $473 billion in savings by 2050, as compared to a clean electricity grid that doesn't expand local solar and storage.
Pairing rooftop solar with strong efficiency standards is a common-sense solution that reduces greenhouse gas emissions, reduces air pollution, saves consumers money, and creates a more resilient electric grid.
As electricity costs in the United States continue to rise, rooftop solar can help consumers save money on their utility bills. According to EnergySage, a solar marketplace, a 6-kW solar system could save the average homeowner between $20,000 and $75,000 over the 25-year lifetime of the system's panels. The residential IECC should include cost-effective measures like on-site clean energy generation.
Installing rooftop solar during construction of a new home can also be more cost effective and allows homeowners to roll the cost of solar into their mortgage or finance the system through a third-party financing option. Installing solar during construction can also protect the homebuyer from roof warranties being voided in the future.
Rooftop solar also has minimal land footprint and increases the energy efficiency of the electric grid. Requiring rooftop solar in new construction would help ensure that new homes and multifamily buildings help generate clean electricity to be used by homeowners and their community. Given that electricity from rooftop solar is often consumed right where it is generated, it reduces electric line losses.
It is critical that the residential IECC provide cities, counties, and states with code provisions that increase energy efficiency and reduce greenhouse gas emissions while helping consumers reduce their energy costs. With 10 states and more than 170 cities committed to reaching 100% renewable electricity, a standard code provision to require rooftop solar on new residential construction is an important tool in achieving those goals. Including a requirement for rooftop solar in the appendix of the residential IECC will provide a uniform standard that cities, counties, and states can adopt.
The Department of Energy has proposed a requirement for solar on new residential construction, including single family homes, townhouses, and low-rise multifamily buildings, for the appendix of the code. We urge the Consensus Committee to support this proposal and include a solar requirement for residential construction in the appendix of the 2024 IECC.
Sincerely,
Solar United Neighbors
Vote Solar
Environment America Research & Policy Center
Michigan Energy Innovation Business Council
Clean Energy for America
Northeast Clean Energy Council
Colorado Solar and Storage Association
MassSolar
PosiGen Solar
Sunnova Energy Corporation
Sunrun
SunPower Corporation
EnergySage
California Solar and Storage Association
Solar Energy Business Association of New England

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
public comment has no change in construction cost

Workgroup Recommendation

Proposal # 1496

REPCD1-22-22

Proponents: Michele DeFrance, representing City of Portland Maine (mdefrance@portlandmaine.gov)

2024 International Energy Conservation Code [RE Project]

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, 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, and 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 either an outlet, junction box or receptacle, that will support an installed EVSE.

ELECTRIC VEHICLE SUPPLY EQUIPMENT (EVSE). Equipment for plug-in power transfer including the ungrounded, grounded and equipment grounding conductors, and the electric vehicle connectors, attached plugs, 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

R404.7 Electric Vehicle Power Transfer Infrastructure. New automobile parking spaces for one- and two-family dwellings and townhouses shall be provided in accordance with Sections R404.7.1 through R404.7.5. New residential automobile parking spaces for R-2 occupancies shall be provided with electric vehicle power transfer infrastructure in accordance with Sections R404.7.1 through R404.7.5.

R404.7.1 Quantity. New one- and two-family dwellings and townhouses with a designated attached or detached garage or other onsite private parking provided adjacent to the dwelling unit shall be provided with one EV-capable, EV-ready, or EVSE installed space 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 EVSE space for 40 percent of each dwelling units or automobile parking spaces, whichever is less.

R404.7.2 EV Capable Spaces. Each EV capable space used to meet the requirements of Section R404.7.1 shall comply with all of the following:

1. A continuous raceway or cable assembly shall be installed between an enclosure or outlet located within 3 feet (914 mm) of the EV capable space and a suitable panelboard or other onsite electrical distribution equipment.
2. Installed raceway or cable assembly shall be sized and rated to supply a minimum circuit capacity in accordance with R404.7.4
3. The electrical distribution equipment to which the raceway or cable assembly connects shall have sufficient dedicated space and spare electrical capacity for a 2-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)."

R404.7.3 EV Ready Spaces. Each branch circuit serving EV ready spaces shall comply with all of the following:

1. Terminate at an outlet or enclosure, located within 3 feet (914 mm) of each EV ready space it serves.
2. Have a minimum circuit capacity in accordance with R404.7.4.
3. The panelboard or other electrical distribution equipment directory shall designate the branch circuit as "For electric vehicle supply equipment (EVSE)" and the outlet or enclosure shall be marked "For electric vehicle supply equipment (EVSE)."

R404.7.4 Circuit Capacity. For one- and two-family dwellings and townhouses, the capacity of electrical infrastructure serving each EV capable space, EV ready space and EVSE space shall have a rated capacity not less than 8.3 kVA (or 40A at 208/240V) for each EV capable space, EV ready space or EVSE space it serves. Where a circuit is shared or managed it shall be in accordance with NFPA 70. For R-2 occupancies, the capacity of electrical infrastructure serving each EV capable space, EV ready space and EVSE space shall comply with one of the following:

1. A branch circuit shall have a rated capacity not less than 8.3kVA (or 40A at 208/240V) for each EV capable space, EV ready space or EVSE space it serves. Where a circuit is shared or managed it shall be in accordance with NFPA 70.
2. The requirements of R404.7.4.1.

Exceptions:

1. Where the local electric distribution entity has certified in writing that it is not able to provide 100 percent of the necessary distribution capacity within 2 years after the estimated date of the certificate of occupancy. The required EV charging infrastructure shall be reduced based on the available existing electric distribution capacity.

2. Where substantiation has been approved that meeting the requirements of Section R404.7.4.1 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 $400.00 per dwelling unit.

R404.7.4.1 Circuit capacity management. The capacity of each branch circuit serving multiple EVSE spaces, EV ready space or EV capable spaces designed to be controlled by an energy management system providing load management in accordance with NFPA 70, shall have a capacity of not less than 2.7 kVA per space.

R404.7.5 EVSE installation. For one- and two-family dwellings and townhouses, EVSE shall be installed in accordance with NFPA 70 and shall be listed and labeled in accordance with UL 2202 or UL 2594. For R-2 occupancies, EVSE shall be installed in accordance with NFPA 70 and Section R404.7.5.1 and shall be listed and labeled in accordance with UL 2202 and UL 2594.

R404.7.5.1 EVSE minimum charging rate. Each installed EVSE shall comply with one of the following:
1. Be capable of charging at a rate of not less than 6.2 kVA (or 30A at 208/240V).
2. Where serving EVSE spaces allowed to have a circuit capacity of not less than 2.7 kVA in accordance with R404.7.4.1 and controlled by an energy management system providing load management, be capable of simultaneously charging each EVSE space at a rate of not less than 2.1 kVA.

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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, 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, and 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 either an outlet, junction box or receptacle, that will support an installed EVSE.

ELECTRIC VEHICLE SUPPLY EQUIPMENT (EVSE). Equipment for plug-in power transfer including the ungrounded, grounded and equipment grounding conductors, and the electric vehicle connectors, attached plugs, 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

N1104.7 Electric Vehicle Power Transfer Infrastructure. New automobile parking spaces for one- and two-family dwellings and townhouses shall be provided in accordance with Sections N1104.7.1 through N1104.7.5.

N1104.7.1 Quantity. New one- and two-family dwellings and townhouses with a designated attached or detached garage or other onsite private parking provided adjacent to the dwelling unit shall be provided with one EV-capable, EV-ready, or EVSE installed space per dwelling unit.

N1104.7.2 EV Capable Spaces. Each EV capable space used to meet the requirements of Section N1104.7.1 shall comply with all of the following:
1. A continuous raceway or cable assembly shall be installed between an enclosure or outlet located within 3 feet (914 mm) of the EV capable space and a suitable panelboard or other onsite electrical distribution equipment.
2. Installed raceway or cable assembly shall be sized and rated to supply a minimum circuit capacity in accordance with N1104.7.4.
3. The electrical distribution equipment to which the raceway or cable assembly connects shall have sufficient dedicated space and spare electrical capacity for a 2-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)."

N1104.7.3 EV Ready Spaces. Each branch circuit serving EV ready spaces shall comply with all of the following:
1. Terminate at an outlet or enclosure, located within 3 feet (914 mm) of each EV ready space it serves.
2. Have a minimum circuit capacity in accordance with N1104.7.4.

3. The panelboard or other electrical distribution equipment directory shall designate the branch circuit as "For electric vehicle supply equipment (EVSE)" and the outlet or enclosure shall be marked "For electric vehicle supply equipment (EVSE)."

N1104.7.4 Circuit Capacity. For one- and two-family dwellings and townhouses, the capacity of electrical infrastructure serving each EV capable space, EV ready space and EVSE space shall have a rated capacity not less than 8.3 kVA (or 40A at 208/240V) for each EV capable space, EV ready space or EVSE space it serves. Where a circuit is shared or managed it shall be in accordance with NFPA 70.
Exceptions:

1. Where the local electric distribution entity has certified in writing that it is not able to provide 100% of the necessary distribution capacity within 2 years after the estimated date of the certificate of occupancy. The required EV charging infrastructure shall be reduced based on the available existing electric distribution capacity.
2. Where substantiation has been approved that meeting the requirements of Section N1104.7.4.1 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 $400.00 per dwelling unit.

N1104.7.4.1 Circuit capacity management. The capacity of each branch circuit serving multiple EVSE spaces, EV ready space or EV capable spaces designed to be controlled by an energy management system providing load management in accordance with NFPA 70, shall have a capacity of not less than 2.7 kVA per space.

N1104.7.5 EVSE installation. For one- and two-family dwellings and townhouses, EVSE shall be installed in accordance with NFPA 70 and shall be listed and labeled in accordance with UL 2202 or UL 2594. For R-2 occupancies, EVSE shall be installed in accordance with NFPA 70 and Section N1104.7.5.1 and shall be listed and labeled in accordance with UL 2202 and UL 2594.

N1104.7.5.1 EVSE minimum charging rate. Each installed EVSE shall comply with one of the following:

1. Be capable of charging at a rate of not less than 6.2 kVA (or 30A at 208/240V).
2. Where serving EVSE spaces allowed to have a circuit capacity of not less than 2.7 kVA in accordance with N1104.7.4.1 and controlled by an energy management system providing load management, be capable of simultaneously charging each EVSE space at a rate of not less than 2.1 kVA.

Reason: ICC Council Policy 7 – Committees and Members, Section 9.1 – Scope of Work states *The work of each committee shall be:*
9.1.1 In accordance with the committee's scope and objectives statement,
9.1.2 In accordance with any instructions subsequently issued by the ICC Board, and
9.1.3 Consonant with the objectives of the ICC.

Additionally, The Scope and Intent were provided to the Committee and posted on the International Energy Conservation Code (IECC) Residential Consensus Committee webpage as the “Committee Procedures”. The intent of the Residential Energy Provisions – IECC, R101.3 (page 2-3 of the Committee Procedures), and the intent of the Residential Energy Provision – Chapter 11 of the IRC, N1101.2 (page 3 of the Committee Procedures), state;

“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 non-mandatory appendices incorporating additional energy efficiency and greenhouse gas reduction resources developed by the Code Council and others.”

The Goals & Objectives were also provided to the Committee and posted on the International Energy Conservation Code (IECC) Residential Consensus Committee webpage as the “Committee Procedures”. The Goals & Objectives (page 3 of the Committee Procedures), state;

The goals and objectives in the “Intent” provisions above note the following for inclusion in the code:

- *Optional requirements that lead to achievement of zero energy buildings, presently, and through glidepaths that achieve zero energy buildings by 2030.*

- *The code may include non-mandatory appendices incorporating additional energy efficiency and greenhouse gas reduction resources.*

These performance objectives are intended to provide jurisdictions with an adoptable set of provisions to achieve net-zero energy by 2030.

And, the ICC Board did not issue any further instructions, but prior to the Committee work, the ICC Board did approved “LEADING THE WAY TO

ENERGY EFFICIENCY A Path Forward on Energy and Sustainability to Confront a Changing Climate", which is referenced and linked in the "Committee Procedures"(Page 2). The last principle in the list of principles (located on page 5 of "LEADING THE WAY TO ENERGY EFFICIENCY A Path Forward on Energy and Sustainability to Confront a Changing Climate".) that govern the work of the committee it states:

The committee should develop <u>supplemental requirements</u> reflecting the diversity of energy efficiency goals made by adopting jurisdictions and the federal government. These shall include minimum requirements and <u>optional requirements</u> aimed at achieving zero energy buildings over multiple timeframes (e.g., through use of the current edition of the code, by 2030 and by 2050).

Furthermore, on page 7 of "LEADING THE WAY TO ENERGY EFFICIENCY A Path Forward on Energy and Sustainability to Confront a Changing Climate" it states;

Building off the success of the IECC and IgCC, <u>the Code Council will develop a layered approach</u> that provides communities with <u>a menu of technical and policy resources</u>, which <u>integrate with the I-Codes</u>, to address their energy efficiency and GHG reduction goals, including those goals identified by the Energy and Carbon Advisory Council. The IECC will remain the minimum requirement.

The <u>resources are intended to be useable independently and adopted alongside the baseline code</u> to support the policies of a community in specific areas. For example, a community could adopt the 2021 IECC with provisions from the Code Council resources developed for electric vehicles or electrification.

It is clear that the ICC Board's instructions were that provisions for electric vehicle-ready, solar renewable energy-ready and other greenhouse gas and zero energy building goals should be in supplemental, optional, non-mandatory appendices or resources, and NOT in the baseline code.

Point 1:

This section requires infrastructure for Electric Vehicles, but code does not require the equipment or systems that the infrastructure is to support, and EV are outside the scope of the code.

Point 2:

This section does not take into account the rapid development of technology and technological obsolescence and creates an unnecessary additional cost to all residential buildings.

Point 3:

This section does not take into account that cars are not mandatory for home ownership, and wrongfully assumes every home owner and renter owns a car during a time when local municipalities and the federal government are trying to encourage public transportation.

Point 4:

This section does not take into account local and regional infrastructure limitations, and doesn't provide any exceptions to accommodate real-world conditions.

Recommendation:

The entire section should be removed from the body of the code to a non-mandatory appendix per Committee Procedures, if not eliminated completely. Likewise, definitions and Section N1104.7 that coordinates with the IECC should be relocated or removed.

Cost Impact: The code change proposal will decrease the cost of construction.
Removing the language from the body of the code, either to an appendix or completely, will remove the requirement to provide infrastructure for a system code does not require, and lower the cost of construction.

Workgroup Recommendation

REPCD1-23-22

Proponents: Ben Rabe, representing New Buildings Institute (ben@newbuildings.org); Mark Lyles, representing California IOUs (markl@newbuildings.org)

2024 International Energy Conservation Code [RE Project]

R404.5 Electric readiness. Systems using fossil fuel: water heaters, household clothes dryers, conventional cooking tops or conventional ovens shall comply with the requirements of Sections R404.5.1 through R404.5.4

R404.5.1 Cooking products. An individual branch circuit outlet with a rating not less than 250-volts, 40-amperes shall be installed, and terminate within three feet of conventional cooking tops, conventional ovens or cooking products combining both.
Exception: Cooking products not installed in an individual dwelling unit.

R404.5.2 Household Clothes Dryers. An individual branch circuit outlet with a rating not less than 240-volts, 30-amperes shall be installed, and terminate within three feet (304 mm) of each household clothes dryer.
Exception: Clothes dryers that serve more than one dwelling unit and are located outside of a dwelling unit.

R404.5.3 Water heaters. An individual branch circuit outlet with a rating not less than either 240-volts, 30-amperes or 120V, 20-amperes shall be installed, and terminate within three feet (304 mm) of each fossil fuel water heater. **Exception:** Water heaters in a centralized water heating system serving multiple dwelling units in a R-2 occupancy.

R404.5.4 Electrification-ready circuits. The unused conductors required by Sections R404.5.1 through R404.5.3 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 R404.5.1 through R404.5.3 shall be included in the load calculations of the original installation.

R404.6 Renewable energy infrastructure. The building shall comply with the requirements of R404.6.1 or R404.6.2.

R404.6.1 One- and two- family dwellings and townhouses . One- and two-family dwellings and townhouses shall comply with Sections R404.6.1.1 through R404.6.1.4.
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^2) of roof area oriented between 110 degrees and 270 degrees of true north.
3. A dwelling unit with less than 500 square feet (46m^2) of roof area oriented between 110 degrees and 270 degrees of true north.
4. Dwelling units where 50 percent of the solar-ready area is shaded from direct-beam sunlight by natural objects or by structures that are not part of the building for more than 2500 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 whole-building electric use on an annual basis.
7. A dwelling unit less than or equal to 1,500 square feet (139 m^2) of living space floor area located above grade plane.

R404.6.1.1 Solar-ready zone area. The total area of the solar-ready zone shall not be less than 250 square feet (23.2 m^2) 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^2) 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^2) per dwelling shall be permitted to have a solar-ready zone area of not less than 150 square feet (14 m^2).

R404.6.1.2 Obstructions. Solar-ready zones shall be free from obstructions, including but not limited to vents, chimneys, and roof-mounted equipment.

R404.6.1.3 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 Solar Electric." The reserved space shall be at the opposite (load) end of the busbar from the primary energy source.

R404.6.1.4 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 minimum 1 inch (25 mm) nonflexible metallic conduit or permanently installed wire as approved by the code official. Where the interconnection terminates in the attic, location shall be no less than 12 inches (35 mm) above ceiling insulation. Both ends of the interconnection shall be labeled "For Future Solar Electric".

R404.6.2 Group R occupancies. Buildings in Group R-2, R-3 and R-4 shall comply with Appendix CB.

R404.7 Electric Vehicle Power Transfer Infrastructure. New automobile parking spaces for one- and two-family dwellings and townhouses shall be provided in accordance with Sections R404.7.1 through R404.7.5. New residential automobile parking spaces for R-2 occupancies shall be provided with electric vehicle power transfer infrastructure in accordance with Sections R404.7.1 through R404.7.5.

R404.7.2 EV Capable Spaces. Each EV capable space used to meet the requirements of Section R404.7.1 shall comply with all of the following:

1. A continuous raceway or cable assembly shall be installed between an enclosure or outlet located within 3 feet (914 mm) of the EV capable space and a suitable panelboard or other onsite electrical distribution equipment.
2. Installed raceway or cable assembly shall be sized and rated to supply a minimum circuit capacity in accordance with R404.7.4
3. The electrical distribution equipment to which the raceway or cable assembly connects shall have sufficient dedicated space and spare electrical capacity for a 2-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)."

R404.7.3 EV Ready Spaces. Each branch circuit serving EV ready spaces shall comply with all of the following:

1. Terminate at an outlet or enclosure, located within 3 feet (914 mm) of each EV ready space it serves.
2. Have a minimum circuit capacity in accordance with R404.7.4.
3. The panelboard or other electrical distribution equipment directory shall designate the branch circuit as "For electric vehicle supply equipment (EVSE)" and the outlet or enclosure shall be marked "For electric vehicle supply equipment (EVSE)."

R404.7.4 Circuit Capacity. For one- and two-family dwellings and townhouses, the capacity of electrical infrastructure serving each EV capable space, EV ready space and EVSE space shall have a rated capacity not less than 8.3 kVA (or 40A at 208/240V) for each EV capable space, EV ready space or EVSE space it serves. Where a circuit is shared or managed it shall be in accordance with NFPA 70. For R-2 occupancies, the capacity of electrical infrastructure serving each EV capable space, EV ready space and EVSE space shall comply with one of the following:

1. A branch circuit shall have a rated capacity not less than 8.3kVA (or 40A at 208/240V) for each EV capable space, EV ready space or EVSE space it serves. Where a circuit is shared or managed it shall be in accordance with NFPA 70.
2. The requirements of R404.7.4.1.

Exceptions:

1. Where the local electric distribution entity has certified in writing that it is not able to provide 100 percent of the necessary distribution capacity within 2 years after the estimated date of the certificate of occupancy. The required EV charging infrastructure shall be reduced based on the available existing electric distribution capacity.
2. Where substantiation has been approved that meeting the requirements of Section R404.7.4.1 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 $400.00 per dwelling unit.

R404.7.4.1 Circuit capacity management. The capacity of each branch circuit serving multiple EVSE spaces, EV ready space or EV capable spaces designed to be controlled by an energy management system providing load management in accordance with NFPA 70, shall have a capacity of not less than 2.7 kVA per space.

R404.7.5 EVSE installation. For one- and two-family dwellings and townhouses, EVSE shall be installed in accordance with NFPA 70 and shall be listed and labeled in accordance with UL 2202 or UL 2594. For R-2 occupancies, EVSE shall be installed in accordance with NFPA 70 and Section R404.7.5.1 and shall be listed and labeled in accordance with UL 2202 and UL 2594.

R404.7.5.1 EVSE minimum charging rate. Each installed EVSE shall comply with one of the following:

1. Be capable of charging at a rate of not less than 6.2 kVA (or 30A at 208/240V).
2. Where serving EVSE spaces allowed to have a circuit capacity of not less than 2.7 kVA in accordance with R404.7.4.1 and controlled by an energy management system providing load management, be capable of simultaneously charging each EVSE space at a rate of not less than 2.1 kVA.

Reason: December 16, 2022

Residential Consensus Committee Members

International Code Council
500 New Jersey Avenue, NW
6th Floor,
Washington, DC 20001

Re: Public Comment Draft #1 for IECC-R

Dear Residential Consensus Committee Members,

As environmental and climate advocates, we applaud the Residential Consensus Committee for approving a draft of the residential 2024 IECC that represents a significant step forward in decarbonizing our homes, positioning our nation for an equitable transition to a carbon free economy and for meeting our climate goals. The provisions adopted into the residential 2024 IECC that promote building decarbonization are critical to keeping global average temperature rise below 2°-degrees Celsius to avoid the worst impacts of climate change. Specifically we thank the Residential Consensus Committee for incorporating the following measures into the 2024 IECC: Incorporating Solar and EV Ready Requirements: Decarbonizing the nation's electric grid and transportation are key to an equitable transition to a carbon free economy and to meeting our climate goals. We applaud the Committee for establishing requirements to ensure that newly built homes will be able to cost effectively accommodate future installations of equipment for renewable energy generation and electric vehicle charging, protecting homeowners from costly upgrades as solar power generation and EVs become more prevalent. Complementary Residential and Commercial EV Ready requirements will create the opportunity for EV owners to charge both at home and at work. Including Electric Ready Requirements: We appreciate the Committee's recognition that all new construction mixed fuel buildings should be electric-ready to the greatest extent possible. The cost of meeting electric-ready requirements when a building is under construction, walls are open, and the trades are already on-site, is small in comparison to the cost of retrofitting a building to install the same level of electric equipment.1 The cost of retrofitting electrical panels, opening walls to install conduit, etc. can be orders of magnitude higher. Having electric-ready infrastructure in place gives building occupants the choice to shift to electric appliances at time of replacement or retrofit without incurring potentially high retrofit costs in the future. The California Building Energy Efficiency Standards 2022 update (Title 24, Part 6) has already moved in this direction, including electric-ready requirements for heat pump space heating, cooktops and clothes drying in both single family homes and multifamily buildings, and for water heating in single family homes. Providing All-Electric Code as an Appendix: The purpose of a model code is to provide cities and states with a starting point on which each jurisdiction can base their energy code. Growing interest in establishing all-electric building requirements is evidenced by the number of cities and states that have already passed pro-electrification ordinances including Washington DC; New York City, Ithaca, New York; Brookline, Massachusetts; Berkeley, Massachusetts; Los Angeles, Sacramento, San Francisco, Oakland and San Jose, California and Washington State. Including an Appendix in the Residential 2024 IECC will streamline adoption and implementation of all-electric residential construction for policy makers and the building industry. We strongly encourage that the code language in this appendix provide common definitions on what constitutes an all-electric home and be applicable to all compliance paths available in the IECC 2024 so that any jurisdiction looking to take action can easily adopt this appendix. We also encourage that the code language minimize the use of electric resistance heat for space and water heating. Reliance on electric resistance heating can create conditions for high bills and negative impacts on local distribution grid systems.

We applaud the Residential Consensus Committee for taking these critical first steps to decarbonizing our residential built environment into the 2024 IECC. We look forward to future collaborations with the Committee to promote residential building electrification to help our country meet its climate goals equitably. Thank you for your leadership and for the opportunity to comment.

Signed,

Gayathri Vijayakumar, SWA
Ann Edminster Design, AVEnues LLC
Erin Sherman, RMI
Lauren Urbanek, NRDC
Emma Gonzalez-Laders, NY DOS
Joe Hiss, Public Citizen
Michael Winka, Sustainable Lawrence
Alex Chase, 2050 Partners
Pat Eilert, California Statewide Utiltiy Codes and Standard Team
Michele Melley, CT Department of Energy and Environmental Protection
Anshul Gupta, Climate Reality Project
Tom Corlett, TCAssociates
Kristina Murphy, Confluence Climate Consulting
Bob Kapicka, Public Citizen
Kaiba White, Public Citizen
Vanessa Warheit, Plug In America/EV Charging for All Coalition
Lisa Albrecht, All Bright Solar
Talmadge Frank Archer, Archer Testing
Julie Curti, Metropolitan Area Planning Council (MAPC)
Doug Presley, Dandelion Energy
Grant Nordby, Shive-Hattery, Inc.
Jennifer Amann, ACEEE
Mark Lyles, New Buildings Institute

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
Letter in support of existing language.

Workgroup Recommendation

Proposal # 1258

REIPC1-1-22 Part I

Proponents: Aaron Gary, representing Tempo, Inc. (aaron.gary@texenergy.org)

2024 ICC Performance Code

Add new text as follows:

R403.6.4 Dwelling unit sampling. For buildings with eight or more dwelling units the mechanical ventilation systems in the greater of seven, or 20 percent of the dwelling units in the building 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, 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 mechanical ventilation rate, corrective actions shall be made to the system and the system retested until it passes. For each tested dwelling unit that has a lesser ventilation flow rate than the minimum permitted ventilation flow rate, an additional three dwelling units, including the corrected unit, shall be tested.

Reason: The committee approved a sampling methodology for demonstrating compliance in the envelope leakage and duct leakage sections. Not approving the same methodology and as a result requiring every bath fans, kitchen hoods, and supply fans to be tested in every dwelling unit does not make sense. The ventilation testing can be more time-consuming that the duct leakage and envelope testing while the resulting negative impact of non-compliance of ventilation systems is less than that of the envelope and duct leakage testing.
Updated Simulated Path table to give direction on how to input results when testing is performed with or with a sampling methodology.

Cost Impact: The code change proposal will decrease the cost of construction.
Reducing the number of tests required to demonstrate compliance will reduce the burden and cost of compliance verification.

Workgroup Recommendation

Proposal # 1047

REIPC1-1-22 Part II

Proponents: Aaron Gary, representing Tempo, Inc. (aaron.gary@texenergy.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R403.6.3 Testing. Each m~~M~~echanical ventilation system~~s~~ shall be tested and verified to provide the minimum ventilation flow rates required by Section R403.6, in accordance with ANSI/RESNET/ICC 380. 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 6-inch (152 mm) or larger , a length of 10ft (3048 mm) or less, and not more than two 90° elbows or equivalent 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, programmable airflow settings, and a user interface that communicates the installed airflow rate.
3. Where tested in accordance with Section R403.6.4, testing of each duct system is not required.

Reason: The committee approved a sampling methodology for demonstrating compliance in the envelope leakage and duct leakage sections. Not approving the same methodology and as a result requiring every bath fans, kitchen hoods, and supply fans to be tested in every dwelling unit does not make sense. The ventilation testing can be more time-consuming that the duct leakage and envelope testing while the resulting negative impact of non-compliance of ventilation systems is less than that of the envelope and duct leakage testing.
Updated Simulated Path table to give direction on how to input results when testing is performed with or with a sampling methodology.

Cost Impact: The code change proposal will decrease the cost of construction.
Reducing the number of tests required to demonstrate compliance will reduce the burden and cost of compliance verification.

Workgroup Recommendation

Proposal # 1495
