

Adopted Filing – Coversheet

Instructions:

In accordance with Title 3 Chapter 25 of the Vermont Statutes Annotated and the “Rule on Rulemaking” adopted by the Office of the Secretary of State, this filing will be considered complete upon filing and acceptance of these forms with the Office of the Secretary of State, and the Legislative Committee on Administrative Rules.

All forms shall be submitted at the Office of the Secretary of State, no later than 3:30 pm on the last scheduled day of the work week.

The data provided in text areas of these forms will be used to generate a notice of rulemaking in the portal of “Proposed Rule Postings” online, and the newspapers of record if the rule is marked for publication. Publication of notices will be charged back to the promulgating agency.

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**PLEASE REMOVE ANY COVERSHEET OR FORM NOT
REQUIRED WITH THE CURRENT FILING BEFORE DELIVERY!**

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Certification Statement: As the adopting Authority of this rule (see 3 V.S.A. § 801 (b) (11) for a definition), I approve the contents of this filing entitled:
**Vermont Residential Building Energy Standards (RBES)
Amendments**

_____/s/ June E. Tierney_____, on 6/21/23_____
(signature) (date)

Printed Name and Title:

June E. Tierney, Commissioner, Vermont Department of
Public Service

RECEIVED BY: _____

- Coversheet
- Adopting Page
- Clean text of the rule (Amended text without annotation)
- Letter regarding changes to the final proposed

1. TITLE OF RULE FILING:

**Vermont Residential Building Energy Standards (RBES)
Amendments**

2. PROPOSED NUMBER ASSIGNED BY THE SECRETARY OF STATE

22P 028

3. ADOPTING AGENCY:

Department of Public Service

4. RECORDS EXEMPTION INCLUDED WITHIN RULE:

*(DOES THE RULE CONTAIN ANY PROVISION DESIGNATING INFORMATION AS CONFIDENTIAL;
LIMITING ITS PUBLIC RELEASE; OR OTHERWISE, EXEMPTING IT FROM INSPECTION AND
COPYING?)* No

IF YES, CITE THE STATUTORY AUTHORITY FOR THE EXEMPTION:

PLEASE SUMMARIZE THE REASON FOR THE EXEMPTION:

5. LEGAL AUTHORITY / ENABLING LEGISLATION:

*(THE SPECIFIC STATUTORY OR LEGAL CITATION FROM SESSION LAW INDICATING WHO THE
ADOPTING ENTITY IS AND THUS WHO THE SIGNATORY SHOULD BE. THIS SHOULD BE A
SPECIFIC CITATION NOT A CHAPTER CITATION).*

30 V.S.A. § 51 RESIDENTIAL BUILDING ENERGY STANDARDS

6. THE FILING HAS CHANGED SINCE THE FILING OF THE FINAL
PROPOSED RULE.

7. THE AGENCY HAS INCLUDED WITH THIS FILING A LETTER EXPLAINING
IN DETAIL WHAT CHANGES WERE MADE, CITING CHAPTER AND SECTION
WHERE APPLICABLE, INCLUDING CHANGES IN ECONOMIC IMPACT.

8. THE LEGISLATIVE COMMITTEE ON ADMINISTRATIVE RULES
DID NOT OBJECT TO THE FINAL PROPOSAL.

9. PROCEDURAL HISTORY OF ADOPTION:

ICAR Filing: 9/23/2022

Proposal Filed with Office of the Secretary of State: 10/27/2022

Notices Posted Online: 11/2/2022

Notices Published in the Newspapers of Record: 11/10/2022

A Hearing WAS Held.

Hearings Held (*PLEASE USE ADDITIONAL SHEETS TO PROVIDE THE DATE, TIME, AND LOCATION OF ALL HEARINGS, IF THIS FORM IS INSUFFICIENT TO LIST ALL HEARINGS HELD*):

Date: 12/2/2022

Time: 02:00 PM

Street Address: VIRTUAL HEARING, MICROSOFT TEAMS

Zip Code:

URL for Virtual: https://teams.microsoft.com/l/meetup-join/19%3ameeting_NWMxYjYzOTktNGU4YS00NjEyLThmZmMtYjU5ZmUxYTVlOWFi%40thread.v2/0?context=%7b%22Tid%22%3a%22f824a265-cbc1-4afc-acc-7191c2525f6d%22%2c%22Oid%22%3a%22d26bc85b-e562-4bc5-81ea-2a3b3911df03%22%7d.

Date:

Time: AM

Street Address:

Zip Code:

URL for Virtual:

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Time: AM

Street Address:

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Date:

Time: AM

Street Address:

Zip Code:

URL for Virtual:

Deadline for Public Comment: 12/9/2022

Final Proposal —

Filed with Secretary of State: 04/25/2023

Filed with LCAR: 04/25/2023

Dates of LCAR Review: 05/25/2023, 06/08/2023, ,
,

Adopted Rule —

Filed with Secretary of State: 06/21/2023

Filed with LCAR: 06/21/2023

10. EFFECTIVE DATE: 07/01/2024

(A RULE MAY TAKE EFFECT 15 DAYS AFTER ADOPTION IS COMPLETE OR AT A LATER TIME PROVIDED IN THE TEXT OF THE RULE SEE 3 V.S.A. §845(d) FOR DETAILS).

Adopting Page

Instructions:

This form must accompany each filing made during the rulemaking process:

Note: To satisfy the requirement for an annotated text, an agency must submit the entire rule in annotated form with proposed and final proposed filings. Filing an annotated paragraph or page of a larger rule is not sufficient. Annotation must clearly show the changes to the rule.

When possible, the agency shall file the annotated text, using the appropriate page or pages from the Code of Vermont Rules as a basis for the annotated version. New rules need not be accompanied by an annotated text.

1. TITLE OF RULE FILING:

**Vermont Residential Building Energy Standards (RBES)
Amendments**

2. ADOPTING AGENCY:

Department of Public Service

3. TYPE OF FILING (*PLEASE CHOOSE THE TYPE OF FILING FROM THE DROPDOWN MENU BASED ON THE DEFINITIONS PROVIDED BELOW*):

- **AMENDMENT** - Any change to an already existing rule, even if it is a complete rewrite of the rule, it is considered an amendment if the rule is replaced with other text.
- **NEW RULE** - A rule that did not previously exist even under a different name.
- **REPEAL** - The removal of a rule in its entirety, without replacing it with other text.

This filing is **AN AMENDMENT OF AN EXISTING RULE** .

4. LAST ADOPTED (*PLEASE PROVIDE THE SOS LOG#, TITLE AND EFFECTIVE DATE OF THE LAST ADOPTION FOR THE EXISTING RULE*):

SOS LOG #:19-072

Title: Residential Building Energy Standards (RBES)

Effective Date: 09/01/2020



State of Vermont
Department of Public Service
112 State Street
Montpelier, VT 05620-2601
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Louise Corliss
Office of the Secretary of State
1078 Route 2, Middlesex
Montpelier, Vt. 05633-7701

June 21, 2023

Legislative Committee on Administrative Rules
c/o, Legislative Counsel
Vermont State House
Montpelier, VT 05633-5301

Re: Adopted Rule Filing for Final Proposed Rule 22-P28, Residential Building Energy Standards Amendments

Dear Ms. Corliss,

The Department of Public Service (“Department”) hereby files its adopted rule, the Residential Building Energy Standards Amendments (“RBES”). The RBES final proposed rule was approved by the Legislative Committee on Administrative Rules (“LCAR”) at its meeting on June 8, 2023, with the Department’s proposal that the effective date for the rule be no earlier than July 1, 2024.

While the Department did not specify an effective date in its final proposed rule filing, it had anticipated setting a date of December 1, 2023, in its adopted rule filing. The Department explained this planned effective date to LCAR in a letter on June 2, 2023. Following discussions with LCAR at its meeting on June 8, the Department chose to move the planned effective date to July 1, 2024. LCAR approved the rule with that understanding.

The Department has made one change to the rule text since the final proposed filing: all relevant dates throughout the rule have been changed from **2023** to **2024** to reflect the fact that the rule will be effective in 2024.

The Department appreciates the assistance and support of the Secretary of State’s Office in implementing the RBES. Please feel free to contact me with any questions or concerns about this letter.

Sincerely,

/s/ Ben Civiletti
Ben Civiletti, Special Counsel
Vermont Department of Public Service
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2024 Vermont Residential Building Energy Standard AMENDMENTS



112 State Street
Montpelier, VT 05620

802-828-2811

<https://publicservice.vermont.gov/>

These rules are adopted under 30 V.S.A. § 51. This document shall be known and cited as the *2024 Vermont Residential Building Energy Standard Amendments*. The *2020 Vermont Residential Building Energy Standards* (First Printing: July 2020) published by International Code Council (ICC), Inc., as amended herein, are incorporated by reference and are available on the ICC website at: www.iccsafe.org

PREFACE

delete and replace Preface as follows:

Introduction

The *2024 Vermont Residential Building Energy Standards* (RBES) is based on the *2020 Vermont Residential Building Energy Standards*, which are based on the 2018 and 2015 *International Energy Conservation Code*[®] (IECC[®]). The 2024 RBES also includes 2021 and 2018 IECC energy efficiency requirements as well as select language updates and additional, more stringent Vermont energy efficiency requirements.

This comprehensive energy conservation code establishes minimum regulations for energy efficient buildings using prescriptive and performance-related provisions. It is founded on broad-based principles that make possible the use of new materials and new energy efficient designs.

The *International Energy Conservation Code* provisions provide many benefits, among which is the model code development process that offers an international forum for energy professionals to discuss performance and prescriptive code requirements. This model code also encourages international consistency in the application of provisions.

Development

This 2024 RBES is founded on principles intended to establish provisions consistent with the scope of an energy conservation code that adequately conserves energy; provisions that do not unnecessarily increase construction costs; provisions that do not restrict the use of new materials, products or methods of construction; and provisions that do not give preferential treatment to particular types or classes of materials, products or methods of construction.

Background

The Vermont Residential Building Energy Standards (RBES) was adopted by statute (30 V.S.A. § 51) in 1997. Act 89 of 2013 established a Stretch Code defined as a building energy code for residential buildings that achieves greater energy savings than the RBES. The stretch code shall be available for adoption by municipalities under 24 V.S.A. §117 and shall apply in proceedings under 10 V.S.A. §151 (Act 250).

Update Process

The Residential Building Energy Standards statute requires that revisions to the RBES are made promptly after the issuance of updated standards under the *International Energy Conservation Code* (IECC). The Department of Public Service (PSD) is required to convene stakeholders that include mortgage lenders, builders, building designers, utility representatives, and other persons with experience and expertise prior to the adoption of a revised RBES to provide recommendations.

The 2024 RBES is based on the language in the 2015 edition of the IECC and includes efficiency improvements included in the 2018 and 2021 IECC to ensure continued progression in efficiency in the Vermont RBES. The 2024 RBES builds on the “Package Plus Points” approach to code compliance, initiated in 2020. (Previous code compliance was achieved through a “prescriptive package” approach). The addition of “points” provides builders and designers greater flexibility in complying with the RBES. The 2024 RBES also simplified the Packages and makes them applicable to both the Base Code and the Stretch Code, with the only difference being the number of Points needing to be achieved. The 2024 RBES also attempts to better address multifamily construction by aligning the standards between RBES and the Commercial Building Energy Standards (CBES) so that regardless of whether the multifamily building falls under RBES (up to three stories in height) or CBES (buildings four stories or higher), the energy standards should be consistent. The Code Collaborative Process undertaken in 2021 allowed for more in-depth discussions with stakeholders on topics and many of the suggestions are reflected in the 2024 RBES. The Vermont PSD also held a series of stakeholder meetings in 2022 to gather feedback on proposed changes to the RBES. The revisions presented in this document were modified based on input received from these meetings.

EFFECTIVE USE OF THE 2024 VERMONT RESIDENTIAL BUILDING ENERGY STANDARDS

The 2024 *Vermont Residential Building Energy Standards* (RBES) is a code that regulates minimum energy conservation requirements for new buildings as well as additions, alterations, renovations, and repairs to existing buildings. The 2024 RBES addresses energy conservation requirements for all aspects of energy uses in residential construction, including heating and ventilating, lighting, water heating, and power usage for appliances and building systems.

The 2024 RBES is a design document. For example, before constructing a building, the designer must determine the minimum insulation *R*-values and fenestration *U*-factors for the building exterior envelope. The RBES sets forth minimum requirements for exterior envelope insulation, window and door *U*-factors and SHGC ratings, duct insulation, lighting and power efficiency, mechanical ventilation, and water distribution insulation.

Arrangement and Format of the 2024 RBES

The 2024 RBES, like other codes published by the International Code Council[®] (the ICC[®]), is arranged and organized to follow sequential steps that generally occur during a plan review or inspection. The 2024 RBES is divided into six different parts:

Chapters	Subjects
1-2	Scope, administration and definitions
3	General requirements
4	Residential energy efficiency
5	Existing buildings
6	Referenced standards

The following is a chapter-by-chapter synopsis of the scope and intent of the provisions of the 2024 Vermont Residential Building Energy Standards:

Chapter 1 Scope and Administration. This chapter contains provisions for the application, enforcement and administration of subsequent requirements of the code. In addition to establishing the scope of the code, Chapter 1 identifies which buildings and structures come under its purview. Chapter 1 is largely concerned with maintaining “due process of law” in enforcing the energy conservation criteria contained in the body of this code. Only through careful observation of the administrative provisions can the *code official or authority having jurisdiction*, where one exists, reasonably expect to demonstrate that “equal protection under the law” has been provided.

Chapter 2 Definitions. Chapter 2 is the repository of the definitions of terms used in the body of the code. Codes are technical documents and every word, term and punctuation mark can impact the meaning of the code text and the intended results. The code often uses terms that have a unique meaning in the code and the code meaning can differ substantially from the ordinarily understood meaning of the term as used outside of the code.

The terms defined in Chapter 2 are deemed to be of prime importance in establishing the meaning and intent of the code text. The user of the code should be familiar with and consult this chapter because the definitions are essential to the correct interpretation of the code and the user may not be aware that a term is defined.

Where understanding of a term’s definition is especially key to or necessary for understanding of a particular code provision, the term is shown in *italics* wherever it appears in the code. This is true only for those terms that have a meaning that is unique to the code. In other words, the generally understood meaning of a term or phrase might not be sufficient or consistent with the meaning prescribed by the code; therefore, it is essential that the code-defined meaning be known.

Guidance regarding tense, gender and plurality of defined terms as well as guidance regarding terms not defined in this code is provided.

Chapter 3 General Requirements. Chapter 3 provides interior design conditions that are used as a basis for assumptions in heating and cooling load calculations, and provides basic material requirements for insulation materials and fenestration materials, and provides standards for residential mechanical ventilation and combustion safety.

Chapter 4 Residential Energy Efficiency. Chapter 4 contains the energy-efficiency-related requirements for the design and construction of residential buildings regulated under this code. It should be noted that the definition of a *residential building* in this code is unique for this code. In this code, a *residential building* is an R-2, R-3 or R-4 building three stories or less in height. All other R-1 buildings, including residential buildings greater than three stories in height, are

regulated by the energy conservation requirements in the Vermont Commercial Building Energy Standards (CBES). The applicable portions of a residential building must comply with the provisions within this chapter for energy efficiency. This chapter defines requirements for the portions of the building and building systems that impact energy use in new residential construction and promotes the effective use of energy. The provisions within the chapter promote energy efficiency in the building envelope, the heating and cooling system, lighting and the service water heating system of the building. Vermont has adopted a two-tiered code structure with a “Base Code” that applies statewide, and a “Stretch Code” that is more stringent. The *Stretch Code* applies to all Act 250 development projects and is also available for municipalities that choose to adopt a higher energy standard.

Chapter 5 Existing Buildings. Chapter 5 of each set of provisions contains the technical energy efficiency requirements for existing buildings. Chapter 5 provisions address the maintenance of buildings in compliance with the code as well as how additions, alterations, repairs and changes of occupancy need to be addressed from the standpoint of energy efficiency. Specific provisions are provided for historic buildings.

Chapter 6 Referenced Standards. The code contains numerous references to standards that are used to regulate materials and methods of construction. Chapter 6 contains a comprehensive list of all standards that are referenced in the code. The standards are part of the code to the extent of the reference to the standard. Compliance with the referenced standard is necessary for compliance with this code. By providing specifically adopted standards, the construction and installation requirements necessary for compliance with the code can be readily determined. The basis for code compliance is, therefore, established and available on an equal basis to the *code official or authority having jurisdiction*, where one exists, contractor, designer and owner.

Chapter 6 is organized in a manner that makes it easy to locate specific standards. It lists all of the referenced standards, alphabetically, by acronym of the promulgating agency of the standard. Each agency’s standards are then listed in either alphabetical or numeric order based on the standard identification. The list also contains the title of the standard; the edition (date) of the standard referenced; any addenda included as part of the ICC adoption; and the section or sections of this code that reference the standard.

Italicized Terms

Selected terms set forth in Chapter 2, Definitions, are italicized where they appear in code text. Such terms are not italicized where the definition set forth in Chapter 2 does not impart the intended meaning in the use of the term. The terms selected have definitions that the user should read carefully to facilitate better understanding of the code.

Marginal Markings

Solid vertical lines in the margins within the body of the code indicate Vermont specific additions and changes from the requirements of the 2015 IECC and the 2018 edition. Deletion indicators in the form of an arrow (➡) are provided in the margin where an entire section, paragraph, exception or table has been deleted or an item in a list of items or a table has been deleted.

Abbreviations and Notations

The following is a list of common abbreviations and units of measurement used in this code. Some of the abbreviations are for terms defined in Chapter 2. Others are terms used in various tables and text of the code.

AFUE	Annual fuel utilization efficiency
ATWHP	Air-to-water heat pump
bhp	Brake horsepower (fans)
Btu	British thermal unit
Btu/h-ft ²	Btu per hour per square foot
C-factor	See Chapter 2—Definitions
CDD	Cooling degree days
CFA	Conditioned floor area
cfm	Cubic feet per minute
cfm/ft ²	Cubic feet per minute per square foot
ci	Continuous insulation
COP	Coefficient of performance
CO ₂ e	Carbon dioxide equivalent
DCV	Demand control ventilation
°C	Degrees Celsius
°F	Degrees Fahrenheit
DWHR	Drain water heat recovery
DX	Direct expansion
E_c	Combustion efficiency
E_v	Ventilation efficiency
E_t	Thermal efficiency
ECM	Electronically commutated motor
EER	Energy efficiency ratio
EF	Energy factor
ERI	Energy rating index
EPD	Environmental product declaration
F-factor	See Chapter 2—Definitions
FDD	Fault detection and diagnostics
FEG	Fan efficiency grade
FL	Full load
ft ²	Square foot
GPF	Gallons per flush
GPM	Gallons per minute
GSHP	Ground-source heat pump
GWP	Global warming potential
HDD	Heating degree days
HERS	Home Energy Rating System
hp	Horsepower
H/ERV	Heat or energy recovery ventilation
HSPF	Heating seasonal performance factor
HVAC	Heating, ventilating and air conditioning

IEER	Integrated energy efficiency ratio
IPLV	Integrated Part Load Value
Kg/m ²	Kilograms per square meter
kW	Kilowatt
LPD	Light power density (lighting power allowance)
L/s	Liters per second
Ls	Liner system
m ²	Square meters
MERV	Minimum efficiency reporting value
NAECA	National Appliance Energy Conservation Act
NPLV	Nonstandard Part Load Value
Pa	Pascal
PF	Projection factor
pcf	Pounds per cubic foot
PSD	Department of Public Service (Vermont)
psf	Pounds per square foot
PTAC	Packaged terminal air conditioner
PTHP	Packaged terminal heat pump
R-value	See Chapter 2—Definitions
SCOP	Sensible coefficient of performance
SEER	Seasonal energy efficiency ratio
SHGC	Solar Heat Gain Coefficient
SPVAC	Single packaged vertical air conditioner
SPVHP	Single packaged vertical heat pump
SRE	System recovery efficiency
SRI	Solar reflectance index
SWHF	Service water heat recovery factor
U-factor	See Chapter 2—Definitions
VAV	Variable air volume
VRF	Variable refrigerant flow
VT	Visible transmittance
W	Watts
w.c.	Water column
w.g.	Water gauge

CHAPTER 1 ADMINISTRATION

PART 1—SCOPE AND APPLICATION

SECTION R101 SCOPE AND GENERAL REQUIREMENTS

delete and replace R101.1 Title.

This code shall be known as the 2024 *Vermont Residential Building Energy Standards* (RBES) and shall be cited as such. It is referred to herein as “this code.”

delete and replace R101.2 Scope.

This code applies to *residential buildings* and the *building sites* and associated systems and equipment, including one family dwellings, two family dwellings, and multifamily housing three stories or less in height.

For the purpose of determining the building type that must comply with the RBES under Vermont statute, a multifamily building is a *residential building* or *mixed-use* building with three or more *dwelling units* three stories or less in height. Multifamily buildings of four stories or more in height must comply with the CBES (from Vermont 30 V.S.A. § 51.)

While many sections of this code (e.g., inspections, review of construction documents, compliance, etc.) do not pertain to most of Vermont that lacks a *code official or authority having jurisdiction*, these sections are included to provide guidance for those jurisdictions that do have a *code official or authority having jurisdiction*.

delete and replace R101.7 Base and Stretch Code.

The “*Base Code*” is the RBES Energy Code that is applicable throughout Vermont, except for projects subject to 10 V.S.A. Chapter 151 (Act 250), and in any municipalities that have adopted the more stringent “*Stretch Code*.”

All *Base Code* requirements shall be met in addition to the requirements in the *Stretch Code* section R407 in order to be in compliance with the *Stretch Code*.

delete and replace R101.8 Compliance options.

There are three thermal efficiency compliance options:

1. Package Plus Points: For the *Base Code* and *Stretch Code*, Table R402.2.1.1 lists the options for insulation and fenestration packages. Table R402.1.2.2 lists the additional points required for compliance based on building square footage for both *Base Code* and *Stretch Code*, and Table R402.1.2.3 lists the components and respective point values to be used to meet the point requirement in Table R402.1.2.2.

2. REScheckTM: The U.S. Department of Energy’s REScheckTM software.

3. Home Energy Rating System (HERS): A HERS energy rating that demonstrates compliance with Section 406.4 for the Base or Stretch Code based on [REM v16.3.3 or later](#) or

PART 2—ADMINISTRATION AND ENFORCEMENT

SECTION R103 CONSTRUCTION DOCUMENTS

delete and replace R103.1 General.

Where required, construction documents, technical reports and other supporting data shall be submitted in one or more sets, or in a digital format where allowed by the code *official or authority having jurisdiction*, where one exists, with each application for a permit. The construction documents and technical reports shall be prepared by a registered design professional where required by the statutes of the jurisdiction in which the project is to be constructed. Where special conditions exist, the *code official or authority having jurisdiction*, where one exists, is authorized to require necessary construction documents to be prepared by a registered design professional.

Exception: The *code official or authority having jurisdiction*, where one exists, is authorized to waive the requirements for construction documents or other supporting data if the *code official or authority having jurisdiction*, where one exists, determines they are not necessary to confirm compliance with this code.

delete and replace R103.2 Information on construction documents.

Where required, construction documents shall be drawn to scale upon suitable material. Electronic media documents are permitted to be submitted where *approved* by the *code official or authority having jurisdiction*, where one exists. 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, but are not limited to, the following as applicable:

1. Insulation materials and their *R*-values.
2. Fenestration *U*-factors and *solar heat gain coefficients* (SHGC).
3. Area-weighted *U*-factor and *solar heat gain coefficients* (SHGC) calculations.
4. Mechanical system design criteria.
5. Mechanical and service water-heating systems and equipment types, sizes and efficiencies.
6. Equipment and system controls and control strategies.
7. Duct sealing, duct and pipe insulation and location.
8. Air sealing details.
9. Energy code compliance path.

SECTION R104 INSPECTIONS

delete and replace **R104.1 General.**

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

CHAPTER 2 DEFINITIONS

SECTION R202 GENERAL DEFINITIONS

add **ACCESS (TO).** That which enables a device, appliance, or equipment to be reached by *ready access* or by a means that first requires the removal or movement of a panel or similar obstruction.

delete and replace **AIR BARRIER.** An air barrier is a durable solid (non-porous) assembly that blocks air flow through the *building thermal envelope* and its assemblies. Air barriers must be continuous, sealed at all joints, penetrations, and interruptions using durable sealants intended for such use and compatible with all adjacent materials, and able to resist pressures without displacement or damage.

add **BUILDING SHELL AREA.** The sum of the area of ceiling, floors, and walls, slab (all “six sides”) separating a *dwelling unit’s conditioned space* from the exterior or from adjacent conditioned or unconditioned spaces. Wall height shall be measured from the finished floor of the *dwelling unit* to the underside of the floor above.

delete and replace **BUILDING SITE.** A contiguous area of land that is under the ownership or control of one entity.

add **CARBON DIOXIDE EQUIVALENT (CO₂E).** A measure used to compare the impact of various greenhouse gases based on their global warming potential (GWP). CO₂e approximates the warming effect of a unit mass of a given greenhouse gas relative to that of carbon dioxide (CO₂).

add **CAVITY INSULATION.** Insulating material located between framing members.

delete and replace **CLIMATE ZONE**. A geographical region based on climatic criteria as specified in this code. Vermont is *Climate Zone 6*.

delete **DEADBAND**. The temperature range in which no heating or cooling is used.

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

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

add **DIMMER**. A control device that is capable of continuously varying the light output and energy use of light sources.

add **ELECTRIC VEHICLE CHARGING – LEVEL 2 CAPABLE**. Level 2 “capable” includes space in the utility room for panel(s) of at least one minimum 40-ampere branch circuit to be provided to garages and/or the exterior of the building to accommodate a future dedicated Society of Automotive Engineers (SAE) standard J1772-approved Level 2 EVSE with a J1772 connector or NEMA 14-50, or equivalent, within 5 feet of the centerline for each EV charging parking space. A conduit or other unobstructed path to easily run a future wire to the parking spot shall also be provided.

add **ELECTRIC VEHICLE CAPABLE PARKING SPACE**. A **parking** space with all the requisite infrastructure in place within five feet to allow electrical wiring and connection to power for EVSE.

delete and replace **ELECTRIC VEHICLE SUPPLY EQUIPMENT (EVSE)**. Level 2 electric vehicle charging parking that requires one 208/240V 40 amp grounded connection for electric vehicle charging through dedicated EVSE with J1772 connector or AC receptacle, NEMA 14-50, or equivalent, within 5 feet (1524 mm) of the centerline for each EV charging parking space.

add **GLOBAL WARMING POTENTIAL (GWP)**. GWP is an index for estimating the relative global warming contribution of atmospheric emissions of 1 kg of a particular greenhouse gas compared to emissions of 1 kg of CO₂. The following GWP values are used based on a 100-year time horizon: 1 for CO₂, < 10 for pentane (e.g., C₅H₁₂), and 1430 for R-134a (CH₂FCF₃).

add **GLOBAL WARMING POTENTIAL (GWP) INTENSITY**. For the purposes of this document, GWP intensity refers to the GWP impact from materials (kg CO₂e) divided by the project’s total conditioned floor area in square feet (ft²).

delete **HIGH-EFFICACY LAMPS/ LIGHTING**.

add **HIGH-EFFICACY LIGHT SOURCES**. Non-linear medium screw- and pin-base lamps with a minimum efficacy of not less than 65 lumens per watt; or light fixtures of not less than 65 lumens per watt. In determining the number or percent of lamps, each replaceable lamp (or light string) connected to a permanently installed lighting fixture shall count as one lamp.

delete **LEVEL 1 ELECTRIC VEHICLE CHARGING**.

delete **LEVEL 2 ELECTRIC VEHICLE CHARGING**.

delete and replace **LIGHTING**. See “High-efficacy light sources.”

delete and replace **MULTIFAMILY DWELLING/BUILDING**. A building containing three or more dwelling units where the occupants are primarily permanent in nature and which are adjacent vertically or horizontally. If built side-by-side, at least one of the following is true: (1) they do not have a wall that extends from ground to roof, (2) they share a heating system, or (3) they have interstructural public utilities such as water supply/sewage disposal.

add **NET ZERO ENERGY READY**. A highly efficient and cost-effective building designed and constructed so that renewable energy could offset all or most of its annual energy consumption.

add **OCCUPANT SENSOR CONTROL**. An automatic control device that detects the presence or absence of people within an area and causes lighting, equipment or appliances to be regulated accordingly.

add **ON-SITE RENEWABLE ENERGY GENERATION**. Energy from renewable energy resources that is generated at the building site.

add **READY ACCESS (TO)**. That which enables a device, appliance, or equipment to be directly reached without requiring the removal or movement of any panel or similar obstruction.

add **RENEWABLE ENERGY CERTIFICATE (REC)**. An instrument that represents the environmental attributes of one megawatt hour of renewable energy; also known as an energy attribute certificate (EAC).

delete **RENEWABLE ENERGY SOURCES**.

add **RENEWABLE ENERGY RESOURCES**. Energy produced using a technology that relies on a resource that is being consumed at a harvest rate at or below its natural regeneration rate including, but not limited to, solar hot water, solar hot air, solar photovoltaics, wind, and hydro.

- (A) Methane gas and other flammable gases produced by the decay of sewage treatment plant wastes or landfill wastes and anaerobic digestion of agricultural products, byproducts, or wastes shall be considered renewable energy resources, but no form of solid waste, other than agricultural or silvicultural waste, shall be considered renewable.
- (B) The only portion of electricity produced by a system of generating resources that shall be considered renewable is that portion generated by a technology that utilizes a renewable fuel or energy source.
- (C) The following fuels shall not be considered renewable energy sources: coal, oil, propane, and fossil natural gas.
- (D) *Biomass* is considered renewable.
- (E) *Biodiesel* is considered renewable.

delete and replace **SOLAR ENERGY SOURCE**. Source of thermal, chemical, or electrical energy derived directly from conversion of incident solar radiation.

delete and replace **STRETCH CODE**. A building energy code that achieves greater energy savings than the B RBES *Base Code*. The *Stretch Code* is required for Act 250 projects and may be adopted by municipalities.

add **THERMAL DISTRIBUTION EFFICIENCY (TDE)**. The resistance to changes in air heat as air is conveyed through a distance of air duct. TDE is a heat loss calculation evaluating the difference in the heat of the air between the air duct inlet and outlet caused by differences in temperatures between the air in the duct and the duct material. TDE is expressed as a percent difference between the inlet and outlet heat in the duct.

add **TINY HOUSE**. A detached *dwelling unit* of less than **400** square feet of floor area **excluding lofts**.

add **TYPE III PRODUCT-SPECIFIC ENVIRONMENTAL PRODUCT DECLARATION (EPD)**. An EPD is a document that describes the results of a life cycle assessment (LCA) for a material or product. While there are industry-specific EPDs, which average results across multiple product manufacturers, product-specific EPDs are the most thorough type of EPD. Type III, product-specific EPDs cover a single product from a manufacturer and are reviewed by a third-party entity. They conform to ISO 14025 and either EN 15804 or ISO 21930. Like all product specific EPDs, the scope must cover the product's life-cycle from cradle to gate.

CHAPTER 3 GENERAL REQUIREMENTS

SECTION R302 DESIGN CONDITIONS

delete and replace **R302.2 Climactic data**.

The following design parameters in Table R302.2 shall be used for calculations required under this code.

Adjustments may be made only in the following cases:

1. Winter heating design temperatures for projects either:
 - i. Located at an elevation of 1,500 feet (457 m) or higher, or
 - ii. Located in Caledonia, Essex or Orleans counties.
 - iii. Adjustments shall be made as listed in the National Climate Data Center for the specific weather station: <http://www.ncdc.noaa.gov/cdo-web/>.
2. As approved by the *code official or authority having jurisdiction*, where one exists.

SECTION R303 MATERIALS, SYSTEMS AND EQUIPMENT

delete and replace **R303.1.2 Insulation mark installation.**

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

add **R303.1.5 Air-impermeable insulation.**

Insulation having an air permeability not greater than 0.004 cubic feet per minute per square foot [0.002 L/(s × m²)] under pressure differential of 0.3 inch water gauge (75 Pa) when tested in accordance with **ASTME2178** shall be determined air-impermeable insulation.

SECTION 304 DESIGN CRITERIA FOR RESIDENTIAL VENTILATION SYSTEMS

delete and replace **R304.1 Scope.**

This section shall govern ventilation of the dwelling unit(s) within Type R-1 *residential buildings*, Type R-2 *residential buildings* and multiple single-family attached dwellings (townhouses and *multifamily buildings*) not more than three stories in height.

delete and replace **R304.1.1 Compliance.**

Compliance with Section 304 shall be achieved by installing a *whole house balanced ventilation system* with minimum 75 *SRE* and 1.2 cfm/Watt, determined in accordance with HVI Publication 920 and listed in HVI Publication 911, while also meeting compliance with Sections 304.2 through 304.11 or demonstrating compliance with one of the following alternatives:

1. ASHRAE Standard 62.2—2019 (Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings)
2. Passive house ventilation requirements (PHI or PHIUS)

Exceptions:

1. *Whole house balanced ventilation systems* that are controlled using user-settable closed-loop feedback based on pollutant levels (e.g., carbon dioxide or volatile organic compounds) are not subject to run-time ventilation rate minimums in the standards referenced above, or Section 304.6.1.1.
2. *Tiny houses* may install an exhaust-only ventilation system.

delete and replace **304.2 Local ventilation.**

Ventilation fans in bathrooms containing a bathtub, shower, spa or similar bathing fixture and not included in the whole house ventilation system shall be sized to provide 50 CFM intermittent or 20 CFM continuous exhaust capacity. Whole house ventilation fans serving both localized and whole house ventilation functions shall be sized to meet the net capacity rates as required by Section R304.6 and must meet all other requirements listed in Section R304.3, as applicable.

**TABLE 304.2
MINIMUM REQUIRED LOCAL EXHAUST**

OCCUPANCY CLASSIFICATION	MECHANICAL EXHAUST CAPACITY (CFM)
Bathrooms	50 cfm intermittent or 20 cfm continuous

delete **R304.3 Whole house balanced ventilation.**

delete and replace **R304.5 Fan motor requirements.**

Fans installed for the purpose of providing whole house ventilation must meet the minimum requirements as specified in this section.

delete **R304.5.2 Fan power consumption.**

delete **R304.5.34 Performance verification.**

delete and replace **R304.6 Net capacity requirements.**

Whole house ventilation system fans shall be installed according to the manufacturer's installation instructions and shall have the manufacturer's fan flow ratings as listed in accordance with HVI 911. Unless the whole house system is tested according to procedures in Section R304.6.1, the minimum continuous flow rate that the ventilation system must be capable of supplying during its operation shall be based on the rate per bedroom as specified in Table R304.6.

**TABLE R304.6
PRESCRIPTIVE FAN CAPACITY REQUIREMENTS FOR CENTRALLY DUCTED SYSTEMS**

NUMBER OF BEDROOMS	MINIMUM NOMINAL RATED TOTAL FAN CAPACITY ^a (at 0.1 inches w.g.)
1	50 cfm
2	75 cfm
3	100 cfm
4	125 cfm
5	150 cfm
Homes > 3,000 ft ²	cfm = 0.05 · ft ²

For SI: 1 cubic foot per minute = 0.0004719 m³/s, 1 cubic foot per minute per square foot = 0.00508 m³/(s · m²).

a. Represents the total installed rated capacity of all fans designed for whole house ventilation.

delete and replace R304.6.1 Testing option.

Testing may be done for Points to verify that the whole house ventilation system satisfies the ventilation requirements of this section in accordance with Sections R304.6.1.1 and R304.6.1.2.

delete and replace R304.8 Controls.

Whole house ventilation systems (balanced ventilation) shall be capable of being set remotely for continuous operation or shall be provided with an automatic control for intermittent operation. All whole house ventilation controls shall be readily accessible.

Exception: Fans installed expressly for local ventilation purposes.

delete and replace R304.9.3 Ducts.

Smooth wall ducts (for example, metal or composite) must be used for all duct runs longer than 8 feet (2438 mm). Ducts shall be insulated when installed in an unheated location

add R304.9.9 Exhaust Dampers.

Dampers with positive closures shall be installed to keep outside air from entering the exhaust duct when the system is not operating.

Exception: Mechanical ventilation systems designed for continuous operation.

delete and replace R304.11 Makeup air required.

Exhaust hood systems and clothes dryers capable of exhausting in excess of 400 cubic feet per minute ($0.19 \text{ m}^3/\text{s}$) shall be provided with makeup air at a rate approximately equal to the exhaust air rate. Such makeup air systems shall be equipped with a means of closure and shall be automatically controlled to start and operate simultaneously with the exhaust system.

CHAPTER 4 RESIDENTIAL ENERGY EFFICIENCY

SECTION R401 GENERAL

delete and replace R401.1 Scope.

This chapter applies to *residential buildings* compliance with both the *Base Code* and *Stretch Code*. *Stretch Code* requires compliance with all Base Code requirements throughout RBES, plus achieving the additional points specified in Table R402.1.2.2, following all requirements of the following sections, and complying with Section R407 Vermont Stretch Code.

delete and replace R401.2 Compliance.

Projects for both *Base Code* and *Stretch Code* shall comply with one of the following:

1. **Package Plus Points:** Sections R402 through R404.
2. **REScheckTM software:** Section R405 and the provisions of Sections R401 through R404 indicated as “Mandatory.”
3. **Home Energy Rating System (HERS):** An energy rating index (ERI) approach in Section R406.

delete and replace **R401.3 Certificate of Compliance**

An *RBES certificate* is required to be issued. The *certificate* should be issued upon completion and before occupancy of any project subject to the Residential Building Energy Standards. A *certificate* may be issued by a builder, a licensed professional engineer, a licensed architect or an accredited home energy rating organization. If certification is not issued by a licensed professional engineer, a licensed architect or an accredited home energy rating organization, it shall be issued by the builder. Any certification shall certify that residential construction meets the RBES. The Department of Public Service will develop and make available to the public a certificate that lists key features of the RBES. Any person certifying shall use this certificate or one substantially like it to certify compliance with the RBES. Certification shall be issued by completing and signing a certificate and affixing it to the electrical service panel, without covering or obstructing the visibility of the circuit directory label, service disconnect label or other required labels. The certificate shall certify that the residential building has been constructed in compliance with the requirements of the RBES. The person certifying under this subsection shall provide a copy of the certificate to the Department of Public Service and shall assure that a certificate is recorded and indexed in the town land records. A builder may contract with a licensed professional engineer, a licensed architect or an accredited home energy rating organization to issue certification and to indemnify the builder from any liability to the owner of the residential construction caused by noncompliance with the RBES.

SECTION R402 BUILDING THERMAL ENVELOPE

delete and replace **R402.1 General.**

The *building thermal envelope* shall meet the requirements of Sections R402.1.1 through R402.1.6. for compliance with the *Base Code* and the *Stretch Code*.

Exception: The following *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. **Low energy use buildings.** Those with a peak design rate of energy usage less than 3.4 Btu/h per square foot of floor space for space conditioning purposes (10.7 W/m^2 or 1.0 watt/ft^2 of floor area for space-conditioning purposes)
2. **Unconditioned buildings.** Those that do not contain *conditioned space*.
3. **Mobile homes.** Homes subject to Title VI of the National Manufactured Housing Construction and Safety Standards Act of 1974 (42 U.S.C. §§ 5401–5426).

4. **Hunting camps.** Residential buildings shall not include hunting camps.
5. **Summer camps.** Residential buildings constructed for nonwinter occupation with only a biomass (wood) or other on-site renewable heating system.
6. **Yurts** with only a biomass (wood) or other on-site renewable heating and hot water system.
7. **Owner-built homes.** Residential construction by an owner, if all of the following apply:
 - 7.1. The owner of the residential construction is the *builder*, as defined in 30 V.S.A. § 51.
 - 7.2. The residential construction is used as a dwelling by the owner.
 - 7.3. The owner in fact directs the details of construction with regard to the installation of materials not in compliance with the RBES.
 - 7.4. The owner discloses in writing to a prospective buyer, before entering into a binding purchase and sales agreement, with respect to the nature and extent of any noncompliance with the RBES.

Any statement or certificate given to a prospective buyer shall itemize how the home does not comply with the RBES and shall itemize which measures do not meet the RBES in effect at the time construction commenced. Any certificate given under this subsection shall be recorded in the land records where the property is located and sent to the Department of Public Service (PSD) within 30 days following sale of the property by the owner. A certificate that itemizes how the home does not comply with the RBES is available from the PSD.

8. **Tiny Houses.** While not specifically exempt, *tiny houses* as defined in Chapter 2 must comply with the envelope, insulation and fenestration requirements in R402.8. All other code provisions are still required with the exception that the mechanical ventilation system does not have to be heat recovery with balanced ventilation and may be exhaust-only.

delete and replace **R402.1.1 Vapor retarder.**

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

delete and replace **R402.1.2 Insulation and fenestration criteria.**

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

1. Package Plus Points Approach: Tables R402.1.2.1, R402.1.2.2 and R402.1.2.3.
2. U-Factor Alternative Approach: Section R402.1.4.
3. Total UA Approach: Section R402.1.5.
4. Log Home Approach: Section R402.1.6.

5. *Tiny House Approach*: Section R402.8.

Building science principles should be applied in all circumstances. Consult with a building science professional and refer to the Vermont Residential Energy Code Handbook for additional guidance and details.

delete and replace R402.1.2.1 Package Plus Points Approach.

Projects shall comply with Items 1 through 4: for both *Base Code* and *Stretch Code*:

1. Select one of the packages listed in Table R402.1.2.1. These standard packages apply to both *Base Code* and *Stretch Code*.
2. Determine the number of points needed to comply with Table R402.1.2.2 based on building size and whether the building needs to comply with *Base Code* or *Stretch Code*.
3. Incorporate a sufficient number of points from Table R402.1.2.3 to meet the points requirements from Table R402.1.2.2.
4. . Points can only be earned from measures that are not already required in the chosen standard package.

delete and replace R402.1.2.1 Package Plus Points Approach.

Projects shall comply with Items 1 through 4: for both *Base Code* and *Stretch Code*:

1. Select one of the packages listed in Table R402.1.2.1. These standard packages apply to both *Base Code* and *Stretch Code*.
2. Determine the number of points needed to comply with Table R402.1.2.2 based on building size and whether the building needs to comply with *Base Code* or *Stretch Code*.
3. Incorporate a sufficient number of points from Table R402.1.2.3 to meet the points requirements from Table R402.1.2.2.
4. . Points can only be earned from measures that are not already required in the chosen standard package.

Delete and replace TABLE R402.1.2.1

**TABLE R402.1.2.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT FOR STANDARD
PACKAGES FOR BASE CODE AND STRETCH CODE ^a**

Component	Package 1	Package 2
	“Standard Package”	“Log Homes”
Ceiling – flat attic ^g	U-0.020:	

	R-49 ^g	
Ceiling – slope (no attic)	U-0.025: R-44	
Above Grade Wall ^b	U-0.044: R-21+5ci ^e OR R-13+10ci OR R-20 6 ½” ci (SIP) OR Other that meets U-factor	Construct log home walls to ICC 400—2022 Standard on the Design and Construction of Log Structures Table 305.3.1.2 or Vermont RBES Table R402.1.6
Frame Floor	U-0.029: R-38	
Basement/Crawl ^c	R-20ci OR R13+10ci	
Slab, on grade ^d	R-20,4’ (edge) OR R-15,4’(edge) + R-7.5 (under entire slab)	
Slab, on grade, Heated ^d	R-20,4’ (edge) + R-15 (under entire slab)	
Windows	U-0.30	
Skylights	U-0.41	
Doors	U-0.37	
Air Leakage	0.15 CFM50/Sq. Ft. of Building Shell (~2 ACH50) ^h	
Ducts	Inside thermal boundary	

For SI: 1 foot = 304.8 mm.

- a. *R*-values are minimums. *U*-factors 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. See Section R402.1.4 for alternative compliance methods.
- b. These are *example* wall assemblies. Any wall assembly would need to meet required *U* values and should consider building science to avoid moisture concerns. See RBES Handbook for building science guidance and more example wall assemblies.
- c. The continuous portion of basement and crawlspace insulation can be met through interior, exterior or combination.
- d. “4 ft” can be horizontal or vertical coverage including slab edge. “Edge and under” requires complete coverage. Up to 8 lineal feet of exposed slab edge may be insulated to R-10. “Heated slab” are those with embedded radiation.
- e. The first value is cavity insulation, the second value is continuous insulation, or “ci”, so “20 + 5ci” means R-20 cavity insulation plus R-5 continuous insulation.
- f. Consider building science principles in all design and construction. Buildings should be designed and constructed recognizing principles behind moisture vapor control approaches for cold climates. Maintain the envelope assembly’s ability to adequately dry in at least one direction by not installing low-perm vapor retarder materials (e.g., vapor barrier) on both sides of an assembly, seek to optimize the assembly’s ability to dry, and limit the potential for wetting. (From Applied Building Technologies Group, LLC).
- g. If there is insufficient space in the eaves, installing R-38 over the top of exterior walls shall be deemed to satisfy the requirement for R-49 insulation provided the rest of the ceiling is R-49. (See Section R402.2.1). Multifamily buildings using continuous insulation with a maximum *U*-factor of 0.023 or tapered insulation with an average *U*-factor of 0.023 for the ceiling assembly satisfies this requirement. A minimum value of R-12 is required for tapered insulation.
- h. “ACH50” = air changes per hour at 50 Pascals building pressure as measured with a blower door. CFM50/Sq. Ft.

of Building Shell = amount of air leakage (in cubic feet per minute, or CFM) that leaks out of each square foot of the exterior surface all six sides of the building measured at 50 Pascals of pressure with a blower door.

- i. Installing R-38 over the top of exterior walls where insulation is compressed in the eaves shall be deemed to satisfy the requirement for R-44 where there is insufficient space in framing rafters for more than R-38 provided the rest of the ceiling is R-44. See R402.2.2 for more detail.

delete R402.1.2.2 Required Points by Building Size.

add R402.1.2.2 Required points by building or addition size.

Determine the number of points required by building or addition size from Table R402.1.2.2. Building size for this table is determined by the *finished conditioned floor* area per dwelling unit inside the *building thermal envelope*, including unfinished basements and storage/utility spaces.

The Multifamily less than 1,250 square feet (185.8 m²) and 1,2500-2,500 square feet point requirement categories cannot be used for semi-detached (semi-attached, side-by-side), row houses, and townhouses, as defined as *single-family dwellings* in Section R202, General Definitions. *Multifamily dwelling* unit size is based on the average *finished conditioned floor* area dwelling size for the building, excluding common areas, hallways, stairwells, etc..

delete and replace TABLE R402.1.2.2

**TABLE R402.1.2.2
REQUIRED POINTS BY BUILDING SIZE FOR BASE CODE AND STRETCH CODE**

BUILDING/DWELLING SIZE	BASE CODE REQUIRED POINTS	STRETCH CODE REQUIRED POINTS
Alterations	0	0
Additions < 250 square feet	0	0
Additions 250 to 500 square feet	1	2
Addition 501 to 1,000 square feet	2	3
Addition > 1,000 square feet	3	4
Multifamily <650 square feet	0	1
Multifamily 650 to 900 square feet	1	2
Multifamily 900 to 1,250 square feet	2	3
Multifamily >1,250 to 2,500 square feet	4	5
< 2,500 square feet	5	7
2,500 to 4,000 square feet	7	12
> 4,000 square feet	10	15

delete and replace TABLE R402.1.2.3

**TABLE R402.1.2.3
POINTS BY COMPONENT FOR BASE CODE AND STRETCH CODE**

Component		Description	Points
Envelope	Slab (on or below grade, heated or unheated)	R-20 around perimeter and below entire slab OR^b	2
		R-25 around perimeter and below entire slab	3
	Walls	R-28 2x6 cavity insulation with continuous (R20+9ci or similar) (U-0.036 wall assembly) OR^b	1
		R-35 double stud or similar (cavity and continuous) (U-0.028 wall assembly) OR^b	2
		R-40 double stud or similar (cavity and continuous) (U-0.025 wall assembly) OR^b	3
		R-48 SIP 10 1/4" XPS or similar (cavity and continuous) (U-0.021 wall assembly)	4
	Ceiling	R-60 attic flats (U-0.018) and R-49 slopes, vaulted and cathedral (U-.020)	1
		R-80 attic flats (U-0.013) and R-60 slopes, vaulted and cathedral (U-.018)	2
	Floors - Exposed	R-49 (U-0.021)	1
	Windows- Triple Pane	Average U-factor ≤ 0.27 OR^b	1
		Average U-factor ≤ 0.25 OR^b	2
		Average U-factor ≤ 0.21 OR^b	3
		Average U-factor ≤ 0.18	4
Doors - Exterior	U-0.26	1	
Air Leakage	Tight	Tested to ≤ 0.11 CFM50/Sq. Ft. of Building Shell (6-sided) (~1.5 ACH50) OR^b	1
	Tighter	Tested to ≤ 0.07 CFM50/Sq. Ft. of Building Shell (6-sided) (~1.0 ACH50) OR^b	2
	Tightest	Tested to ≤ 0.03 CFM50/Sq. Ft. of Building Shell (6-sided) (~0.5 ACH50)	3
Mechanical Ventilation	Better Heat Recovery OR	Balanced ventilation with ECM fans and $\geq 80\%$ SRE and ≥ 1.2 cfm/watt OR^b	align="center">3
	Better Electrical Efficiency	Balanced ventilation with ECM fans and $\geq 70\%$ SRE, and ≥ 2.0 cfm/watt	
	Mechanical Ventilation Testing	Mechanical ventilation systems shall be tested and verified to provide the minimum ventilation flow rates required by Section R403.6. Testing shall be performed according to the ventilation equipment manufacturer's instructions, or by using a flow hood or box, flow grid, or other airflow measuring device at the mechanical ventilation fan's inlet terminals or grilles, outlet terminals or grilles, or in the connected ventilation ducts.	1

Heating and Cooling ^a	Basic Equipment	ENERGY STAR basic: (1) Gas/propane furnace ≥ 95 AFUE, Oil furnace ≥ 85 AFUE; (2) Gas/propane boiler ≥ 90 AFUE, Oil boiler ≥ 87 AFUE; OR ^b	1
	Cold Climate Air Source Heat Pump	Whole building heating /cooling is ENERGY STAR v.6 labeled ^d	5
	Ground Source Heat Pump	Whole building heating /cooling is Ground Source Heat Pump (GSHP) and ENERGY STAR labeled ^d	10
	Air-to-Water Heat Pump	Whole building heating/cooling is Air-to-Water Heat Pump (ATWHP) COP ≥ 2.5	5
	Advanced Wood Heating System	Whole building heating/cooling is Advanced wood heating system from http://www.erc-vt.org/advanced-wood-heating-system/eligible-equipment-inventory-eei	5
	Low-Temperature Hydronic Distribution System	Hydronic distribution system designed to meet building peak heating demand with 120-degree water	1
	Demand Responsive Thermostats	All electric heating thermostats provided with <i>demand responsive controls</i>	1
Water	Heat Pump Basic	Electric Heat Pump Water Heater UEF ≥ 2.20 OR ^b	3
	Heat Pump Advanced	Electric Heat Pump Water Heater UEF ≥ 3.30	5
	Low flow	All showerheads ≤ 1.75 gpm, all lavatory faucets ≤ 1.0 gpm, and all toilets ≤ 1.28 gpf ^c OR ^b	1
	Certified ^e	Certified water efficient design per WERS, WaterSense, or RESNET HERS _{H2O}	2
	Drain heat recovery	Drain water heat recovery system on <i>primary showers</i> and tubs	1
	Recirculation User-demand	Controlled hot water recirculation system with user-demand via push-button for furthest fixtures	1
	Pipe Insulation	All service hot water piping is insulated to at least R-4 from the hot water source to the fixture shutoff.	1
	Demand Responsive Controls	Electric storage water heater(s) provided with <i>demand responsive controls</i>	1

	Point of Use Electric Water Heater	Remote fixtures requiring hot water supplied from a localized source of hot water with no recirculating system.	1
	Solar Ready Zone	Follow R402.7 Solar –ready zone requirements. These points are only available for Base Code and not Stretch Code since Stretch Code requires following R402.7.	2
	Solar Hot Water	Solar hot water system designed to meet at least 50% of the annual hot water load	2
Renewables	On-Site Generation	Solar photovoltaic (PV) (or other on-site renewable energy system), 1 point per 1.5 kW per housing unit of renewable generation on site	1 per 1.5 kW, max. 4
Other Measures	Monitoring	Whole-building energy monitoring system installed, minimum 5 circuits and homeowner access to data	1
	Radon Mitigation System	Radon mitigation designed to https://www.epa.gov/radon/radon-standards-practice is installed and documented to homeowner	1
	Energy Model	Building energy model with projected annual energy use and costs developed, used in design and construction decisions, and provided to homeowner	1
	Battery	Minimum 6 kWh grid-connected dispatchable demand-response-enabled battery	1
	Advanced Lighting Controls	All lighting for at least 50% of floor area is controlled and/or continuously dimmed based by occupancy, daylight, load shedding, and/or schedule.	2
Insulation Embodied Carbon Emissions	Global Warming Potential (GWP)/square footage (kg CO ₂ e/ft ²)	Report the global warming potential (GWP) impact of project insulation materials as described in Section R408. Use calculation table R408.1.1 to summarize insulation GWP intensity (kg CO ₂ e/ft ²) for the project. Default global warming potential (GWP) values for common insulation products are provided in table R408.1.2. The calculation may utilize Type III, product-specific environmental product declaration (EPD) in lieu of default values for insulation products. If EPD values are used for a given insulation product, include the sum of lifecycle stages A1-A3 from the sourced EPD instead of default GWP value when completing the calculation. Include A5 and B1 GWP values for SPF and XPS products, as noted in R408. OR^b	1

	Global Warming Potential (GWP)/square footage (kg CO2e/ft ²)	Demonstrate a calculated insulation GWP intensity (kg CO2e/ft ²) less than 0.5. Product-specific EPDs may be used in place of default values, subject to requirements in R408. OR ^b	2
		Demonstrate a calculated insulation GWP intensity (kg CO2e/ft ²) less than 0. Product-specific EPDs may be used in place of default values, subject to requirements in R408.	3
Multifamily Buildings	Efficient Elevator Equipment	Elevators in the building qualify with Energy Efficiency Class A per ISO 25745-2, Table 7.	1
	Residential Kitchen Equipment	All dishwashers, refrigerators, and freezers comply with the most recent ENERGY STAR Most Efficient label.	2
	Water Heating System Submeters	Each individual dwelling unit served by a central service water-heating system is provided with a service hot water meter connected to a reporting system that provides individual dwelling unit reporting of actual domestic hot water use.	1

For SI: 1 foot = 304.8 mm.

- a. Heating and cooling system points are only available if all components of primary systems comply.
- b. "OR" indicates that points are not additive; one component OR the following one can be selected, but not both.
- c. Applies to new construction only.
- d. https://www.energystar.gov/products/spec/central_air_conditioner_and_air_source_heat_pump_specification_version_6_0_pd
- e. Certification standard as of 1/1/2019 or later. "WERS" = Water Efficiency Rating Score <http://www.wers.us/>. EPA WaterSense compliance for all water products: <https://www.epa.gov/watersense>. RESNET Water Energy Rating Index compliant: http://www.resnet.us/professional/about/resnet_to_develop_water_efficiency_rating_system.

delete and replace R402.1.3 R-value computation.

Insulation material used in layers, such as framing cavity insulation, or continuous insulation Cavity insulation alone shall be used to determine compliance with the cavity insulation R-value requirements in Tables R402.1.1 and R402.1.3. Where cavity insulation is installed in multiple layers, the R-values of the cavity insulation layers shall be summed to compute the corresponding component R-value determine compliance with the cavity insulation R-value requirements. The manufacturer's settled R-value shall be used for blown insulation. Continuous insulation (ci) alone shall be used to determine compliance with the continuous insulation R-value requirements in Tables R402.1.1 and R402.1.3. Where continuous insulation is installed in multiple layers, the R-values of the continuous insulation layers shall be summed to determine compliance with the continuous insulation R-value requirements. Cavity insulation R-values shall not be used to determine compliance with the continuous insulation R-value requirements in Tables R402.1.1 and R402.1.3. Computed R-values shall not include an R-value for other building materials or air films. Where insulated siding is used for the purpose of complying with the continuous insulation requirements of Tables R402.1.1 and R402.1.3, the manufacturer's labeled R-value for insulated siding shall be reduced by R-0.6. Average continuous insulation R-values across flat roofs meet the requirements of **Tables R402.1.2.1 and R402.1.2.3,**

delete and replace R402.1.4 U-factor alternative.

An assembly with a *U*-factor equal to or less than that specified in Table R402.1.4 shall be permitted as an alternative to the *R*-values in Tables R402.1.2.1 and R402.1.2.3. The building must still comply with Tables R402.1.2.1, R402.1.2.2, and Table R402.1.2.3.

An assembly with a *U*-factor equal to or less than that specified in Table R402.1.4 shall be permitted as an alternative compliance method with no Table R402.1.2.3 points required, provided that (a) airtightness is less than or equal to 0.15 CFM50/Sq. Ft. of Building Shell (~2 ACH50) tested, and (b) the ventilation system complies with section R304.

Exception: The following are not required to comply with the airtightness limit or the balanced ventilation system and heat recovery efficiency requirements.

1. Alterations.
2. Additions complying with this code based on the attributes of the addition alone using the *U*-factor alternative.

delete and replace TABLE R402.1.4

**TABLE R402.1.4
EQUIVALENT *U*-FACTORS^{a,c}**

FENESTRATION U-FACTOR	SKYLIGHT U-FACTOR	CEILING U-FACTOR	FRAME WALL U-FACTOR	MASS WALL U-FACTOR ^b	FLOOR U-FACTOR	BASEMENT WALL U-FACTOR	CRAWL SPACE WALL U-FACTOR	SLAB ON GRADE & UNHEATED SLAB U-FACTOR & DEPTH
0.30	0.41	0.020	0.044	0.060	0.027	0.39	0.39	0.05, 4 ft

For SI: 1 foot = 304.8 mm.

- a. Nonfenestration *U*-factors shall be obtained from measurement, calculation or an approved source.
- b. When more than half the insulation is on the interior, the mass wall *U*-factors shall be a maximum of 0.057.
- c. Airtightness of less than or equal to 0.15 CFM50/Sq. Ft. of Building Shell (~2 ACH50) tested and balanced ventilation system compliant with R304, or the building must comply with Tables R402.1.2.2 and R402.1.2.3.

delete and replace R402.1.5 Total UA alternative.

Where the total *building thermal envelope UA*, the sum of *U*-factor times assembly area, is less than or equal to the total UA resulting from multiplying the *U*-factors in Table R402.1.4 by the same assembly area as in the proposed *building*, the *building* shall be considered to be in compliance provided that (a) airtightness is less than or equal to 0.15 CFM50/Sq. Ft. of Building Shell (~2 ACH50) tested, and (b) the ventilation system is: balanced, complying with R304. The UA calculation shall be performed using a method consistent with the ASHRAE *Handbook of Fundamentals* and shall include the thermal bridging effects of framing materials.

Exception: The following are not required to comply with the airtightness limit (a) or the balanced ventilation system and heat recovery efficiency requirements (b).

1. Alterations.
2. Additions complying with this code based on the attributes of the addition alone using the Total UA alternative.

delete and replace **R402.1.6 Log homes.**

Log homes shall comply by doing all of the following steps:

1. Design log home in accordance with ICC 400—2022 or to the requirements of Table R402.1.6.
2. Determine the number of points needed to comply, using Table R402.1.2.2 based on building size.
3. Incorporate a sufficient number of points from Table R402.1.2.3 to meet the points requirement from Table R402.1.2.2.

delete and replace **TABLE R402.1.6**

**TABLE R402.1.6
LOG HOME INSULATION, FENESTRATION AND HEATING REQUIREMENTS BY
COMPONENT^a**

FENESTRATION U-FACTOR ^b	SKYLIGHT U-FACTOR	CEILING R-VALUE	LOG WALL ^d	FLOOR R-VALUE ^e	BASEMENT/ CRAWLSPACE WALL U-VALUE ^f	SLAB R-VALUE & DEPTH	HEATED SLAB R-VALUE ^g	AIR LEAKAGE ⁱ	HEATING SYSTEM ^h AFUE ^h
0.30	0.41	49	□ ≥ 5 in. log	38	R-20ci OR R13+10ci	R-20,4' (edge) OR R-15,4'(e dge) + R-7.5 (under)	R-20,4' (edge) OR R-15,4'(e dge) + R-15 (under)	0.15 CFM50/ Sq. Ft. of Building Shell (~2 ACH50)	ENERGY STAR basic: (1) Gas/propane furnace ≥ 95 AFUE, Oil furnace ≥ 85 AFUE; (2) Gas/propane boiler ≥ 90 AFUE,

										Oil boiler ≥ 87 AFUE;
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For SI: 1 foot = 304.8 mm.

- a. *U*-factors are maximums, *R*-values are minimums.
- b. The fenestration *U*-factor column excludes skylights.
- c. Glazing area includes window and skylight opening area, plus actual glazed area of glass in doors, as a percentage of wall area. Sunrooms are exempt from this requirement.
- d. Log walls must comply with ICC 400 with an average minimum average wall thickness of 5 inches or greater. Nonlog exterior walls shall be insulated in accordance with Table 402.2.1.
- e. Alternatively, insulation sufficient to fill the framing cavity, with R-38 as the absolute maximum.
- f. Basement walls shall be R-15 continuous insulation or R-20 cavity full basement height.
- g. Heated slabs shall be completely insulated around the perimeter and under the entire slab.
- h. Boilers must have an outdoor temperature reset or thermal purge control.
- i. "ACH50" = air changes per hour at 50 Pascals building pressure as measured with a blower door. CFM50/Sq. Ft. of Building Shell = amount of air leakage (in cubic feet per minute, or CFM) that leaks out of each square foot of the exterior surface all six sides of the building measured at 50 Pascals of pressure with a blower door.

delete and replace R402.2.1 Ceilings with attic spaces.

Where Section R402.1.2 would require R-49 insulation in the ceiling, installing R-38 over the top of exterior walls where insulation is compressed in the eaves shall be deemed to satisfy the requirement for R-49 insulation provided that the balance of the ceiling is at R-49. Where Section R402.1 would require R-60 insulation in the ceiling, installing R-49 over the top of exterior walls where insulation is compressed in the eaves shall be deemed to satisfy the requirement for R-60 provided the balance of the ceiling is at R-60. This reduction shall not apply to the *U*-factor alternative approach in Section R402.1.4 and the total UA alternative in Section R402.1.5.

delete and replace R402.2.2 Ceilings without attic spaces (slopes).

Where Section R402.1.2 would require R-49 insulation in the ceiling, installing R-38 over the top of exterior walls where insulation is compressed in the eaves shall be deemed to satisfy the requirement for R-49 insulation provided that the balance of the ceiling is at R-49. Where Section R402.1 would require R-60 insulation in the ceiling, installing R-49 over the top of exterior walls where insulation is compressed in the eaves shall be deemed to satisfy the requirement for R-60. This reduction shall not apply to the *U*-factor alternative approach in Section R402.1.4 and the Total UA alternative in Section R402.1.5.

delete and replace R402.2.3 Eave baffle.

For air-permeable insulations in vented attics, a baffle shall be installed adjacent to soffit and eave vents. Baffles shall maintain a net free area opening equal to or greater than the net free area of the vent. The baffle shall extend over the top of the attic insulation. The baffle shall be permitted to be any solid material.

The baffle shall be installed to the outer edge of the exterior wall top plate so as to provide maximum space for attic insulation coverage over the top plate. Where soffit venting is not continuous, baffles shall be installed continuously to prevent ventilation air in the eave soffit from bypassing the baffle.

delete and replace R402.2.4 Access hatches and doors.

Access hatches and doors from conditioned spaces to unconditioned spaces such as attics and crawl spaces shall be weatherstripped and insulated to the same R-value required by Section R402 for the wall or ceiling in which they are installed. Access shall be provided to all equipment

that prevents damaging or compressing the insulation. A wood-framed or equivalent baffle or retainer is required to be provided when loose-fill insulation is installed, the purpose of which is to prevent the loose-fill insulation from spilling into the living space when the attic access is opened, and to provide a permanent means of maintaining the installed *R*-value of the loose-fill insulation.

Exception: Vertical doors that provide access from conditioned to unconditioned spaces shall be permitted to meet the fenestration requirements of Table R402.1.2.1.

The reduction shall not apply to the total UA alternative in Section R402.1.5.

delete and replace **R402.2.6 Steel-frame ceilings, walls and floors.**

Steel-frame ceilings, walls, and floors shall comply with the U-factor requirements of Table R402.1.2.1. The calculation of the U-factor for steel-framed ceilings and walls in an 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% framing factor or framing spaced at 16 inches (400 mm) on center with a 25% framing factor, the net lower framing member spacing input values shall be used when calculating using AISI S250.
3. Where the steel-framed wall contains less than 23% foaming 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.

delete **TABLE R402.2.6**

delete and replace **R402.2.8 Floors.**

Floor framing-*cavity insulation* shall be installed to maintain permanent contact with the underside of the subfloor decking.

Exception: The floor framing-*cavity insulation* shall be permitted to be in contact with the topside of sheathing or continuous insulation installed on the bottom side of floor framing where combined with insulation that meets or exceeds the minimum wood frame wall *R*-value in Table 402.1.2.1 and that extends from the bottom to the top of all perimeter floor framing members.

delete and replace **R402.2.9 Basement walls.**

Walls associated with conditioned basements shall be insulated from the top of the *basement wall* down to 10 feet (3048 mm) below grade or to the basement floor, whichever is less. Walls associated with unconditioned basements shall meet this requirement unless the floor overhead is insulated in accordance with Sections R402.1.2.1 and R402.2.8.

delete and replace **R402.2.10 Slab-on-grade floors.**

Slab-on-grade floors with a floor surface less than 12 inches (305 mm) below grade shall be insulated in accordance with Table R402.1.2.1. 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 R402.1.2.1 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*. Slab-edge insulation is not required in jurisdictions designated by the *code official or authority having jurisdiction*, where one exists, as having a very heavy termite infestation.

delete and replace R402.2.13 Sunroom and conditioned garage insulation.

Sunrooms enclosing *conditioned space* and conditioned garages shall meet the insulation requirements of this code.

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

1. The minimum ceiling insulation *R*-value shall be R-38.
2. The minimum wall insulation *R*-value shall be R-20. Walls separating a *sunroom* or heated garage with a *thermal isolation* from *conditioned space* shall comply with the *building thermal envelope* requirements of this code.

add R402.2.16 Building Science

Consider building science principles in all design and construction. Buildings should be designed and constructed recognizing principles behind moisture vapor control approaches for cold climates. Maintain the envelope assembly's ability to adequately dry in at least one direction by not installing low-perm vapor retarder materials (e.g., vapor barrier) on both sides of an assembly, seek to optimize the assembly's ability to dry, and limit the potential for wetting. (From Applied Building Technologies Group, LLC).

delete and replace R402.3 Fenestration.

In addition to the requirements of Section R402.1.2.1, fenestration shall comply with Sections R402.3.1 through R402.3.5.

delete and replace R402.3.2 Glazed fenestration SHGC.

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

Dynamic glazing shall be permitted to satisfy the SHGC requirements of Table R402.1.2.1 provided the ratio of the higher to lower labeled SHGC is greater than or equal to 2.4, and the *dynamic glazing* is automatically controlled to modulate the amount of solar gain into the space in multiple steps. *Dynamic glazing* shall be considered separately from other fenestration, and area-weighted averaging with other fenestration that is not dynamic glazing shall not be permitted.

Exception: *Dynamic glazing* is not required to comply with this section when both the lower and higher labeled SHGC already comply with the requirements of Table R402.1.2.1.

delete and replace R402.3.3 Glazed fenestration exemption.

Up to 15 square feet (1.4 m²) of glazed fenestration per dwelling unit shall be permitted to be exempt from *U*-factor and SHGC requirements in Section R402.1.2.1. This exemption shall not apply to the *U*-factor alternative approach in Section R402.1.4 and the Total UA alternative in Section R402.1.5.

delete and replace R402.3.4 Opaque door exemption.

One side-hinged opaque door assembly up to 24 square feet (2.22 m²) in area is exempted from the *U*-factor requirement in Section R402.1.2.1. This exemption shall not apply to the *U*-factor alternative approach in Section R402.1.4 and the total UA alternative in Section R402.1.5.

delete and replace R402.3.5 Sunroom and conditioned garage fenestration.

Sunrooms and conditioned garages enclosing *conditioned space* shall meet the fenestration requirements of this code.

Exception: *sunrooms and conditioned garages with thermal isolation* and enclosing *conditioned space*, the fenestration *U*-factor shall not exceed 0.30 and the *skylight U*-factor shall not exceed 0.41.

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

delete and replace R402.4 Air leakage.

The *building thermal envelope* shall be constructed to limit air leakage in accordance with the requirements of this Section.

delete and replace R402.4.1 Building thermal envelope.

The *building thermal envelope* shall comply with Sections R402.4.1.1 through R402.4.1.3. The sealing methods between dissimilar materials shall allow for differential expansion and contraction.

delete and replace R402.4.1.1 Installation.

The components of the *building thermal envelope* as listed in Table R402.4.1.1 shall be installed in accordance with the manufacturer's instructions and the criteria listed in Table R402.4.1.1, as applicable to the method of construction.

delete and replace TABLE R402.4.1.1

**TABLE R402.4.1.1
AIR BARRIER, AIR SEALING AND INSULATION INSTALLATION**

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
General conditions and appropriate materials for air barriers	A continuous, durable air barrier shall be installed in the building envelope. Breaks or joints in the air barrier shall be sealed. The air barrier should be continuous and be durably connected to all penetrations,	Air-permeable insulation shall not be used as a sealing material; when installed in vertical walls, sloped ceilings, and floors within the thermal envelope, it shall be enclosed on all six sides and in contact with a

	<p>windows and other (structural) interruptions.</p> <p>Open-cell or closed-cell foam shall have a finished thickness greater than or equal to 5.5 in. or 1.5 in., respectively, to qualify as an air barrier unless the manufacturer indicates otherwise.</p> <p>If flexible air barriers are used, they shall be fully sealed at all seams and edges and supported in accordance with manufacturer's installation instructions.</p> <p>Flexible air barriers shall not be made of kraft paper, or other materials that are easily torn. If polyethylene is used, its thickness shall be greater than or equal to 6 mil. Materials meeting ASTM E2357 Standard Test Method for Determining Air Leakage of Air Barrier Assemblies are acceptable.</p>	<p>durable, air barrier.</p>
Dropped ceilings/soffits	<p>The air barrier in any dropped ceiling/soffit shall be aligned with (in contact with) the insulation and any gaps in the air barrier shall be sealed. Access openings, drop downstairs or knee wall doors to unconditioned attic spaces shall be sealed, insulated and gasketed.</p>	<p>The insulation in any dropped ceiling/soffit shall be aligned with (in contact with) the air barrier and shall be enclosed on five sides and in contact with a durable, interior air barrier. A top-side air barrier is not required in a flat attic.</p>
Framing junctions and cavities	<p>The junction of the foundation and sill plate shall be sealed. The junction of the top plate and the top of exterior wall sheathing shall be sealed.</p> <p>Knee walls shall be air sealed. When part of the thermal envelope, knee wall insulation shall be enclosed on all six sides and in contact with a durable, interior air barrier.</p>	<p>Cavities within corners and headers of frame walls shall be insulated by completely filling the cavity with a material having a minimum thermal resistance of R-3 per inch.</p> <p>Exterior thermal envelope insulation for framed walls shall be installed in substantial contact and continuous alignment with the air barrier.</p> <p>Exterior thermal envelope insulation for framed walls shall be enclosed on all six sides and in contact with a durable, air barrier.</p>
Windows, skylights and doors	<p>The space between window/door jambs and framing, and skylights and framing shall be sealed with minimally-expanding foam, caulk with backer rod and sealant as well as flexible membranes supported by or adhered to rigid air barrier material.</p>	<p>—</p>
Rim joists	<p>Rim joists shall include an exterior air barrier. Junctions of the foundation and sill plate, sill plate and rim band, and rim band and subfloor shall be sealed.</p> <p>When air permeable insulation is installed, a</p>	<p>Rim joists shall be insulated and air sealed so that the insulation maintains permanent contact with the exterior rim board.^b</p>

	<p> durable, interior air barrier shall be installed at the rim joist.</p>	
<p>Floors (including above garage and cantilevered floors)</p>	<p>The air barrier shall be installed at any exposed edge of insulation.</p>	<p>Floor framing cavity insulation shall be installed to maintain permanent contact with the underside of subfloor decking, or floor framing cavity insulation shall be permitted to be in contact with the top side of sheathing, or with continuous insulation installed on the underside of floor framing and extending from the bottom to the top of all perimeter floor framing members.</p>
<p>Basement crawl space and slab foundations</p>	<p>Exposed earth in unvented crawl spaces shall be covered with a Class I vapor retarder/air barrier in accordance with Section R402.2.10 with overlapping joints taped in accordance with Section R402.2.10.</p> <p>Penetrations through concrete foundation walls and slabs shall be air sealed.</p> <p>Class 1 vapor retarders shall not be used as an air barrier on below-grade walls and shall be installed in accordance with Section R702.7 of the <i>International Residential Code</i>.</p>	<p>Where provided instead of floor insulation, vapor barrier shall be installed in accordance with Section R402.2.10.</p> <p>Conditioned basement foundation wall insulation shall be installed in accordance with Section R402.2.8.</p> <p>Slab-on-grade floor insulation shall be installed in accordance with Section R402.2.10.</p>
<p>Shafts, penetrations</p>	<p>Duct and flue shafts, and other penetrations to exterior or unconditioned space shall be sealed to allow for expansion, contraction, and mechanical vibration.</p> <p>Utility penetrations of the air barrier shall be caulked, gasketed or otherwise sealed and shall allow for expansion, contraction of materials and mechanical vibration.</p> <p>Doors or hatches in knee walls opening to exterior or unconditioned space shall be insulated and gasketed.</p>	<p>Insulation shall be fitted tightly around utilities passing through shafts and penetrations in the building thermal envelope to maintain required <i>R</i>-value.</p>

(continued)

**TABLE R402.4.1.1—continued
AIR BARRIER AND INSULATION INSTALLATION**

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
Narrow cavities	Narrow cavities of 1 inch or less that are not able to be insulated shall be air	Batts in narrow cavities shall be cut to fit, or narrow cavities shall be filled

	sealed.	by insulation that on installation readily conforms to the available cavity space.
Garage separation	Air sealing shall be provided between the garage and <i>conditioned spaces</i> .	Insulated portions of the garage separation assembly shall be installed in accordance with Sections R303 and R402.2.7.and R402.2.7.
Recessed lighting and appliances	Recessed light fixtures installed in the building thermal envelope shall be air sealed in accordance with Section R402.4.5. Recessed light fixtures and other appliances (speakers, exhaust fans, light shafts, etc.) installed in the building thermal envelope shall be ICAT (Insulation Contact and Air Tight) rated, airtight labeled (or “Washington State Approved”) and sealed with a gasket or caulk between the housing and the interior wall or ceiling cover. Fixtures and appliances shall maintain required clearances of not less than $\frac{1}{2}$ inch from combustible material and not less than 3 inches from insulation material, or as required by manufacturer’s installation requirements.	Recessed light fixtures installed in the building thermal envelope shall be airtight and ICAT rated (ICAT-rated indicates Insulation Contact and Airtight and meets the IC and air tightness requirement), and shall be buried or surrounded with insulation.
Plumbing and wiring	All holes created by wiring, plumbing or other penetrations 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 <i>R</i> -value can be met by installing insulation and air barrier systems completely to the exterior side of the obstructions. Insulation shall be placed between the exterior of the wall assembly and pipes. Insulation should not be installed on the interior of the piping. Batt insulation shall be cut neatly to fit around wiring and plumbing in exterior walls, or insulation that on installation readily conforms to available space shall extend behind piping and wiring and shall be in full contact with all air barriers.
Shower/tub on exterior wall	Exterior walls adjacent to showers and tubs shall have insulation filling any gaps or voids between tub or shower walls and unconditioned space.	Exterior walls adjacent to showers and tubs shall have a rigid, durable air barrier separating the exterior wall from the shower and tubs and be insulated.
Electrical/phone box on exterior walls	The air barrier shall be installed behind electrical, or communication boxes or air-sealed boxes shall be installed.	Insulation completely fills voids between the box and exterior sheathing.

Common wall	Whenever continuity of the building thermal envelope is broken at walls separating dwelling units in Group R-2 building, including common, party, and fire walls, such walls shall be insulated to a minimum of R-10 on each side of the break in insulation continuity.	Air barrier shall be installed in the common wall between dwelling units. Common walls shall be sealed at junctions with outside walls and at the top pressure plane of the house.
HVAC register boots	HVAC register boots that penetrate building thermal envelope shall be sealed to the subfloor or drywall.	—
Concealed sprinklers	When 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.	—
Fireplace	A durable air barrier shall be installed in contact with insulation. Fireplaces shall have compression closure doors and combustion air supplied from the outdoors.	—

- a. In addition, inspection of log walls shall be in accordance with the provisions of ICC-400—2022
- b. Air barrier and insulation full enclosure is not required in unconditioned/ventilated attic spaces and at rim joints.

***delete and replace* R402.4.1.2 Air Leakage Testing.**

The *building* or dwelling unit shall be tested *and* verified as having an air leakage rate not exceeding two (2) air changes per hour or 0.15 CFM50/Sq. Ft. Building Shell area of all six sides of the building. Testing shall be conducted in accordance with **ANSI/RESNET/ICC 380, ASTM E779 or ASTM E1827** and reported at a pressure of 0.2 inches w.g. (50 Pascals). Multifamily buildings shall comply with CBES C402.4.—Testing and verification shall be conducted by an applicable Building Performance Institutes (BPI) Professional, a Home Energy Rating System (HERS) Energy Rater, HERS Field Inspector, or a Vermont Department of Public Service approved air leakage tester. A written report of the results of the test shall be signed by the party conducting the test. Testing shall be performed at any time after creation of all penetrations of the *building thermal envelope*.

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.
7. Plumbing and drainage traps shall be filled with water as normally found, but not otherwise sealed.

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.

delete and replace **R402.4.1.3 Reporting.**

Air leakage testing shall be reported on the RBES Certificate in units of air changes per hour at 50 Pascals (ACH50) and CFM50/Sq. Ft. Building Shell area of all six sides of the building.

delete and replace **R402.4.2 Fireplaces.**

New wood-burning fireplaces shall have tight-fitting 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. Where using tight-fitting doors on masonry fireplaces, the doors shall be listed and labeled in accordance with UL 907 2019.

add **R402.4.6 Electrical and communication outlet boxes (air-sealed boxes).**

Electrical and communication outlet boxes installed in the building thermal envelope that are through or outside the building air barrier shall be sealed to limit air leakage between conditioned and unconditioned spaces. Electrical and communication outlet boxes shall be tested in accordance with **NEMA OS 4**, Requirements for Air-Sealed Boxes for Electrical and Communication Applications and shall have an air leakage rate of not greater than 2.0 cubic feet per minute (0.944 L/s) at a pressure differential of 1.57 psf (75 Pa). Electrical and communication outlet boxes shall be marked "NEMA OS 4" or "OS 4" in accordance with **NEMA OS 4**. Electrical and communication outlet boxes shall be installed per the manufacturer's instructions and with any supplied components required to achieve compliance with **NEMA OS 4**.

delete and replace **R402.5 Maximum fenestration U-factor and SHGC ().**

The area-weighted average maximum *fenestration* U-factor permitted using tradeoffs from Section R402.1.5 or R405 shall be 0.30 for *vertical fenestration*, and 0.41 for skylights.

add **R402.7 Solar-ready zone.**

add **R402.7.1 General.**

Solar-ready zone is required for Stretch Code but is optional for Base Code. Points are available for meeting the solar-ready zone requirements for Base Code.

For Stretch Code, new detached one- and two-family dwellings, and multiple single-family dwellings (townhouses) with not less than 600 square feet (55.74 m²) of roof area oriented between 110 and 270 degrees of true north shall comply with this Section.

Exceptions:

1. New residential buildings with a permanently installed on-site renewable energy system.
2. A building where all areas of the roof that would otherwise meet the requirements of Section R407.5 are in full or partial shade for more than 70 percent of daylight hours annually.
3. Buildings and structures as designed and shown in construction documents that do not meet the conditions for a solar-ready zone area.
4. Buildings with possible location(s) for ground mounted systems identified in the submitted construction documents. Buildings claiming this exception must either install appropriate electrical conduit to the site of the proposed ground mounted solar array or include a solar site evaluation that supports the siting of the proposed ground mounting location.

Multifamily buildings shall comply with CBES C402.5.

add R402.7.2 Construction document requirements for solar-ready zone.

Construction documents shall indicate the solar-ready zone where applicable.

add R402.7.3 Solar-ready zone area.

The total solar-ready zone area shall consist of an area not less than 300 square feet (27.87 m²) per dwelling exclusive of mandatory access or setback areas. New multiple single-family dwellings (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) per dwelling. The 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 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 required set back areas.

For ground-mounted systems, possible locations of the panels must be identified in the submitted construction documents and be supported by a solar site evaluation. At least one potential location must be identified in the construction documents for the future installation of the panels.

add R402.7.4 Obstructions.

Solar-ready zones shall consist of an area free from obstructions, including but not limited to vents, chimneys, and roof-mounted equipment.

add R402.7.5 Shading.

The solar-ready zone shall be set back from any existing or new permanently affixed object on

the building or site that is located south, east or west of the solar zone a distance not less than two times the object's height above the nearest point on the roof surface. Such objects include, but are not limited to, taller portions of the building itself, parapets, chimneys, antennas, signage, rooftop equipment, trees, and roof plantings.

add R402.7.6 Capped roof penetration sleeve.

A capped roof penetration sleeve shall be provided adjacent to a solar-ready zone located on a roof slope of not greater than 1 unit vertical in 12 units horizontal (8-percent slope). The capped roof penetration sleeve shall be sized to accommodate the future photovoltaic system conduit, but shall have an inside diameter of not less than 1 1/4 inches (32 mm).

add R402.7.7 Roof load documentation.

The structural design loads for roof dead load and roof live load to support the solar system shall be clearly indicated on the construction documents.

add R402.7.8 Interconnection pathway.

Construction documents shall indicate pathways for routing of conduit (or plumbing for solar thermal systems) from the solar-ready zone to the electrical service panel or service hot water system. Alternatively, install two 1-inch minimum diameter EMT conduits from the main electrical panel location to the attic or other area easily accessible to the solar array's proposed location. Conduits for future solar installations are to be capped, airtight and labeled at both ends.

add R402.7.9 Electrical service reserved space.

The main electrical service panel shall have a reserved space to allow installation of a dual pole circuit breaker for future solar electric installation and shall be labeled "For Future Solar Electric." The reserved space shall be positioned at the opposite (load) end from the input feeder location or main circuit location. Note: this requirement is in addition to the electrical service reserved space for electric vehicle charging. This requirement is only for the building master panel and not individual dwelling unit panels in the case of multifamily buildings.

add R402.7.10 Electrical energy storage system-ready area.

The floor area of the electrical energy storage system-ready area shall be not less than 2 feet (610 mm) in one dimension and 4 feet (1219 mm) in another dimension and located in accordance with Section 1207 of the *International Fire Code*. The location and layout diagram of the electrical energy storage system-ready area shall be indicated on the construction documents.

add R402.7.11 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.

add R402.8 Tiny houses.

Tiny Houses as defined in Chapter 2 must comply with the envelope, insulation and fenestration requirements below. All other code provisions are still required.

Tiny houses require the following:

- ceiling flat attic U-0.033 (R-30);
- ceiling slope U-0.04 (R-24);
- above grade walls U-0.08 (R-13);
- frame floors U-0.05 (R-21);
- basement/crawl space walls R-20 continuous (ci) or R13+10ci;
- slab on grade R-20 for 4' on edge or under, OR R-15,4'(edge) + R-15 (under entire slab);
- heated slab on grade R-20,4' (edge) + R-15 (under entire slab);
- windows U-0.27;
- doors U-0.37;
- air leakage 0.15 CFM50/Sq. Ft. of Building Shell (~2 ACH50);
- ducts inside thermal boundary.

Compliance with all other provisions of this code is required.

Exception: Mechanical ventilation system for *tiny houses* is not required to be a *balanced ventilation system* and may be exhaust-only.

SECTION R403 SYSTEMS

delete and replace **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 the 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 down to 55°F (13°C) or up to 85°F (29°C). The thermostat shall initially be programmed by the manufacturer with a heating temperature set point no higher than 70°F (21°C) and a cooling temperature set point no lower than 78°F (26°C). Adjustments to these settings for elderly, disabled or those with special needs is permissible.

Exception: The following are allowed only where a 5-wire connection to thermostat location is provided:

1. Radiant floor, wall, ceiling and/or beam system on dedicated zone.
2. *Cold-climate heat pump* not designed for setbacks.
3. Wi-Fi or “smart” Internet-connected thermostats.

delete **R403.1.2 Heat pump supplementary heat.**

add **R403.1.2 Ductless heat pump supplementary heat.**

Ductless heat pumps shall not have integrated supplementary electric-resistance heat other than that provided for frost control. See Section R404.4 for guidance on electric-resistance heating equipment other than heat pumps.

delete and replace R403.3 Ducts.

Ducts and air handlers for space conditioning shall be in accordance with Sections R403.3.1 through R403.3.2.

delete R403.3.1 Ducts located outside conditioned space.

add R403.3.1 Duct placement.

All ducts and air handlers shall be located within *conditioned space*.

delete R403.3.3 Duct testing.

delete R403.3.4 Duct leakage

delete R403.3.5 Building cavities

delete R403.3.6 Ducts buried within ceiling insulation.

delete R403.3.7 Ducts located in conditioned space.

delete and replace R403.4 Mechanical system piping insulation (Mandatory).

Mechanical system piping designed to carry fluids above 105°F (41°C) or below 55°F (13°C) shall be located within the building thermal envelope and insulated to a minimum of R-4.

delete and replace R403.5.1.1 Circulation systems.

Where installed, heated water circulation systems shall be provided with a circulation pump. The system return pipe shall be a dedicated return pipe or a cold-water supply pipe. Gravity and thermosyphon circulation systems shall be prohibited. Controls for circulating hot water system pumps shall automatically turn off the pump when the water in the circulation loop is at the desired temperature and when there is no demand for hot water. The controls shall limit the temperature of the water entering the cold-water piping to not greater than 104°F (40°C).

delete and replace R403.5.3 Hot water pipe insulation ().

Insulation for service hot water pipe with a minimum thermal resistance (*R*-value) of R-4 shall be applied to the following:

1. Piping $\frac{3}{4}$ inch (19.1 mm) and larger in nominal diameter located inside the *conditioned space*
2. Piping serving more than one dwelling unit.
3. Piping located outside the conditioned space.
4. Piping from the water heater to a distribution manifold.
5. Piping located under a floor slab.
6. Buried piping.
7. Supply and return piping in circulation and recirculation systems other than cold water pipe return demand recirculation systems.

R403.6 Mechanical ventilation.

Follow the mechanical ventilation requirements in R304.

delete **R403.6.1 Heat or energy recovery ventilation.**

delete **R403.6.1 Whole-house mechanical ventilation system fan efficacy.**

delete **TABLE R403.6.1**

delete and replace **R403.8 Systems serving multiple dwelling units.**

Systems serving multiple dwelling units shall comply with Sections C403 and C404 of the 2024 *Vermont Commercial Building Energy Standards* (CBES) in lieu of Section R403 but will not be subject to the additional requirements outlined in Tables C406.1.1 and Table 406.1.2.

delete and replace **R403.10.1 Residential pools and permanent residential spas.**

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

delete and replace **R403.10.4 Covers.**

Outdoor heated pools and outdoor permanent spas shall be provided with an insulated vapor-retardant cover of at least R-12 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 site-recovered energy, such as from a heat pump or solar energy source, covers or other vapor-retardant means shall not be required.

SECTION R404 ELECTRICAL POWER AND LIGHTING SYSTEMS

delete and replace **R404.1 Lighting equipment.**

All permanently installed lighting fixtures, excluding kitchen appliance lighting fixtures, shall contain only high-efficacy lighting sources.

delete **R404.1.1 Lighting equipment**

add **R404.1.1 Exterior lighting.**

Exterior lighting for residential buildings shall comply with Sections C405.5 (Exterior Lighting Power Requirements) of the *Vermont Commercial Building Energy Standards* (CBES).

Exceptions:

1. Detached one- and two- family dwellings.
2. Townhouses.
3. Solar-powered lamps not connected to any electrical service.
4. Luminaires controlled by a motion sensor.
5. Lamps and luminaires that comply with Section R404.1.

delete and replace R404.1.2 Lighting equipment for multifamily spaces

Multifamily buildings three-stories or less with common areas, stairwells, vestibules, lobbies, parking garages, and exterior parking areas and drives must meet the lighting power density (LPD) specifications of the *Vermont Commercial Building Energy Standards* (CBES). For parking garages, see Section C405.3.2; for uncovered parking areas and drives, see Section C405.5.2.

add R404.1.3 Fuel gas lighting equipment. Fuel gas lighting systems shall not be permitted.

add R404.1.44 Exterior lighting controls. Where the total permanently installed exterior lighting power is greater than 30 watts, the permanently installed exterior lighting shall comply with the following

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

For multifamily buildings, follow C405.2.7 (Exterior Lighting Controls).

delete R404.2 Electric resistance heating equipment.

add R404.2 Electric heating equipment.

Heat pumps shall be certified *cold-climate heat pumps* only and shall have controls that, except during defrost, prevent supplementary electric heat operation where the heat pump compressor can meet the heating load.

Building heating with electric-resistance heating equipment is prohibited.

Exceptions:

1. Replacement of existing electrical resistance units.
2. Limited areas where other heating sources are cost prohibitive or impractical (for example, a small interior space such as a bathroom or stairwell, which is distant from the distribution system).
3. Buildings with cold-climate heat pump(s) as the primary heating system, provided that:
 - a. The supplemental electric-resistance heat is controlled to prevent it from operating at an outside air temperature of 5°F or higher.
 - b. The building has a tested air tightness of less than or equal to 0.15 CFM50/Sq. Ft. of Building Shell (~2 ACH50).

4. Multifamily buildings with heating loads less than or equal to 6.0 Btu/h/ft² at design temperature.

Note: Buildings served by the Burlington Electric Department (BED) must also receive approval from BED before installing electric resistance heating equipment.

delete and replace R404.3 Electric vehicle charging.

One *Electric Vehicle Charging - Level 2 Capable* parking space or *Electric Vehicle Charging - Level 2 EVSE* is required for new construction based on Table R404.3.

Exception: Electric vehicle parking spaces are not required if one of the following conditions apply:

1. Parking spaces intended exclusively for storage of vehicles for retail sale or vehicle service.
2. Parking spaces are separated from the meter by a public right-of-way
1. Parking spaces which are limited to parking durations of less than one hour.
2. EV Capable Spaces are not required where no parking spaces are provided.

Parking spaces with *electric vehicle supply equipment (EVSE)* shall be marked for EV use only.

Exception: The number of parking spaces with *EVSE* that are marked for “EV use only” need not exceed the number of EV cars driven by occupants of the building. This exception does not reduce the number of *EVSE* spaces required, just the number that are marked for EV use only.

delete and replace TABLE R404.3 REQUIRED LEVEL 2 CAPABLE ELECTRIC VEHICLE CHARGING PARKING SPACES FOR ALL NEW BUILDINGS (BASE CODE and STRETCH CODE)

BUILDING/PARKING TYPE	MINIMUM REQUIRED NUMBER OF LEVEL 2 CAPABLE EV CHARGING PARKING SPACES
Single Family Home or Multifamily Building	1 per dwelling unit or the number of parking spaces provided, whichever is less
Additional Parking Spaces	25% of remaining parking spaces not utilized by dwelling units, or 40 spaces, whichever is less

For *multifamily building* garage or covered parking, provide on electrical drawings the appropriate sized pathway to the building electrical room to accommodate a future electrical upgrade for Level 2 *EVSE* electric vehicle charging; provide adequate wall and floor space in the building electrical room for future EV charging related electrical equipment; provide the appropriate sized pathways to exterior on-grade surface parking spaces for future Level 2 *EVSE* electric vehicle charging; provide a line diagram on the electrical drawings demonstrating a

pathway for future Level 2 EVSE electric vehicle charging. Quantity of future Level 2 EVSE electric vehicle charging stations shall be as required by Table R404.3.

add R404.4 200 Amp Electrical Service.

Each new building, except for individual multifamily units, shall be supplied with at least 200 amp electrical service in anticipation of increased electrical services that will need to be provided in the future.

add R404.5 Dwelling electrical meter.

Each residential unit and each dwelling unit located in a *Group R-2* building shall have a separate electrical meter.

Exception: Buildings where a majority of the living units serve tenants at or below 80 percent of area median income.

add R404.6 Electrical transformers.

Low-voltage dry-type distribution electric transformers shall meet the minimum efficiency requirements of Table R405.6 as tested and rated in accordance with the test procedure listed in DOE 10 CFR 431. The efficiency shall be verified through certification under an approved certification program or, where a certification program does not exist, the equipment efficiency ratings shall be supported by data furnished by the transformer manufacturer.

Exception: The following transformers are exempt:

1. Transformers that meet the *Energy Policy Act of 2005* exclusions based on the DOE 10 CFR 431 definition of special purpose applications.
2. Transformers that meet the *Energy Policy Act of 2005* exclusions that are not to be used in general purpose applications based on information provided in DOE 10 CFR 431.
3. Transformers that meet the *Energy Policy Act of 2005* exclusions with multiple voltage taps where the highest tap is not less than 20 percent more than the lowest tap.
4. Drive transformers.
5. Rectifier transformers.
6. Auto-transformers.
7. Uninterruptible power system transformers.
8. Impedance transformers.
9. Regulating transformers.
10. Sealed and nonventilating transformers.
11. Machine tool transformers.

- 12. Welding transformers.
- 13. Grounding transformers.
- 14. Testing transformers.

**TABLE R405.6
MINIMUM NOMINAL EFFICIENCY LEVELS FOR 10 CFR 431 LOW-VOLTAGE DRY-TYPE
DISTRIBUTION TRANSFORMERS**

SINGLE-PHASE TRANSFORMERS		THREE-PHASE TRANSFORMERS	
kVA ^a	Efficiency (%) ^b	kVA ^a	Efficiency (%) ^b
15	97.70	15	97.89
25	98.00	30	98.23
37.5	98.20	45	98.40
50	98.30	75	98.60
75	98.50	112.5	98.74
100	98.60	150	98.83
167	98.70	225	98.94
250	98.80	300	99.02
333	98.90	500	99.14
—	—	750	99.23
—	—	1000	99.28

- a. kiloVolt-Amp rating.
- b. Nominal efficiencies shall be established in accordance with the DOE 10 CFR 431 test procedure for low-voltage dry-type transformers.

**SECTION R405
ALTERNATIVE USING REScheck™ SOFTWARE**

delete and replace R405.2 Mandatory requirements.

Compliance with this section requires that the applicable provisions in Sections R401.3, R402, R403, R404, and Chapter 3 be met.

*modify “SECTION R406 ENERGY RATING INDEX COMPLIANCE ALTERNATIVE”
to “SECTION R406 ENERGY RATING INDEX / HOME ENERGY RATING SYSTEM
COMPLIANCE ALTERNATIVE”*

**SECTION R406
ENERGY RATING INDEX/ HOME ENERGY RATING SYSTEM
COMPLIANCE ALTERNATIVE**

delete and replace R406.2 Mandatory requirements.

Compliance with this section requires that the applicable provisions in Sections R401.3, R402, R403 and R404 be met. The *building thermal envelope* shall be greater than or equal to levels of efficiency and *solar heat gain coefficients* in Table 402.1.2 of the 2009 *International Energy Conservation Code* for *Climate Zone 6*.

delete R406.4 ERI-based compliance.

add R406.4 ERI/HERS-Based Compliance for *Base Code* and *Stretch Code*.

Compliance based on an ERI analysis requires that the *rated design* be shown to have an ERI/HERS Index less than or equal to 54 for *Base Code* and less than or equal to 47 for *Stretch Code* when compared to the *ERI reference design*. Up to 5 ERI points can be earned with renewables. This includes all residential structures, including log homes. The ERI to be used to verify compliance is REM v16.3.3 or later or Ekotrope version 4.0 or later that is accredited by RESNET at <https://www.resnet.us/providers/accredited-providers/hers-software-tools/>. If the HERS Index scale is revised, the Department of Public Service may update these Index points.

**TABLE R406.4
ERI/HERS COMPLIANCE FOR BASE CODE AND STRETCH CODE**

BASE CODE	STRETCH CODE
60	59

delete R406.6.3 Additional documentation.

add R406.6.3 Renewable Energy Certificate (REC) Documentation.

Where on-site renewable energy is included in the calculation of an ERI, one of the following forms of documentation shall be provided to the *code official or authority having jurisdiction*, where one exists:

1. Substantiation that the RECs associated with the on-site renewable energy are owned by, or retired on behalf of, the homeowner.
2. An executed 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

add R406.6.4 Additional documentation.

The *code official or authority having jurisdiction*, where one exists 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*.

SECTION R407 VERMONT STRETCH CODE

delete and replace **R407.2 Compliance**

Compliance for *Stretch Code* shall be documented through either Section R402.1.2.1 “Package Plus Points Approach” or Section R406 “Energy Rating Index / Home Energy Rating System (HERS) Compliance Approach”.

For both Base Code and Stretch Code compliance, in Section R402.1.2.1 “Package Plus Points Approach”, the same standard package is used. Stretch Code then requires more Points than the Base Code. For ERI/HERS compliance, a lower HERS Index is required for Stretch Code than for Base Code.

delete **R407.2.1 Package Plus Points Approach.**

delete **TABLE R407.2.1.1 INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT FOR STRETCH PACKAGES**

delete **R407.2.1.2 Required points by building size.**

delete **TABLE R407.2.1.2**

delete **R407.2.1.3 Points by Component.**

delete **TABLE R407.2.1.3**

delete **R407.2.2 ERI-based compliance for Stretch Code.**

delete **R407.3 Air Leakage Testing for Stretch Code.**

delete **R407.4 Electric vehicle charging**

delete **R407.5 Solar Ready Zone for Stretch Code.**

SECTION R408 INSULATION EMBODIED CARBON EMISSIONS

R408.1 Insulation Embodied Carbon

In order to earn Points from Table 402.1.2.3, complete calculation Table 408.1.1 to summarize estimated embodied carbon emissions from insulation materials used in the project. The output metric for this measure shall be global warming potential (GWP) intensity, capturing insulation GWP per conditioned square foot of project area. To complete the basic calculation, project teams shall provide the following information for foundation, wall, and roof insulation materials:

1. Insulation material type
2. Product R-value

3. Total surface area (ft²)
4. Default, industry-average GWP value, from Table 408.1.2 or GWP values from *Type III Product-specific Environmental Product Declaration (EPD)*
5. Total project area (conditioned square feet)

Projects may substitute product-specific data for the default GWP value if the specified product has a lower reported GWP than the default value. Product-specific shall be substituted in Column G of the calculation Table 408.1.1. Substitution of default GWP values is only allowed when type III product-specific EPDs are sourced and noted in Column G. Projects shall use GWP values that include A1-A3 lifecycle stages, as documented in product-specific EPDs, with the exception of SPF and XPS products. For these products, the A5 and B1 values shall be included in the documented GWP value to account for the on-site and off gassing impact of blowing agents. Projects shall provide the EPDs declaration number in Column G.

TABLE R408.1.1

Table 1 - Insulation Global Warming Potential Calculation							Optional				
A	B	C	D	E	F	G	H	I			
Assembly	Material <i>List insulation material type from Table 2</i>	Product R-Value	Surface Area (gross square feet)	Framing Factor ["1.0" for continuous, "0.8" for cavity]	Default Global Warming Potential (kg CO ₂ e /sq.m. RSI-1) <i>Use Default GWP values from Table 2. Leave blank for products where product specific data will be</i>	Project has sourced Type III - Product-specific Environmental Product <i>Check box if project will be substituting default values with product specific data</i>	Product Specific Global Warming Potential (kg CO ₂ e /sq.m. RSI-1) <i>Leave blank unless EPDs have been sourced. Use GWP values from product-specific EPDs.</i>	Conversion Factor	GWP Result (kg CO ₂ e)		
Below grade, slab/stab edge			X	X	1.0	X		X	0.0164	=	
Basement walls			X	X	1.0	X		X	0.0164	=	
Above grade walls, cavity			X	X	0.8	X		X	0.0164	=	
Above grade walls, continuous			X	X	1.0	X		X	0.0164	=	
Roof, flat			X	X	1.0	X		X	0.0164	=	
Roof, sloped, cavity			X	X	0.8	X		X	0.0164	=	
Roof, sloped, continuous			X	X	1.0	X		X	0.0164	=	
		Input for basic calculation							Total Insulation GWP (kg CO ₂ e)		
		Inputs for product-specific data							Conditioned Floor Area (sf)		
		Calculation outputs					Summary Metrics		OUTPUT: Insulation GWP Intensity		

**TABLE R408.1.2
DEFAULT INSULATION GLOBAL WARMING POTENTIAL VALUES**

All values are from Building Emissions Accounting for Materials (BEAM)^a, unless noted.

Material	Default Global Warming Potential (kg CO ₂ e /sq.m. RSI-1)
Cellular glass - Aggregate	3.93 ^b
Cellulose - Denspack	-2.10
Cellulose - Blown/loosefill	-1.10
Cork - Board	-6.80
EPS/graphite - Board, unfaced, Type II - 15psi	2.80
EPS/graphite - Board, unfaced, Type IX - 25psi, graphite	3.40
EPS - Board, unfaced, Type I - 10psi	2.80

EPS - Board, unfaced, Type II- 15psi	3.80
EPS - Board, unfaced, Type IX- 25psi	4.80
Fiberglass - Batt, unfaced	0.70
Fiberglass - Blown/loosefill	1.00
Fiberglass - Blown/spray	1.93 ^c
Hemp - Batt	-0.50
HempCrete	-3.00
Mineral wool - Batt, unfaced	1.70
Mineral wool - Blown	1.60
Mineral wool - Board, unfaced, "light" density	3.30
Mineral wool - Board, unfaced, "heavy" density	8.10
Phenolic foam - Board	1.54 ^d
Polyiso - Wall Board	4.10
Polyiso - Roof Board	2.90
SPF – Spray, open cell	1.40
SPF – Spray, closed cell HFO	4.20
SPF – Spray, high density HFO	4.90
SPF – Spray, closed cell HFC	13.10
SPF – Spray, high density HFC	17.00
Straw – Panel	-6.50
Vacuum Insulated Panel	7.40
Wood fiber – Board, unfaced, European	-6.50
Wood fiber – Board, unfaced, North America	-10.30
Wood fiber – Batt, unfaced	-2.40
Wool (Sheep) – Batt	1.00
Wool (Sheep) – Loosefill	0.80
XPS – Board, 25psi HFC	55.50
XPS – Board, 25psi “Low GWP” (HFO/HFC)	4.90

^a <https://www.buildersforclimateaction.org/beam-estimator.html>

^b EPD Declaration Number NEPD-2012-889-EN

^c EPD Declaration Number 4788647002.102.1

^d EPD Declaration Number EPD-KSI-20190072-IBC1-EN

CHAPTER 5 EXISTING BUILDINGS

SECTION R501 GENERAL

***delete* R501.2 Existing buildings.**

***add* R501.2 General**

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

***delete and replace* R501.4 Compliance.**

Additions, alterations, 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. Changes where unconditioned space is changed to conditioned space shall comply with Section R502.

SECTION R502 ADDITIONS

***delete and replace* R502.1.1.1 Building envelope.**

New *building* envelope assemblies that are part of the *addition* shall comply with Sections R402.1, R402.2, R402.3.1 through R402.3.5, and R402.4. Air leakage testing in accordance with Section R402.4.1.2 is not required for *additions* complying with this code based on the attributes of the *addition* alone. Where the existing *building* and the *addition* comply with this code as a single building, or where the *building* with the *addition* does not use more energy than the existing *building*, testing must be performed in accordance with Section R402.4.1.2 and an air leakage rate not exceeding three (3) air changes per hour at 50 Pascals (or 0.23 CFM50/Sq. Ft. building shell area, six sided) must be verified.

Exception: Where *unconditioned* space is changed to *conditioned* space, the building envelope of the addition shall comply where the UA, as determined in Section R402.1.5, of the existing building and the addition, and any alterations that are part of the project, is less than or equal to UA generated for the existing *building*.

SECTION R503 ALTERATIONS

***delete and replace* R503.1 General.**

Alterations to any building or structure shall comply with the requirements of the code for new construction, without requiring the unaltered portions of the existing building or building system to comply with this code. *Alterations* shall be such that the existing *building* or structure is no less conforming to the provisions of this code than the existing *building* or structure was prior to the *alteration*.

Alterations shall not create an unsafe or hazardous condition or overload existing *building* systems. *Alterations* shall be such that the existing *building* or structure uses no more energy than the existing *building* or structure prior to the *alteration*. *Alterations* to existing *buildings* shall comply with Sections R503.1.1 through R503.1.4.

delete and replace R503.1.4 Lighting.

New lighting systems that are part of the *alteration* shall comply with Section R404.1.

Exception: *Alterations* that replace less than 10 percent of the luminaires in a space, provided that such *alterations* do not increase the installed interior lighting power.

SECTION R505 CHANGE OF OCCUPANCY OR USE

delete and replace R505.2 General.

Any space that is converted to a dwelling unit or portion thereof from another use shall comply 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.

add R505.2.1 Unconditioned space.

Any unconditioned or low-energy space that is altered to become a conditioned space shall comply with **Section R502**.

CHAPTER 6 REFERENCED STANDARDS

delete and replace the following referenced standards in Chapter 6 as follows:

ASHRAE

ASHRAE—2017 ASHRAE Handbook of Fundamentals
R402.1.5

ASHRAE 62.2 Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings
R304.1.1

ASHRAE 193—2010 (RA2014) Method of Test for Determining the Airtightness of HVAC Equipment
R403.3.2.1

APSP

The Association of Pool
and Spa
Professionals
2111 Eisenhower
Avenue
Alexandria, VA 22314

ANSI/APSP/ICC 14—2014 American National Standard for Portable Electric Spa Energy Efficiency
R403.11

**ANSI/APSP/ICC 15a—2013 American National Standard for Residential Swimming Pool and Spa
Energy Efficiency—includes Addenda A Approved January 9, 2013**
R403.10.1

ASTM

ASTM International
100 Barr Harbor Drive
West Conshohocken,
PA 19428-2859

**C1363—11 Standard Test Method for Thermal Performance of Building Materials and Envelope
Assemblies by Means of a Hot Box Apparatus**
R303.1.4.1

**E283—2004(2012) Test Method for Determining the Rate of Air Leakage Through Exterior
Windows, Curtain Walls and Doors Under Specified Pressure Differences Across the
Specimen**
R202 “Air-Impermeable Insulation,” R402.4.4

E779—10 Standard Test Method for Determining Air Leakage Rate by Fan Pressurization
R402.4.1.2

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Orifice Blower Door**
R402.4.1.2

E2178—2013: Standard Test Method for Air Permanence of Building Materials
R202 “Air-Impermeable Insulation”

CSA

CSA Group
8501 East
Pleasant Valley
Cleveland, OH
44131-5575

R402.4.3

R403.5.4

CSA B55.2—2020 Drain Water Heat Recovery Units

R403.5.4

DASMA

Door and Access Systems
Manufacturers Association
1300 Sumner Avenue
Cleveland, OH 44115-2851

105 - 2017

R303.1.3

HVI

Home Ventilating Institute
1000 North Rand Road, Suite 214
Wauconda, IL 60084

HVI Publication 916 - Air Flow Test Procedure

Table R403.6.1

HVI Publication 920 - Product Performance Certification Procedure

R304.1.1, R403.6.1

HVI Publication 911: Certified Home Ventilating Products Directory - [Section III - HRV/ERV Directory Listing](#)

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ICC

International Code Council, Inc.
500 New Jersey Avenue, NW
6th Floor
Washington, DC 20001

ICC 400—17 Standard on the Design and Construction of Log Structures

Table R402.1.2.1, R402.1.6, Table R402.1.6, Table 402.4.1.1

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R402.2.11,

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IECC—09 2009 International Energy Conservation Code®

R406.2

IFC—21 International Fire Code®

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IFGC—21 International Fuel Gas Code®

R201.3,

IMC—21 International Mechanical Code®

R201.3, R402.4.1.2, R403.3.2, R403.6,

IPC—21 International Plumbing Code®

R201.3,

IRC—21 International Residential Code®

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IEEE

The Institute of
Electrical and Electronic
Engineers, Inc.
3 Park Avenue
New York, NY 1016-
5997

515.1—2012 IEEE Standard for the Testing, Design, Installation, and Maintenance of Electrical Resistance Trace Heating for Commercial Applications

R403.5.1.2

NEMA

National Electrical
Manufacturers

Association 1300 17th
Street North No. 900
Arlington, VA 22209

OS 4—2016: Requirements for Air-Sealed Boxes for Electrical and Communication Applications

R402.4.6

NFPA

National Fire Protection
Association.
1 Batterymarch Park
Quincy, MA 02169-
7471

31—06 Installation of Oil-Burning Equipment
R305.1, R305.2, R305.3

54—09 National Fuel Gas Code
R202, R305.1, R305.2, R305.3

NFRC

National Fenestration
Rating
Council, Inc.
6305 Ivy Lane, Suite
140
Greenbelt, MD 20770

100—2020 Procedure for Determining Fenestration Products *U*-factors
R303.1.3

200—2020 Procedure for Determining Fenestration Product Solar Heat Gain Coefficients and Visible Transmittance at Normal Incidence
R303.1.3

400—2020 Procedure for Determining Fenestration Product Air Leakage
R402.4.3

RESNET

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

ANSI/RESNET/ICC 301—2019 Standard for the Calculation and Labeling of the Energy Performance of Dwelling and Sleeping Units using an Energy Rating Index Published December 18, 2018
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**ANSI/RESNET/ICC 380—2016 Standard for Testing Airtightness of Building Dwelling Unit and
Sleeping Unit Enclosures, Airtightness of Heating and Cooling Air Distribution Systems, and
Airflow of Mechanical Ventilation Systems — Republished January 2016**
R402.4.1.2

UL

UL LLC
333 Pfingsten Road
Northbrook, IL 60062

127—2011 Standard for Factory Built Fireplaces — with Revisions through July 2016
R402.4.2

515—2015 Standards for Electrical Resistance Trace Heating for Commercial Applications
R403.5.1.2

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