~~2020~~2023 Vermont Residential Building Energy Standard AMENDMENTS

VERMONT
DEPARTMENT OF PUBLIC SERVICE

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These rules are adopted under 30 V.S.A. § 51. This document shall be known and cited as the *2023 Vermont Residential Building Energy Standard Amendments.* The *2020 Vermont Residential Building Energy ~~Standard Amendments. The 2015 Vermont Residential Building Energy~~ Standards* (First Printing: ~~March 2015~~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 2023 *Vermont Residential Building Energy Standards* (RBES) is based on the *2020 Vermont Residential Building Energy Standards* ~~(RBES) is based on the *2015 Vermont Residential Building Energy Standards*~~, which are based on the 2018 and 2015 *International Energy Conservation Code*® (IECC~~) 2015 edition.~~ ®). The ~~2020~~2023 RBES also ~~include~~includes 2021 and 2018 IECC ~~2018~~ 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 ~~2020~~2023 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 ~~passed in~~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 ~~2020~~2023 RBES is based on the language in the 2015 edition of the IECC and includes ~~all of the~~ efficiency improvements included in ~~IECC~~the 2018 ~~as well as some of the improvements proposed for IECC~~and 2021 IECC to ~~insure~~ensure continued progression in efficiency in the Vermont RBES. The ~~2020~~2023 RBES ~~also provides a new~~ 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 ~~RBES. The Vermont PSD held a series of stakeholder meetings in 2018 and 2019 to gather feedback on proposed changes to RBES.~~the RBES. The 2023 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 2023 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 2023 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 ~~2020~~2023 VERMONT RESIDENTIAL BUILDING ENERGY STANDARDS

The ~~2020~~2023 *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 ~~2020~~2023 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 ~~2020~~2023 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 ~~2020~~2023 RBES

The ~~2020~~2023 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 ~~2020~~2023 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

~~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.~~

The following is a chapter-by-chapter synopsis of the scope and intent of the provisions of the ~~2020~~2023 *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 ~~other~~ 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 ~~buildings~~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 "B*ase 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* ~~other~~ *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 ~~upon~~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 ~~a technical change~~ Vermont specific additions and changes from the requirements of the ~~IECC~~ 2015 IECC and the 2018 edition. ~~Vermont specific additions and changes are designated through dotted lines in the margin.~~ 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_2e	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 ~~2020~~2023 *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 ~~multi-family~~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 ~~*code officials*~~*a code official or authority having jurisdiction*, these sections are included to provide guidance for those jurisdictions that do have a *code official or* ~~*other*~~ *authority having jurisdiction*.

delete and replace **R101.~~5.2 Exempt buildings.~~**
7 Base and Stretch Code.
The ~~following buildings, or portions thereof, shall be exempt from the provisions of this code:~~

1. ~~**Low**~~"*Base Code*" is the RBES Energy ~~**Use Buildings.** Those with a peak design rate of energy usage less than 3.4 Btu/h · ft^2 (10.7 W/m^2) or 1.0 watt/ft^2 (10.7 W/m^2) of floor area for space conditioning purposes.~~

2. ~~**Unconditioned Buildings.** Those~~Code that ~~do not contain *conditioned space*.~~

3. ~~**Mobile homes.** Homes~~is applicable throughout Vermont, except for projects subject to ~~Title VI of the National Manufactured Housing Construction and Safety Standards Act of 1974 (42 U.S.C. §§ 5401- 5426). On-site constructed basements and crawlspaces must comply with this code.~~

4. ~~**Hunting camps.** Residential buildings shall not include hunting camps.~~

5. ~~**Summer camps.** Residential buildings constructed for non-winter 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(a)(1), and;

7.2. The residential construction is used as a dwelling by the owner, and;

7.3. The owner10 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 fact directs the details of construction with regardaddition to the installation of materials notrequirements in the *Stretch Code* section R407 in order to be in compliance with the RBES, and;

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 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 RBES is available from the PSD*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 *Strech 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. For the Stretch Code, Table R407.2.1.1 lists three options for insulation and fenestration packages, Table R407.2.1.2 lists the required additional points for compliance based on building square footage, and Table R407.2.1.3 lists the components and respective point values to be used to meet the point requirement in Table R407.2.1.2.

2. RES*check*™: The U.S. Department of Energy's RES*check*™ software.

3. Home Energy Rating System (HERS): A HERS energy rating that demonstrates compliance with Section 406.4 for the Base Code or Section 407.2.2 for the Stretch Code . (All HERS Index values in this code are based on REM/Rate 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/15.7.).

~~**SECTION R102**~~
~~**ALTERNATIVE MATERIALS, DESIGN AND METHODS OF CONSTRUCTION AND EQUIPMENT**~~

~~*delete and replace* **R102.1 General.**~~
~~The provisions of this code are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed by this code. The *code official* or other authority having jurisdiction, where one exists, may approve an alternative material, design or method of construction upon application of the owner or the owner's authorized agent. The *code official* or other authority having jurisdiction shall first find that the proposed design is satisfactory and complies with the intent of the provisions of this code, and that the material, method or work offered is, for the purpose intended, not less than the equivalent of that prescribed in this code for strength, performance, fire resistance, durability and safety. Where the alternative material, design or method of construction is not *approved*, the *code* official or other authority having jurisdiction shall respond to the applicant, in writing, stating the reasons why the alternative was not *approved*.~~

~~*delete and replace* **R102.1.1 Above code programs.**~~
~~The *code official* or other authority having jurisdiction, where one exists, shall be permitted to deem a national, state or local energy-efficiency program to exceed the energy efficiency required by this code. *Buildings approved* in writing by such an energy-efficiency program, official or authority shall be considered to be in compliance with this code. The requirements identified as "mandatory" in Chapter 4 shall be met.~~

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

~~*delete and replace* **R103.3 Examination of documents.**~~
~~The *code official or other authority having jurisdiction, where one exists,* shall examine or cause to be examined the accompanying construction documents and shall ascertain whether the construction indicated and described is in accordance with the requirements of this code and other pertinent laws or ordinances. The *code official or other authority having jurisdiction, where one exists,* is authorized to utilize a registered design professional, or other *approved* entity not affiliated with the building design or construction, in conducting the review of the plans and specifications for compliance with the code. Compliance with this code shall be certified by a builder, licensed professional engineer, licensed architect, or an accredited home energy rating organization by completing, signing, and posting a Vermont Residential Building Energy Standards (RBES) Certificate. The person certifying 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.~~

~~*delete* **R103.3.2 Previous approvals.**~~

9. Energy code compliance path.

SECTION R104
INSPECTIONS

delete and replace ~~section R104 and subsections as follows:~~

R104.1 General.
Where required, construction or work for which a permit is required shall be subject to inspection by the *code official or* ~~other~~ *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.

R104.2 Required inspections.
The *code official* or other authority having jurisdiction, where one exists, or his or her designated agent, upon notification, may make the inspections set forth in Sections R104.2.1 through R104.2.4.

R104.2.1 Footing and foundation inspection.
Inspections associated with footings and foundations shall verify compliance with the code as to *R-value*, location, thickness, depth of burial and protection of insulation as required by the code and *approved* plans and specifications.

R104.2.2 Framing and rough-in inspection.
Inspections at framing and rough-in shall be made before application of interior finish and shall verify compliance with the code as to: types of insulation and corresponding *R-values* and their correct location and proper installation (both interior and exterior); fenestration properties such as *U*-factor and SHGC and proper installation; and air leakage controls as required by the code; and approved plans and specifications.

R104.2.3 Plumbing rough-in inspection.
Inspections at plumbing rough-in shall verify compliance as required by the code and *approved* plans and specifications as to types of insulation and corresponding *R*-values and protection, and required controls.

R104.2.4 Mechanical rough-in inspection.
Inspections at mechanical rough-in shall verify compliance as required by the code and *approved* plans and specifications as to installed HVAC equipment type and size, required controls, system insulation and corresponding *R*-value, system air leakage control, programmable thermostats, dampers, whole house ventilation, and minimum fan efficiency.

R104.3 Required approvals.
Work shall not be done beyond the point indicated in each successive inspection without first obtaining the approval of the *code official* or other authority having jurisdiction, *where one exists*. The *code official* or other authority having jurisdiction, *where one exists,* upon notification, shall make the requested inspections and shall either indicate the portion of the construction that is satisfactory as completed, or notify the permit holder or his or her agent wherein the same fails to comply with this code. Any portions that do not comply shall be corrected and such portion shall not be covered or concealed until authorized by the *code official* or other authority having jurisdiction, where one exists.

R104.3.1 Final inspection.
The *building* shall have a final inspection and shall not be occupied until *approved*. The final inspection shall include verification of the installation of all required *building* systems, equipment and controls and their proper operation and the required number of high-efficacy lamps and fixtures.

R104.4 Reinspection.
A *building* shall be reinspected when determined necessary by the *code official* or other authority having jurisdiction, where one exists.

R104.5 Approved inspection agencies.
The *code official or other authority having jurisdiction, where one exists,* is authorized to accept reports of third-party inspection agencies not affiliated with the *building* design or construction, provided such agencies are *approved* as to qualifications and reliability relevant to the *building* components and systems they are inspecting.

R104.6 Inspection requests.
It shall be the duty of the holder of the permit or their duly authorized agent to notify the *code official or other authority having jurisdiction, where one exists,* when work is ready for inspection. It shall be the duty of the permit holder to provide access to and means for inspections of such work that are required by this code.

R104.7 Reinspection and testing.
Where any work or installation does not pass an initial test or inspection, the necessary corrections shall be made to achieve compliance with this code. The work or installation shall then be resubmitted to the *code official or other authority having jurisdiction, where one exists,* for inspection and testing.

R104.8 Approval.
After the prescribed tests and inspections indicate that the work complies in all respects with this code, a notice of approval shall be issued by the *code official or other authority having jurisdiction, where one exists.*

R104.8.1 Revocation.
The *code official or other authority having jurisdiction, where one exists,* is authorized to, in writing, suspend or revoke a notice of approval issued under the provisions of this code wherever the certificate is issued in error, or on the basis of incorrect information supplied, or where it is determined that the *building* or structure, premise, or portion thereof is in violation of any ordinance or regulation or any of the provisions of this code.

CHAPTER 2
DEFINITIONS

SECTION R202
GENERAL DEFINITIONS

delete and replace **ADDITION.** An extension or increase in the *conditioned space* floor area, number of stories or height of a building or structure.

add **ADVANCED WOOD HEATING SYSTEM.** A wood pellet fueled central heating system that meets the standards established by the Vermont Clean Energy Development Fund and Efficiency Vermont and is listed on the Eligible Equipment Inventory posted at .

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 **AIR-IMPERMEABLE INSULATION.** An insulation that also functions as an air barrier material, having an air permeance equal to or less than 0.02 L / s-m^2 at 75 Pa pressure differential as tested in accordance with ASTM E 2178 or E 283.

delete and replace **APPROVED.** Acceptable to the *code official or other authority having jurisdiction, where one exists.*

add **BALANCED VENTILATION SYSTEM.** See "Whole House Ventilation System, Balanced".

delete and replace **BEDROOM.** A room or space 70 square feet or greater, with egress window and closet, used or intended to be used for sleeping. A "den," "library," or "home office" with a closet, egress window, and 70 square feet or greater or other similar rooms shall count as a bedroom, but living rooms and foyers shall not. (Source: RESNET)

add **BIODIESEL.** Mono alkyl esters derived from plant or animal matter that meet the registration requirements for fuels and fuel additives established by the Environmental Protection Agency under section 211 of the Clean Air Act (42 U.S.C. § 7545), and the requirements of ASTM D6751.

delete and replace **CODE OFFICIAL, VERMONT.** The officer or other designated authority charged with the administration and enforcement of this energy code, or a duly authorized representative. The Department of Public Service is not the code official and shall not be required to conduct inspections of construction or construction documents.

add **COLD-CLIMATE HEAT PUMP.** A heat pump with an inverter-driven, variable capacity compressor that is designed to provide full heating heat pump capacity and having a minimum COP of 1.75 or greater at an outside air temperature of 5°F.

delete and replace **COMMERCIAL BUILDING ENERGY STANDARDS (CBES).** The Vermont non-residential Energy Code, based on the IECC 2018.

delete and replace **CONDITIONED FLOORSHELL AREA.** The horizontal projectionsum of the area of ceiling, floors associated with the , and walls, slab (all "six sides") separating a *dwelling unit's conditioned space*. See also *Finished Conditioned Floor Area*.

delete and replace **CONDITIONED SPACE.** An area, room or space that is enclosed within the *building thermal envelope* and that is directly or indirectly heated or cooled. Spaces are indirectly heated or cooled where they communicate through openings with from the exterior or from adjacent conditioned or unconditioned spaces, where they are separated from *conditioned spaces*

by uninsulated walls, floors or ceilings, or where they contain uninsulated ducts, piping or other sources of heating or cooling. See also *Finished Conditioned Floor Area*.

add **CONSTRUCTION DOCUMENTS.** The physical drawings and specifications that outline the building.

delete and replace **CONTINUOUS AIR BARRIER.** A combination of materials and assemblies that prevent the passage of air through the *building thermal envelope*.

delete and replace **DEMAND RECIRCULATION WATER SYSTEM.** A water distribution system having one or more recirculation pumps that pump water. Wall height shall be measured from a heated water supply pipe to the heated water fixture upon user demand via push-button at the fixture.

add **DYNAMIC GLAZING.** Any fenestration product that has the fully reversible ability to change its performance properties, including U-factor, solar heat gain coefficient (SHGC), or visible transmittance (VT).

add **ELECTRIC VEHICLE SUPPLY EQUIPMENT** (**EVSE**). Electrical infrastructure for charging electric vehicles. EVSE can be either Level 1 (120 V) or Level 2 (240 V)

delete and replace **ENERGY RECOVERY VENTILATION SYSTEM (ERV).** Systems that employ air-to-air heat exchangers to recover sensible and latent energy from exhaust air for the purpose of preheating, precooling, humidifying or dehumidifying outdoor ventilation air prior to supplying the air to a space, either directly or as part of an HVAC system.

delete and replace **EXTERIOR WALL.** Walls that are part of the *Building Thermal Envelope*, including bothe finished floor of the *dwelling unit* to the underside of the floor above grade walls and *basement walls*.

add **GROUND SOURCE HEAT PUMP.** A heat pump that extracts heat from the ground or water within the ground.

delete and replace **HEAT RECOVERY VENTILATION SYSTEM (HRV).** A factory-assembled device or combination of devices, including fans or blowers, designed to provide outdoor air for ventilation in which heat is transferred between two isolated intake and exhaust air streams.

add **HEAT PUMP WATER HEATER.** A water heater that uses electricity and a refrigeration cycle to move heat from the ambient air to heat water instead of directly heating water.

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

add **CARBON DIOXIDE EQUIVALENT (CO_2E).** A measure used to compare the impact of various greenhouse gases based on their global warming potential (GWP). CO_2e approximates the warming effect of a unit mass of a given greenhouse gas relative to that of carbon dioxide (CO_2).

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 CO_2. The following GWP values are used based on a 100-year time horizon: 1 for CO_2, < 10 for pentane (e.g., C_5H_{12}), and 1430 for R-134a (CH_2FCF_3).

add **GLOBAL WARMING POTENTIAL (GWP) INTENSITY**. For the purposes of this document, GWP intensity refers to the GWP impact from materials (kg $CO2_e$) divided by the project's total conditioned floor area in square feet (ft^2).

delete **HIGH-EFFICACY LAMPS/ LIGHTING.** ~~Compact fluorescent lamps, light-emitting diode (LED) lamps, T-8 or smaller diameter~~

add **HIGH-EFFICACY LIGHT SOURCES.** Non-linear ~~fluorescent lamps, or~~medium screw- and pin-base lamps with a minimum efficacy of not less ~~than 65~~than65 lumens per watt; or light fixtures of not less than ~~55~~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 and replace* **HOME ENERGY RATING SYSTEM (HERS).** A home energy rating system approved by the Vermont Department of Public Service that provides a numerical rating in compliance with 30 V.S.A. § 52. The purpose of this procedure is to ensure that accurate and consistent home energy ratings are performed by accredited HERS providers in Vermont and to promote an objective, cost-effective, sustainable home energy rating process as a compliance method for residential building energy codes; as qualification for energy programs designed to reach specific energy-saving goals; and as a way to provide Vermont's housing market the ability to differentiate residences based on their energy efficiency.~~

~~*delete and replace* **INFILTRATION.** The uncontrolled inward air leakage into a *building* through the building thermal envelope caused by the pressure effects of wind or differences in the indoor and outdoor air density or both.~~

~~*delete and replace* **LABELED.** Equipment, materials or products to which have been affixed a label, seal, symbol or other identifying mark of a nationally recognized testing laboratory, inspection agency or other organization concerned with product evaluation that maintains periodic inspection of the production of the above-labeled items and whose labeling indicates either that the equipment, material or product meets identified standards or has been tested and found suitable for a specified purpose.~~

~~*delete and replace*~~ *delete* ~~**LEVEL 1 ELECTRIC VEHICLE CHARGING.** Level 1 charging uses a standard alternating current 120V outlet.~~

delete ~~*and replace*~~ ~~**LEVEL 2 ELECTRIC VEHICLE CHARGING.** Level 2 uses a 240V alternating current outlet.~~

~~*delete and replace* **LOCAL VENTILATION.** A mechanical ventilation system including fans, controls and ducts, dedicated to exhausting moisture-laden and/or contaminated air to the outside of the building from a room or space in which the moisture or contamination is generated or supplying outdoor air to that space.~~

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

delete and replace **MULTIFAMILY DWELLING/BUILDING.** ~~For the purpose of determining the building type that must comply with RBES under Vermont statute, a multifamily building is a *residential building* or *mixed-use* building with~~ A building containing three or more dwelling units ~~three stories or less in height. Multifamily buildings of four stories or more in height must comply with CBES.~~

~~(From Vermont 30 V.S.A. § 51.) See R101.2 for scope. For the purpose of determining points in R402.1.2, a multifamily dwelling is a residential building containing units built one on top of another and those built side-by-side which do not have a ground-to-roof wall and/or have common facilities (i.e., attic, basement, heating plant, plumbing, etc.) (From).~~

~~*delete and replace* **OCCUPANCY CLASSIFICATIONS.** Residential Group R is the occupancy group used for buildings that include sleeping rooms and are not institutional and are not generally regulated by the *International Residential Code*. The IRC typically regulates single family homes and duplexes, any structure with more than two units is in the International Building Code (IBC). There are four different occupancy groups within R.~~

~~Occupancy group **R-1**: transient uses like hotels, motels and boarding houses.~~

~~Occupancy group **R-2**: (most common) residences~~ where the occupants are primarily permanent~~, including apartments, dormitories, fraternities and sororities. It also includes vacation timeshares (with more than two units), convents and monasteries. Congregate living facilities with 16 or fewer occupants are in Group R-3.~~

~~Occupancy group **R-3:** permanent occupancies that aren't R-1, R-2, R-4 or I, including buildings that are in the IBC but have no more than two units. Adult facilities and childcare facilities that provide accommodation for five or less people less than 24 hours a day are R-3. Where these facilities are in a single-family home~~ in nature and which are adjacent vertically or horizontally. If built side-by-side, at least one of the following is true: (1) they ~~must comply with the IRC.~~

~~Occupancy group **R-4**: residential care/assisted living facilities including more than five and not more than 16 occupants.~~

~~*delete and replace* **OPAQUE AREAS.** All exposed areas of a building envelope which enclose *conditioned space*, except openings for windows, skylights and building service systems. Doors are considered opaque when~~do not have a wall that extends from ground to roof, (2) they ~~are 50-percent or greater opaque in surface area~~share a heating system, or (3) they have interstructural public utilities such as water supply/sewage disposal.

~~*add* **PRIMARY SHOWERS.** The one or two showers in the dwelling that will be used the most.~~

~~*delete and replace*~~*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.** ~~Means~~

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 ~~qualifies as~~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* **ROOF ASSEMBLY.** A system designed to provide weather protection and resistance to design loads. A roof assembly can be part of the building thermal envelope if it also includes insulation and an air barrier. A roof assembly includes the roof covering, underlayment, roof deck, structural members, and if it is part of the thermal envelope, insulation, air barrier, vapor retarder and interior finish. The gross area of a roof assembly consists of the total interior surface of all roof/ceiling components, including opaque surfaces, dormer and bay window roofs, trayed ceilings, overhead portions of an interior stairway to an unconditioned attic, doors and hatches, glazing and skylights exposed to *conditioned space*, that are horizontal or sloped at an angle less than 60 degrees (1.1 rad) from the horizontal (see "Exterior wall"). A roof assembly that is part of the thermal envelope, or portions thereof, having a slope of 60 degrees (1.1 rad) or greater from horizontal shall be considered in the gross area of exterior walls and thereby excluded from consideration in the roof assembly. Skylight shaft walls 12 inches (305 mm) in depth or greater (as measured from the ceiling plane to the roof deck) shall be considered in the gross area of exterior walls and are thereby excluded from consideration in the roof assembly.~~

~~*add* **SENSIBLE RECOVERY EFFICIENCY (SRE):** The net sensible energy recovered by the supply airstream as adjusted by electric consumption, case heat loss or heat gain, air leakage, airflow mass imbalance between the two airstreams and the energy used for defrost (when running the Very Low Temperature Test), as a percent of the potential sensible energy that could be recovered plus the exhaust fan energy.~~

~~*add* **SINGLE-FAMILY DWELLING**. Fully detached, semidetached (semiattached, side-by-side), row houses, and townhouses. In the case of attached units, each must be separated from the adjacent unit by a ground-to-roof wall in order to be classified as a single-family structure. Also, these units must not share heating/air-conditioning systems or utilities. (From www.census.gov).~~

~~*delete and replace* **STOREFRONT.** A nonresidential system of doors and windows mulled as a composite fenestration structure that has been designed to withstand heavy use. *Storefront* systems include, but are not limited to, exterior fenestration systems that span from the floor level or above to the ceiling of the same story on commercial buildings.~~

~~*delete "THERMAL CONDUCTANCE"*~~

add **THERMAL CONDUCTANCE, OVERALL (U_o).** The overall (average) heat transmission of a gross area of the exterior building envelope (Btu/h · ft^2 · °F) [W/(m^2 · K)].

The U_o factor applies to the combined effect of the time rate of heat flow through the various parallel paths, such as windows, doors and opaque construction areas, comprising the gross area of one or more exterior building components, such as walls, floors or roof/ceilings.

delete and replace **THERMAL TRANSMITTANCE (U).** (See thermal conductance).

The *U* factor applies to combinations of different materials used in series along the heat flow path, single materials that comprise a building section, cavity airspaces and surface air films on both sides of a building element.

delete **THERMAL TRANSMITTANCE, OVERALL (U_o).**

delete **U-FACTOR THERMAL TRANSMITTANCE**

add **U-FACTOR (THERMAL CONDUCTANCE).** The coefficient of heat transmission (air to air) through a building component or assembly, equal to the time rate of heat flow per unit area and unit temperature difference between the warm side and cold side air films (Btu/h • ft^2 • °F) [W/(m^2 • K)].

delete **VAPOR PERMEABLE MEMBRANE**

delete and replace **VAPOR RETARDER.** A vapor-resistant material, membrane or covering such as foil, plastic sheeting or insulation facing with a permeance rating of less than 10. Vapor retarders limit the amount of moisture vapor that passes through a material or wall assembly.

delete and replace **VAPOR RETARDER CLASS.** A measure of the ability of a material or assembly to limit the amount of moisture that passes through that material or assembly. Vapor retarder class shall be based on the manufacturer's certified testing of a tested assembly and defined using the desiccant method with Procedure A of ASTM E96 as follows:

VAPOR RETARDER CLASSES AND EXAMPLES

Vapor Retarder Class[1]	**Perm Rating** (Dry Cup)	**Description**	**Examples of Materials**
Class I	0.1 perm or less	Vapor impermeable or "Vapor Barrier"	Rubber membrane, sheet polyethylene, glass, foils
Class II	0.1 – 1.0 perm	Vapor semi-impermeable	Oil-based paint, Kraft-faced batt, vinyl wall coverings, stucco

Class III	1.0 – 10 perm	Vapor semi-permeable	Plywood, OSB, EPS, XPS, most latex paints, heavy asphalt-impregnated building paper, wood board sheathing
Vapor open	> 10 perm	Vapor permeable	Unpainted gypsum board, unfaced fiberglass, cellulose, many "housewraps"

1. Test Procedure for vapor retarders: ASTM E-96 Test Method A (the desiccant method or dry cup method)

delete and replace **WHOLE HOUSE MECHANICAL VENTILATION SYSTEM.** An exhaust system, supply system, or combination thereof that is designed to mechanically exchange indoor air with outdoor air when operating continuously or through a programmed intermittent schedule to satisfy the whole house ventilation requirements.

add **YURT**. A circular tent on a wooden framework used as a *residential building*.

delete and replace **ZONE.** A space or group of spaces within a *building's thermal envelope* with heating or cooling requirements that are sufficiently similar so that desired conditions can be maintained throughout using a single controlling device.

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 **~~302.2 Exterior design conditions.~~**

~~add~~and replace **R302.2** ~~Climatic~~**Climactic data.**
The following design parameters in Table ~~302~~R302.2 shall be used for calculations required under this code.

~~TABLE 302.2~~
~~THERMAL DESIGN PARAMETERS~~

~~CONDITION~~	~~VALUE~~
~~Winter[a], Design Dry-Bulb~~	~~-11°F~~
~~Summer[a], Design Dry-Bulb~~	~~84°F~~
~~Summer, Design Wet-Bulb~~	~~69°F~~
~~Degree Days Heating[b]~~	~~7,665~~
~~Degree Days Cooling[b]~~	~~489~~

~~For SI: °C = [(°F) - 32]/1.8.~~

~~a. The outdoor design temperature is selected from the columns of 97- percent values for winter and 2-percent values for summer from tables in the ASHRAE *Handbook of Fundamentals*. Adjustments shall be permitted to reflect local climates which differ from the tabulated temperatures, or local weather experience determined by the code official or other authority having jurisdiction, where one exists.~~
~~b. The degree days heating (base 65°F) and cooling (base 65°F) are from the NOAA "Annual Degree Days to Selected Bases Derived from the 1971-2000 Normals" for Burlington International Airport.~~

Adjustments may be made only in the following cases:

1. ~~1.~~ Winter heating design temperatures for projects either:

   i. ~~i.~~ Located at an elevation of 1,500 feet (457 m) or higher, or

   ii. ~~ii.~~ Located in Caledonia, Essex or Orleans counties.

   iii. ~~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. ~~2.~~ As approved by the *code official or ~~other~~ authority having jurisdiction*, where one exists.

SECTION R303
MATERIALS, SYSTEMS AND EQUIPMENT

delete and replace **R303.1.1.1 Blown or sprayed roof and ceiling insulation.**
The thickness of blown-in or sprayed roof/ceiling insulation (fiberglass or cellulose shall be written in inches (mm) on markers that are installed at least one for every 300 square feet (28 m^2) throughout the attic space. The markers shall be affixed to the trusses or joists and marked with the minimum initial installed thickness with numbers not less than 1 inch (25 mm) in height. Each marker shall face the attic access opening. Spray polyurethane foam minimum thickness and installed *R*-value shall be *listed* on certification provided by the insulation installer.

delete and replace **TABLE R303.1.3(1)**

TABLE R303.1.3(1)
DEFAULT GLAZED WINDOW,
GLASS DOOR AND SKYLIGHT *U*-FACTORS

FRAME TYPE	WINDOW AND GLASS DOOR		SKYLIGHT	
	Single pane	Double pane	Single	Double
Metal	1.20	0.80	2.00	1.30
Metal with Thermal Break	1.10	0.65	1.90	1.10
Nonmetal or Metal Clad	0.95	0.55	1.75	1.05
Glazed Block	0.60			

delete and replace **TABLE R303.1.3(2)**

TABLE R303.1.3(2)
DEFAULT OPAQUE DOOR *U*-FACTORS

DOOR TYPE	OPAQUE *U*-FACTOR
Uninsulated Metal	1.20
Insulated Metal	0.60
Wood	0.50
Insulated, nonmetal edge, max 45% glazing, any glazing double pane	0.35

delete and replace **R303.1.4 Insulation product rating.**
The thermal resistance, *R*-value, of insulation shall be determined in accordance with Part 460 of US-FTC CFR Title 16 in units of h • ft^2 • °F/Btu at a mean temperature of 75°F (24°C).

delete and replace **R303.2 Installation.**
Materials, systems and equipment shall be installed in accordance with the manufacturer's instructions and the *International Building Code* or the *International Residential Code*, as applicable.
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 ~~**304**~~**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 ~~Section~~compliance with Sections 304.2 through 304.11 or demonstrating compliance with one of the following alternatives:

1. ASHRAE Standard 62.2~~-2016—~~2019 (Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings)

~~1. BSC Standard 01-2015 (Ventilation for New Low-Rise Residential Buildings)~~

2. Passive house ventilation requirements (PHI or PHIUS)

~~**Exception**~~

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 ~~meet the net~~provide 50 CFM intermittent or 20 CFM continuous exhaust capacity~~ rates as required in Table 304.2~~.
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 ~~304~~R304.6 and must meet all

other requirements listed in Section ~~304~~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 ~~**304.6.1.1 Minimum outdoor air.**~~
~~Automatic operation of~~ **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 ~~not reduce~~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 ~~ventilation rate below 15 cfm of outdoor air~~flow rate that the ventilation system must be capable of supplying during its operation shall be based on the rate per bedroom ~~plus 15 cfm during occupancy~~as specified in Table R304.6.

~~**Exception:** Whole house approach in accordance using one of the compliance alternatives in Section 304.1.1.~~

~~*delete and replace* 304~~
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 m^3/s, 1 cubic foot per minute per square foot = 0.00508 $m^3/(s \cdot m^2)$.
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 ~~or exhaust only~~ 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 ~~304~~R304.9.3 Ducts.
Smooth wall ducts (~~e.g.~~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 ~~or outside the building thermal envelope.~~

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 ~~**304.9.5 Joints**~~**R304.11 Makeup air required.**
Exhaust hood systems and ~~**connections.**~~
~~All joints, seams and connections shall be securely fastened and sealed with welds, gaskets, o-rings, mastics (adhesives), mastic embedded fabric systems or approved tapes.~~

~~SECTION 305~~
~~COMBUSTION SAFETY (MANDATORY)~~

~~*delete and replace* **305.2 Unusually tight construction.**~~
~~For the purpose~~clothes dryers capable of ~~applying the provisions of Section 305 to fuel gas, kerosene and oil-burning equipment, buildings constructed~~exhausting in ~~compliance with the RBES~~excess of 400 cubic feet per minute (0.19 m^3/s) shall be ~~considered of unusually tight construction as defined in NFPA 54 and NFPA 31.~~

~~*delete and replace* **305.4.1 Gasketed doors.**~~
~~All solid fuel-burning appliances and fireplaces shall have tight-fitting (defined as gasketed doors with compression closure or compression latch system) metal glass or ceramic doors.~~

~~**Exception:** Any home certified~~provided with makeup air at a rate approximately equal to ~~have passed the Appendix RA – Recommended Procedure for Worst-Case Testing of Atmospheric Venting Systems" is not required to have tight-fitting doors.~~

delete **305.4.2 Exterior air supply requirements** *and replace with* **305.4.3 Exterior air supply requirements** *as follows:*
Solid fuel-burning appliances and fireplacesthe exhaust air rate. Such makeup air systems shall be equipped with an exterior air supply according to the provisions of Sections 305.4.3.1 through 305.4.3.7. Factory-built fireplaces, masonry fireplaces and solid fuel-burning appliances that list exterior air supply ducts as optional or required for proper installation are permitted to be installed with those exterior air supply ducts according to the manufacturer's installation instructions in place of sections 305.4.3.1 through 305.4.3.7. This is not an exemption from the exterior air supply requirements. a means of closure and shall be automatically controlled to start and operate simultaneously with the exhaust system.

*modify "***305.4.2.1" to "305.4.3.1"**

delete **305.4.2.2** *and replace with* **305.4.3.2** *as follows:*
The exterior air inlet shall not terminate to the exterior higher than the firebox and the combustion air duct shall not rise vertically within 18 inches of the firebox.

> **Exception:** Where woodstove or fireplace is installed below grade (in a basement), air intake is permitted to terminate above the firebox if the combustion air supply point is below the firebox and the combustion air intake point is greater than 15 inches (381 mm) below the top of the chimney.

*modify "***305.4.2.3"** *to "***305.4.3.3"**

*modify "***305.4.2.4"** *to "***305.4.3.4"**

*modify "***305.4.2.5"** *to "***305.4.3.5"**

*modify "***305.4.2.6"** *to "***305.4.3.6"**

*modify "***305.4.2.7"** *to "***305.4.3.7"**

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 S*tretch 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. ~~"~~**RES*check*™ 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 ~~(Mandatory).~~**

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 ~~certification~~*certificate* may be issued ~~and signed~~ 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 ~~(Prescriptive).~~**

:

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*.

~~Exceptions:~~

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. ~~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. ~~4.~~ **Hunting camps.** Residential buildings shall not include hunting camps.

5. ~~5.~~ **Summer camps.** Residential buildings constructed for ~~non-winter~~nonwinter occupation with only a biomass (wood) or other on-site renewable heating system.

6. ~~6.~~ **Yurts** with only a biomass (wood) or other on-site renewable heating and hot water system.

7. ~~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~~, and;~~.

    7.2. The residential construction is used as a dwelling by the owner~~, and;~~.

    7.3. The owner in fact directs the details of construction with regard to the installation of materials not in compliance with the RBES~~, and;~~.

    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 ~~and roof or ceiling assemblies which are part of~~in the *building thermal envelope* shall comply with the vapor retarder requirements of Section R702.7 of the

International Residential Code or Section ~~1405~~1404.3 of the *International Building Code*, as applicable~~, or with R402.2.15 in this document~~.

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~~; or~~.

2. *U*-Factor Alternative Approach: Section R402.1.4~~; or~~.

3. Total UA Approach~~;~~; Section R402.1.5~~; or~~.

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 ~~**TABLE R402.1.2**~~

~~*add*~~*and replace* **R402.1.2.1 Package Plus Points Approach~~ — Base.~~**

~~.~~
Projects shall comply with Items 1 ~~to 3~~through 4: for both *Base Code* and *Stretch Code*:

1. Select one of the ~~five base~~ packages listed in Table R402.1.2.1~~; and~~. 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~~ 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.

~~*add*~~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 ~~BASE~~STANDARD PACKAGES FOR BASE CODE AND STRETCH CODE [a]

Component[a]		*Package 1* *"Standard"*	*Package 2* *"SIPS"*	*Package 3* *"Thick Wall"*	*Package 4* *"Cavity Only"*	*Package 5* *"Log Homes"*
Envelope	Ceiling R-Value	R-49[f]	R-28 cont.	R-49[f]	R-60[g] attic / R-49[f] slope	Construct log home to ICC 400-2017 "Standard on the Design and Construction of Log Structures" **OR** Table R402.1.6
	Wood Frame Wall R-Value	R-20+5[e] **OR** 13+10[e]	R-21 cont.	R-20+12[e]	R-20 cavity	
	Common Wall Insulation	R-10	R-10	R-10	R-10	
	Floor R-Value	R-30	R-30	R-30	R-38	
	Basement/Crawl Space Wall[c] R-Value	R-15 (continuous) **OR** 20 (cavity) **OR** R13+5	R-15 (continuous) **OR** 20 (cavity) **OR** R13+5	R-20 (continuous) **OR** R-13+10[e]	R-20 (continuous) **OR** R-13+10[e]	
	Slab Edge[d] R-Value	R-15, 4ft **OR** R10 perimeter + R-7.5 under entire rest of slab	R-15, 4 ft **OR** R10 perimeter + R-7.5 under entire rest of slab	R-10, 4ft	R-15, 4 ft **OR** R10 perimeter + R-7.5 under entire rest of slab	
	Heated Slab[d] R-Value	R-15 (edge and under)	R-15 (edge and under)	R-15 (edge and under)	R-15 (edge and under)	
	Fenestration[b] (Window and Door) max. U-Value	U-0.30	U-0.30	U-0.30	U-0.28	
	Skylight[b] max. U-Value	U-0.55	U-0.55	U-0.55	U-0.55	
Air Leakage	Air Leakage[i]	≤3.0 ACH50[h] tested	≤3.0 ACH50[h] tested	≤3.0 ACH50[h] tested	≤3.0 ACH50[h] tested	
Mechanicals	Duct Leakage	Inside thermal boundary	Inside thermal boundary	4 CFM25 per 100 sq. ft. of CFA[i]	Inside thermal boundary	
Lighting	Percent *High Efficacy Lamps*[i]	90%	90%	90%	100%	

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.
~~a. The fenestration *U* factor row excludes skylights.~~

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 "~~13+10~~20 + 5ci" means R-~~13~~20 cavity insulation plus R-~~10~~5 continuous insulation.~~When used, continuous insulation values shall~~

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 ~~R-5.~~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 ~~100 percent of the ceiling area requiring insulation~~the top of exterior walls shall be deemed to satisfy the requirement for R-49 insulation ~~wherever the full height of uncompressed R-38 insulation extends over the wall top plate at the eaves.~~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.

b. Installing R-49 over 100 percent of the ceiling area requiring insulation shall be deemed to satisfy the requirement for R-60 insulation wherever the full height of uncompressed R-49 insulation extends over the wall top plate at the eaves. (See Section R402.2.1.)

c. h. "ACH50" = air changes per hour at 50 Pascals building pressure as measured with a blower door

d. "CFA" = conditioned floor area

e. See Table R402.4.1.1 for further details.

Insulation systems complying. 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 Table R402.1.4 shall be deemed to comply with the R-value requirements of Table 402.1.2.1a 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 ~~Size.~~ 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 ~~within~~inside the *building thermal envelope*, including unfinished basements and storage/utility spaces. The Multifamily ~~< 2000~~less than 1,250 square feet (185.8 m^2) and 1,2500-2,500 square feet point requirement categories cannot be used for ~~semidetached~~semi-detached (semi-attached, side-by-side), row houses, and townhouses, as defined as *single-family dwellings* in Section R202, General Definitions ~~R202~~. *Multifamily dwelling* unit size is based on the average *finished conditioned floor* area dwelling size for the building~~.~~, excluding common areas, hallways, stairwells, etc..

~~*add*~~*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 < ~~2000~~650 square feet	~~4 points~~0	1
Multifamily 650 to 900 square feet	1	2
Multifamily 900 to 1,250 square feet	2	3
~~<2000~~Multifamily >1,250 to 2,500	4	5 ~~points~~

square feet		
< 2,500 square feet	5	7
20002,500 to 40004,000 square feet	7 points	12
>4000 4,000 square feet	10 points	15

add **R402.1.2.3 Points by Component.**

After determining the number of points required using Table R402.1.2.2, select the components from Table 402.1.2.3 to accumulate the required number of points. The total number of points selected from Table 402.1.2.3 must meet or exceed the required points from Table 402.1.2.2.

add
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	SlabSlab (on or below grade, heated or unheated)	R-1020 around perimeter and below entire slab **OR**[b]	12
		R-25 around perimeter and below entire slab	3
	Walls – Upgraded	Above grade walls R-20+12 (28 2x6 cavity insulation with continuous (R20+9ci or similar) (U-factor maximum 0.033036 wall assembly) (Not available for base package 3) **OR**[b]	21
		R-35 double stud or similar (cavity and continuous) (U-0.028 wall assembly) **OR**[b]	2
	Walls – High R	Above grade walls ≥ R-40 double stud or similar (cavity and continuous) (or U-factor maximum 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-8060 attic flat / R-60 slopedflats (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 ≤ 0.2225 **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
~~**Air Leakage and**~~Mechanical Ventilation	~~Pre-Drywall~~Better Heat Recovery **OR**	~~ACH50 is tested with blower door after full insulation/primary air barrier completion but before insulation is fully enclosed/covered **OR**[b]~~Balanced ventilation with ECM fans and ≥80% SRE and ≥1.2 cfm/watt **OR**[b]	~~1~~3
	~~Tight~~Better Electrical Efficiency	~~ACH50 ≤ 2.0 and~~ Balanced ventilation with ~~ECM[e]~~ECM fans and ≥70% ~~SRE[d] for HRV[e], ≥65% SRE[d] for ERV[e] **OR**[b]~~SRE, and ≥2.0 cfm/watt	~~3~~
	~~Very Tight~~Mechanical Ventilation Testing	~~ACH50 ≤ 1.0 and balanced ventilation with ECM[e] fans and ≥ 80% SRE[d] for HRV[e], ≥75% SRE[d] for ERV[e]~~ 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.	~~4~~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~~, (3) Heat pump HSPF ≥9.0; PLUS any AC is SEER ≥14.5~~; **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 ~~heat/cool~~heating/cooling is ~~(1) NEEP-listed air source heat pump combination[j], (2) GSHP[i], closed loop and COP ≥ 3.3, (3) ATWHP[f] COP ≥2.5 and 120F design temp, (4)~~ Advanced wood heating system from http://www.rerc-vt.org/advanced-wood-heating-system/eligible-equipment-inventory-eei	~~3~~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 *demand responsive controls*	1
Water	Heat Pump Basic	~~ENERGY STAR basic: Fossil fuel [EF 0.67 for ≤ 55 gal; EF 0.77 for > 55 gal] OR~~[b] Electric Heat Pump Water Heater UEF ≥ 2.20 **OR**[b]	~~1~~3
	Heat Pump Advanced	~~ENERGY STAR advanced:~~ Electric ~~[EF or~~Heat Pump Water Heater UEF ≥ ~~2.00 for ≤ 55 gal; EF ≥2.20 for > 55 gal]~~3.30	~~2~~5
	Low flow	All showerheads ≤ 1.75 ~~gpm~~[g]gpm, all ~~lav.~~lavatory faucets ≤ 1.0 ~~gpm~~[g]gpm, and all toilets ≤ 1.28 ~~gpf~~[h]gpf[c] **OR**[b]	1
	~~Certified~~[k]Certified[e]	Certified water efficient design per WERS, WaterSense, or ~~RESNETH2O~~ RESNET $HERS_{H2O}$	2
	Drain heat recovery	Drain water heat recovery system on *primary showers* 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 *demand responsive controls*	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
~~**Renewables**~~	Solar Ready Zone	~~Home is Solar Ready per R407.5, OR~~[b]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.	~~1~~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
	~~Solar Hot Water~~	~~Solar hot water system designed to meet at least 50% of annual hot water load~~	~~2~~
Other Measures	Monitoring	~~Install~~ Whole-building energy monitoring system~~, min.~~ installed, minimum 5 circuits and homeowner access to data	1
	~~EV Ready~~Radon Mitigation System	Radon mitigation designed to https://www.epa.gov/radon/radon-standards-practice~~Level 2 electric vehicle charger ready per R407.4~~ [i] 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	~~Min.~~Minimum 6 kWh grid-connected dispatchable demand-response-enabled battery ~~backup~~	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 CO2e/ 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 CO2e/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	3

		intensity (kg CO_2e/ft^2) less than 0. Product-specific EPDs may be used in place of default values, subject to requirements in R408.	
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.

~~a. "H/ERV" = Heat or Energy Recovery Ventilation~~

~~b. "SRE" = System Recovery Efficiency~~

~~c. "ECM" = Electronically Commutated Motor~~

~~d. "ATWHP" = Air-to-Water Heat Pump~~

~~e. "gpm" = gallons per minute~~

~~"gpf" = gallons per flush.~~ c. Applies to new construction only.

~~f. "GSHP" = ground-source heat pump~~

d. https://~~neep.org/initiatives/high-efficiency-~~www.energystar.gov/products/~~emergingtechnologies/ashp/cold-climate-~~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.~~

~~g. Points are limited to one per dwelling. Additional Level 2 charging equipment receives no more points.~~

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 ~~Table~~Tables R402.1.2.1~~.~~ and R402.1.2.3. The building must still comply with ~~Table~~Tables R402.1.~~2.~~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 ~~≤ 2.~~less than or equal to 0.15 CFM50/Sq. Ft. of Building Shell (~2 ACH50) tested, and (b) the ventilation system ~~is: Balanced;~~complies with ~~ECM fan(s) plus ≥ 70% SRE for HRV, or ≥ 65% SRE for ERV~~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	~~SKY-LIGHT~~ 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.~~27~~30	0.~~55~~41	0.~~022~~020	0.044	0.060	0.~~030~~027	0.~~035~~39	0.~~035~~39	0.~~066~~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 ~~≤ 2.~~less than or equal to 0.15 CFM50/Sq. Ft. of Building Shell (~2 ACH50) tested and balanced ventilation system compliant with ~~ECM fan(s) plus ≥ 70% SRE for HRV, or ≥ 65% SRE for ERV are required~~R304, or the building must comply with ~~Table~~Tables R402.1.2.2 and ~~Table~~ 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. ~~In addition to UA compliance, the SHGC requirements shall be met.~~

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 ~~**TABLE R402.1.5**~~

~~*add*~~*and replace* **R402.1.6 Log homes.**
~~Projects~~Log homes shall comply by doing all ~~3~~of the following steps ~~below.~~:

1. Design log home in accordance with ICC 400~~-2017~~—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~~; AND~~.

3. Incorporate a sufficient number of points from Table R402.1.2.3 to meet the points requirement from Table R402.1.2.2.

~~*add*~~ *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	~~MAXIMUM GLAZING AREA~~ [c]CEILING *R*-VALUE	~~CEILING *R*-VALUE~~LOG WALL [d]	~~LOG WALL~~ [d]FLOOR *R*-VALUE [e]	~~FLOOR *R*-VALUE~~[e]BASEMENT/ CRAWL SPACE WALL *U*-VALUE [f]	~~BASEMENT/ CRAWL SPACE WALL *U*-VALUE~~ [f]SLAB *R*-VALUE & DEPTH	HEATED SLAB *R*-VALUE & ~~DEPTH~~ VALUE [g]	~~HEATED SLAB *R*-VALUE~~ [g]AIR LEAKAGE i	HEATING SYSTEM AFUE [h]

0.30	0.~~55~~41	~~20%~~49	~~49~~ ≥ 5 in. log	~~≥ 5″ Log~~38	~~38~~R-20ci OR R13+10ci	~~15/20~~ R-20,4' (edge) OR R-15,4'(edge) + R-7.5 (under)	~~15, 4 ft.~~ R-20,4' (edge) OR R-15,4'(edge) + R-15 (under)	~~15 edge and under~~0.15 CFM50/ Sq. Ft. of Building Shell (~2 ACH50)	~~90% gas/LP, 85% oil~~ ENERGY STAR basic: (1) Gas/propane furnace ≥ 95 AFUE, Oil furnace ≥ 85 AFUE; (2) Gas/propane boiler ≥ 90 AFUE, Oil boiler ≥ 87 AFUE;

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. ~~Non-log~~Nonlog exterior walls shall be insulated in accordance with Table 402.2.1.
e. ~~Or~~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 ~~Specific insulation requirements (Prescriptive).~~**
~~In addition to the requirements of Section R402~~**.1**~~, insulation shall meet the specific requirements of Sections R402.2.1 through R402.2.15.~~

~~*delete and replace* **R402.2.2~~** **Ceilings ~~without~~with attic spaces.**
Where Section R402.1.2 would require R-49 insulation ~~levels above R-30 and~~in the ~~design of the roof/~~ceiling ~~assembly does not allow sufficient space for the required insulation, the minimum required insulation for such roof/ceiling assemblies shall be~~ , installing R-~~30. Insulation shall extend~~38 over the top of ~~the wall plate to the outer edge of such plate and shall not be~~ exterior walls where insulation is compressed~~. This reduction of insulation from the requirements of~~ 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~~.2 shall be limited to 500 square feet (46 m^2) or 20 percent of the total insulated~~ would require R-60 insulation in the

ceiling ~~area, whichever is less~~, 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 ~~an~~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.

~~*delete and replace* **TABLE R402.2.6** *footnotes as follows:*~~
~~a. The first value is~~ 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 ~~*R*-value,~~ and ~~the second value is~~ uses continuous insulation ~~*R*-value. For example, "R-30+3" means R-30~~ 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% froaming 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* ~~plus R-3 continuous insulation~~shall be installed to maintain permanent contact with the underside of the subfloor decking.
~~b. Insulation exceeding the height of the framing shall cover the framing.~~

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-~~30.~~ 38.

2. The minimum wall insulation *R*-value shall be R-~~13~~20. Walls separating a *sunroom* or heated garage with a *thermal isolation* from *conditioned space* shall ~~meet~~comply with the *building thermal envelope* requirements of this code.

~~*delete* **R402.2.15 Wood framed walls** *and replace with* **R402.2.15 Frame walls** as follows:~~

~~Efforts must be made to protect insulated cavities from airborne water vapor and condensation. Air sealing the interior face of the assembly, controlled mechanical ventilation (targeting 30% relative humidity during the winter season), exterior continuous insulation and proper consideration of the vapor permeance of materials are all design elements that can contribute to this protection.~~

~~*add* **R402.2.15.1 Vapor retarders.** Class I or II vapor retarders shall be provided on the interior side of frame walls. Exceptions:~~

~~1. Basement /concrete foundation walls.~~
~~2. Below *grade* portion of any wall.~~
~~3. Construction where moisture or its freezing will not damage the materials.~~

~~*add* **R402.2.15.2 Low permeability insulating sheathing.** Where a Class II vapor retarder is used on the interior side of frame walls, in combination with a low permeability insulating sheathing installed as continuous insulation on the exterior side of frame walls, the Class II vapor retarder shall have a vapor permeance greater than 1 perm when measured by ASTM E96 water method (Procedure B). Use of a Class I interior vapor retarder in frame walls with a Class I vapor retarder on the exterior side shall require an engineered approved design.~~

~~*add* **R402.2.15.3 Class III vapor retarders.** Class III vapor retarders on the interior side of frame walls shall be permitted where any one of the following conditions is met:~~

~~1. Vented cladding over the following sheathing types:~~
~~a. fiberboard;~~
~~b. gypsum;~~
~~c. plywood (CDX or comparable); or~~
~~d. solid wood~~
~~2. Insulated sheathing with *R*-value 7.5 minimum over 2 × 4 wall.~~
~~3. Insulated sheathing with *R*-value 11.25 minimum over 2 × 6 wall.~~

~~*add* **R402.2.15.4 Material vapor retarder class.** The *vapor retarder class* shall be based on the manufacturer's certified testing of a tested assembly. See R202 General Definitions for vapor retarder classes and examples.~~

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 ~~(Prescriptive).~~.**
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 m^2) 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 m^2) 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: ~~For~~ *sunrooms and conditioned garages* with *thermal isolation* and enclosing *conditioned space*, the ~~maximum~~ fenestration *U*-factor shall ~~be~~not exceed 0.~~45~~30 and the ~~maximum~~ *skylight U*-factor shall not exceed 0.~~55~~41.

New fenestration separating ~~the~~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 ~~(Mandatory).~~**
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.~~4.5~~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~~[a]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. ~~The exterior thermal envelope contains a continuous, durable air barrier.~~ Breaks or joints in the air barrier shall be sealed. ~~An air barrier is defined as any durable solid (non-porous) material that completely blocks air flow between *conditioned space* and *unconditioned space*, including necessary accessories to provide adequate support to resist positive and negative pressures without displacement or damage.~~ The air barrier should be continuous and be durably connected to all penetrations, windows and other (structural) interruptions. 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. If flexible air barriers are used, they shall be fully sealed at all seams and edges and supported ~~per~~in accordance with manufacturer's installation instructions. 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.	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 durable, air barrier.
Dropped ceilings/soffits	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 ~~down stairs~~downstairs or knee wall doors to unconditioned attic spaces shall be sealed, insulated and gasketed.	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.
Framing junctions and cavities	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. Knee walls shall be air sealed. When part of the thermal envelope, knee wall insulation shall be enclosed on all six	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

	sides and in contact with a durable, interior air barrier.	per inch ~~minimum.~~ . Exterior thermal envelope insulation for framed walls shall be installed in substantial contact and continuous alignment with the air barrier. Exterior thermal envelope insulation for framed walls shall be enclosed on all six sides and in contact with a durable, air barrier.
Windows, skylights and doors	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.	—
Rim joists	Rim joists shall include ~~the~~an exterior air barrier. Junctions of the foundation and sill plate, sill plate and rim band, and rim band and subfloor shall be sealed. When air permeable insulation is installed, a durable, interior air barrier shall be installed at the rim joist.	Rim joists shall be insulated and air sealed~~.~~ so that the insulation maintains permanent contact with the exterior rim board.[b]
Floors (including above garage and ~~cantilevered~~cantile vered floors)	The air barrier shall be installed at any exposed edge of insulation.	Floor framing cavity insulation shall be installed to maintain permanent contact with the underside of subfloor decking, 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.
Basement crawl space ~~walls~~and slab foundations	Exposed earth in unvented crawl spaces shall be covered with a Class I vapor retarder/air barrier in accordance with Section R402.2.10 with overlapping joints taped.in accordance with Section R402.2.10. Penetrations through concrete foundation walls and slabs shall be air sealed. Class 1 vapor retarders shall not be used as an air barrier on below-grade walls and shall be installed in accordance with Section R702.7 of the *International Residential Code*.	Where provided instead of floor insulation, vapor barrier shall be ~~permanently attached to the crawlspace walls~~ installed in accordance with Section R402.2.10. Conditioned basement foundation wall insulation shall be installed in accordance with Section R402.2.8. Slab-on-grade floor insulation shall be installed in accordance with Section R402.2.10.
Shafts, penetrations	Duct ~~shafts, utility penetrations,~~ and flue shafts ~~opening,~~ and other penetrations to exterior or unconditioned space shall be sealed~~.~~ to allow for expansion, contraction, and mechanical vibration. Utility penetrations of the air barrier shall be caulked, gasketed or otherwise sealed and shall allow for expansion, contraction of materials and mechanical vibration.	—Insulation shall be fitted tightly around utilities passing through shafts and penetrations in the building thermal envelope to maintain required *R*-value.

	Doors or hatches in knee walls opening to exterior or unconditioned space shall be insulated and gasketed.	
~~Narrow cavities~~		~~Batts in narrow cavities shall be cut to fit, or narrow cavities shall be filled by insulation that on installation readily conforms to the available cavity space.~~
~~Garage separation~~	~~Air sealing shall be provided between the garage and *conditioned spaces*.~~	
~~Recessed lighting and appliances~~	~~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 ½" from combustible material and not less than 3" from insulation material, or as required by manufacturer's installation requirements.~~	~~Recessed light fixtures installed in the building thermal envelope shall be air tight and ICAT rated (ICAT rated indicates Insulation Contact and Air Tight and meets IC and air tightness requirement).~~
~~Plumbing and wiring~~	~~All plumbing and wiring penetrations shall be sealed to the air barrier.~~	~~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 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. Fireplace shall have compression closure doors and combustion air supplied from the outdoors.~~	

(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 sealed.	Batts in narrow cavities shall be cut to fit, or narrow cavities shall be filled by insulation that on installation readily conforms to the available cavity space.
Garage separation	Air sealing shall be provided between the garage and *conditioned spaces*.	Insulated portions of the garage separation assembly shall be installed in accordance with Sections R303 and R402.2.7.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 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 *R*-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 ~~2017~~ 2022

~~add~~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 ~~three (3~~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 ~~inch~~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.

~~*add*~~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~~).~~

~~Exception: Report cubic feet per minute at 50 Pascals (~~) and CFM50~~) per square foot of building thermal~~ /Sq. Ft. Building Shell area~~. Building thermal shell area shall include~~ of all six ~~(6)~~ 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.

~~*delete and replace*~~*add* **R402.4.~~5 Recessed lighting.~~**
~~Recessed luminaires~~**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. ~~All recessed luminaires~~Electrical and communication outlet boxes shall be ~~ICAT-rated (Insulation Contact and~~tested in accordance with **NEMA OS 4**, Requirements for Air~~-Tight) or IC-rated and *labeled* as having~~-Sealed Boxes for Electrical and Communication Applications and shall have an air leakage rate of not ~~more~~greater than 2.0 ~~cfm~~cubic feet per minute (0.944 L/s) ~~when tested in accordance with ASTM E283~~ at a ~~1.57 psf (75 Pa)~~ pressure differential~~. All recessed luminaires~~ of 1.57 psf (75 Pa). Electrical and communication outlet boxes shall be ~~sealed~~marked "NEMA OS 4" or "OS 4" in accordance with ~~a gasket or caulk between the housing and~~ **NEMA OS 4**. Electrical and communication outlet boxes shall be installed per the ~~interior wall or ceiling covering~~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 ~~(Mandatory).~~().**
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.~~55~~41 for skylights.

~~*delete* **402.6 Vapor retarders.**~~

add **R402.~~6 Vestibules~~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 m^2) 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 ~~3~~ 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 m^2) per dwelling exclusive of mandatory access or setback areas. New multiple single-family dwellings (townhouses) three stories or less ~~built~~in height above ~~a parking garage require a vestibule~~grade plane and with a total floor area less than or equal to 2,000 square feet (185.8 m^2) per dwelling shall have a solar-ready zone area of not less than 150 square feet (13.94 m^2) 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 m^2) 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 11/4 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 ~~C402.4.7 from the Vermont Commercial~~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 house*s.**

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 ~~Energy Standards (CBES).~~Shell (~2 ACH50);

~~*delete* **402.7 Class III vapor retarders.**~~

~~*delete* **402.8 Material vapor retarder class.**~~

- 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 exceptions are allowed as long asonly 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.

Wifi

3. Wi-Fi or "smart" Internet-connected thermostats.

delete and replace **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 R404.24 for guidance on electric-resistance heating equipment other than heat pumps.

delete and replace **R403.3** .2 Sealing (Mandatory).

Ducts,.

Ducts and air handlers and filter boxesfor space conditioning shall be sealed. Joints and seams shall comply with either the *International Mechanical Code* or *International Residential Code*, as applicable.in accordance with Sections R403.3.1 through R403.3.2.

delete and replace **R403.3.3 Duct testing**

1 Ducts shall be pressure tested to determine air leakage by one of the following methods:**located outside conditioned space.**

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

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

Exceptions:

A structure where the *add* **R403.3.1 Duct placement.**

All ducts and air handlers areshall be located entirely within the *building thermal envelope**conditioned space*.

2. Ducts serving heat or energy recovery ventilators that are not integrated with ducts serving heating or cooling systems.

A written report of the results of the test shall be signed by an individual certified as either a Building Performance Institute (BPI) Heating Professional or Air Conditioning/Heat Pump Professional, a Home Energy Rating System (HERS) Energy Rater or HERS Field Inspector or a Vermont Department of Public Service approved duct leakage tester, and provided to the *code official or other authority having jurisdiction, where one exists,* and to the *Department of Public Service* along with the RBES certificate upon completion of the construction project.

delete *and replace***R403.3.3 Duct testing.**

delete **R403.3.4 Duct leakage (Prescriptive).**

The total leakage of the ducts, where measured in accordance with Section R403.3.3, shall be as follows:

1. Rough-in test: The total leakage shall be less than or equal to 3 cubic feet per minute (85 L/min) per 100 square feet (9.29 m^2) of conditioned floor area.

2. Postconstruction test: Total leakage shall be less than or equal to 4 cubic feet per minute (113.3 L/min) per 100 square feet (9.29 m^2) of conditioned floor area.

*add**delete* **R403.3.5 Building cavities**

delete **R403.3.6 Ducts buried within ceiling insulation.**

Where supply and return air ducts are partially or completely buried in ceiling insulation, such ducts shall comply with all of the following:

1. The supply and return ducts shall have an insulation *R*-value not less than R-8.

2. At all points along each duct, the sum of the ceiling insulation *R*-value against and above the top of the duct, and against and below the bottom of the duct, shall be not less than R-40, excluding the *R*-value of the duct insulation.

*add**delete* **R403.3.7 Ducts located in conditioned space.**

For ducts to be considered as inside a *conditioned space*, such ducts shall comply with either of the following:

~~1. The duct system shall be located completely within the continuous air barrier and within the building thermal envelope.~~

~~2. The ducts shall be buried within ceiling insulation in accordance with Section R403.3.6 and all of the following conditions shall exist:~~

~~2.1. The air handler is located completely within the *continuous air barrier* and within the building thermal envelope.~~

~~2.2. The duct leakage, as measured either by a rough-in test of the ducts or a post-construction total system leakage test to outside the building thermal envelope in accordance with Section R403.3.4, is less than or equal to 1.5 cubic feet per minute (42.5 L/min) per 100 square feet (9.29 m^2) of conditioned floor area served by the duct system.~~

~~2.3. The ceiling insulation *R*-value installed against and above the insulated duct is greater than or equal to the proposed ceiling insulation *R*-value, less the *R*-value of the insulation on the duct.~~

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-~~3~~4.

~~*delete and replace* **R403.6.1 Whole-house mechanical ventilation system fan efficacy.**~~
~~Mechanical ventilation system fans shall meet the efficacy requirements of Table R403.6.1.~~
~~Where an air handler that is integral to tested and *listed* HVAC equipment is used to provide whole-house mechanical ventilation, the air handler shall be powered by an electronically commutated motor.~~

~~*delete and replace*~~ *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 104ºF (40ºC).

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 $^3/_4$ 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**

~~**TABLE R403.6.1**~~
~~**WHOLE HOUSE MECHANICAL VENTILATION SYSTEM FAN EFFICACY[a]**~~

~~FAN LOCATION~~	~~AIR FLOW RATE MINIMUM (CFM)~~	~~MINIMUM EFFICACY (CFM/WATT)~~	~~AIR FLOW RATE MAXIMUM (CFM)~~
~~HRV or ERV~~	~~Any~~	~~1.2 cfm/watt~~	~~Any~~
~~Range hoods~~	~~Any~~	~~2.8 cfm/watt~~	~~Any~~
~~In-line fan~~	~~Any~~	~~2.8 cfm/watt~~	~~Any~~
~~Bathroom, utility room~~	~~10~~	~~1.4 cfm/watt~~	~~< 90~~
~~Bathroom, utility room~~	~~90~~	~~2.8 cfm/watt~~	~~Any~~

~~a. When tested in accordance with IBC-18~~
~~b. Standard 916.~~
~~For SI: 1 cfm = 28.3 L/min.~~

~~**Exception:** Where mechanical ventilation fans are integral to tested and listed HVAC equipment, they shall be powered by an electronically commutated motor.~~

~~*delete and replace* **R403.7 Equipment sizing and efficiency rating (Mandatory).**~~
~~Heating and cooling equipment shall be sized in accordance with ACCA Manual S based on *building* loads calculated in accordance with ACCA Manual J or other *approved* heating and cooling calculation methodologies. New or replacement heating and cooling equipment shall have an efficiency rating equal to or greater than the minimum required by federal law for for Climate Zone 6.~~

delete and replace **R403.8 Systems serving multiple dwelling units ~~(Mandatory).~~**
Systems serving multiple dwelling units shall comply with Sections C403 and C404 of the ~~2020~~2023 *Vermont Commercial Building Energy Standards* (CBES) in lieu of Section R403~~.~~

~~*delete and replace* **R403.9 Snow melt and ice system controls (Mandatory).**~~
~~Snow- and ice-melting systems, supplied through energy service to the building, shall include automatic controls capable of shutting off the system when the pavement temperature is above 45°F (10°C) and precipitation is falling, and an automatic or manual control that~~ but will ~~allow shutoff when the outdoor temperature is above 40°F (4.8°C).~~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 ~~residential~~ permanent residential spas ~~that are accessory to detached one- and two-family dwellings and townhouses three stories or less in height above grade plane and that are available only to the household and its guests~~ 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.

~~*delete* **R403.12 Residential pools and permanent residential spas.**~~

SECTION R404
ELECTRICAL POWER AND LIGHTING SYSTEMS

delete and replace **R404.1 Lighting equipment ~~(Mandatory).~~**
~~Not less than 90 percent of the lamps (or "bulbs") in.~~
All permanently installed lighting fixtures, excluding kitchen appliance lighting fixtures, shall ~~be~~contain only high-efficacy ~~lamps. Where multiple replaceable lamps are~~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 ~~permanently installed lighting fixture, the number of lamps is to be used in calculating the percentage~~motion sensor.

~~*add*~~5. Lamps and luminaires that comply with Section R404.1.

delete and replace **R404.1.2 Lighting equipment for multifamily spaces ~~(Mandatory).~~**
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 C405.45.2.

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 ~~*and replace*~~ **R404.2 Electric resistance heating equipment.**

add **R404.2 Electric heating equipment.**

Heat pumps ~~having supplementary electric resistance heat~~ 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 (~~e.g.,~~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~~; and~~ .

   b. The building has a tested air tightness of ~~≤~~ less than or equal to 0.15 CFM50/Sq. Ft. of Building Shell (~2~~.0~~ ACH50~~.~~).

4. Multifamily buildings with heating loads ~~≤~~less than or equal to 6.0 Btu/~~hour/square foot~~h/ft^2 at design temperature.

*

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

~~add~~*delete and replace* **R404.3 Electric vehicle charging.**

~~New parking lots serving *multifamily* developments of 10 or more dwelling units shall provide either level 1 or level 2 electrical service within 5 feet of the centerline of the parking space ("EV Charging Parking Space") with the capacity to serve the number of~~One *Electric Vehicle Charging* ~~Parking Spaces in~~- *Level 2 Capable* parking space or *Electric Vehicle Charging - Level 2 EVSE* is required for new construction based on Table R404.3. ~~Electrical service capacity includes use of a listed cabinet, box or enclosure connected to a conduit linking the parking spaces with the electrical service.~~

Exception: Electric vehicle parking spaces are not ~~counted in Table R404.3~~ 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. ~~3.~~ ~~Parking spaces which are limited to parking durations of less than an~~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.

~~Level 1 Electric Vehicle Charging Parking requires one 120V 20 amp grounded AC receptacle, NEMA 5-20R or equivalent, within 5 feet of the centerline of each EV Charging Parking Space.~~

~~Level 2 Electric Vehicle Charging Parking 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 of the centerline for each EV Charging Parking Space.~~

~~add~~*delete and replace* TABLE R404.3

~~**TABLE R404.3**~~

REQUIRED LEVEL 2 CAPABLE ELECTRIC VEHICLE CHARGING PARKING SPACES FOR ~~MULTIFAMILY~~ALL NEW BUILDINGS (BASE CODE and STRETCH CODE)

~~NUMBER OF~~ BUILDING/PARKING ~~SPOTS~~TYPE	MINIMUM REQUIRED NUMBER OF LEVEL 2 CAPABLE EV CHARGING PARKING SPACES
~~10–25~~	~~1~~
~~26–50~~	~~2~~
~~51–75~~	~~3~~

~~76–100~~	~~4~~
~~>100~~Single Family Home or Multifamily Building	~~4%~~ 1 per dwelling unit or the number of parking ~~spots, rounded up to the nearest whole number~~spaces provided, whichever is less
Additional Parking Spaces	25% of remaining parking spaces not utilized by dwelling units, or 40 spaces, whichever is less

~~*modify* "~~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 i**n 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

~~**SIMULATED PERFORMANCE** **ALTERNATIVE USING RES*check*™ SOFTWARE (PERFORMANCE)" *to* "SECTION R405 ALTERNATIVE **USING RESCHECK™ SOFTWARE"**~~

delete and replace **R405.2 Mandatory requirements.**
Compliance with this section requires that the applicable provisions in Sections ~~R402.1.1, R403.3.1, R403.5.3 and the mandatory provisions identified in Sections~~ R401.3, R402, R403 ~~and~~, R404, and Chapter 3 be met. ~~All supply and return ducts not completely inside the *building thermal envelope* shall be insulated to meet the same *R*-value requirement that applies to immediately proximal surfaces.~~

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

~~*delete and replace* **R406.1 Scope.**~~
~~This section establishes criteria for compliance using an Energy Rating Index (ERI) analysis. This approach uses a Home Energy Rating System (HERS) Energy Rating provided by a Vermont Department of Public Service-approved accredited HERS provider. The "ERI" referenced herein is the same as the RESNET HERS Index.~~

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 ~~R402.1.1, R403.3.1, R403.5.3 and the mandatory provisions identified 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.

> ~~**Exception:** Supply and return ducts not completely inside the *building thermal envelope* shall be insulated to a minimum of R-6.~~

delete ~~*and replace*~~ **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 ~~61~~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 ~~"HERS Index with IAF" using~~ REM~~/Rate~~ 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/~~15.7. Up to 5 ERI points can be earned with renewables.~~ .If the HERS Index scale is revised, the Department of Public Service may update these Index points.

delete **TABLE 406.4**

delete and replace **R406.6.1 Compliance software tools.**
Documentation verifying that the methods and accuracy of the compliance software tools conform to the provisions of this section shall be provided to the *code official* or *other authority having jurisdiction, where one exists* and be an approved Software Rating Tools in accordance with RESNET/ICC 301.
delete and replace **R406.7.3 Input values.**
Where calculations require input values not specified by Sections R402, R403, R404 and R405, those input values shall be taken from an approved source such as RESNET/ ICC 301.

SECTION R407
VERMONT STRETCH CODE

delete and replace **R407.1 Scope.**
This section establishes criteria for compliance with Vermont's "Stretch Code," as defined in 30 V.S.A. § 51. Act 250 residential projects and residential buildings in municipalities that adopt the Stretch Code shall demonstrate compliance with R407.2. All other requirements in the RBES shall apply.

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

delete **TABLE R407.1**

delete **R407.2 Testing.**

delete **TABLE R407.2**

add **R407.2 Compliance.**
Compliance for Stretch Code shall be documented through R407.2.1 Package Plus Points Approach or R407.2.2 ERI-based compliance for Stretch Code.

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

add **R407.2.1.1** Projects shall comply by completing all three steps below:

1. Select one of the three base packages listed in Table R407.2.1.1; and
2. Determine the number of points needed to comply with Table R407.2.1.2. based on building size; and
3. Incorporate a sufficient number of points from Table R407.2.1.3 to meet the points requirements from Table R407.2.1.2.

add **TABLE R407.2.1.1**

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

~~PACKAGES~~

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

~~Component~~[a] BASE CODE		~~*Package 1*~~ STRETCH CODE	~~*Package 2*~~	~~*Package 3*~~
60		~~*"Standard"*~~ 59	~~*"SIPS"*~~	~~*"Thick Wall"*~~
~~**Envelope**~~	~~Ceiling R-Value~~	~~R-60[g] attic / R-49[f] slope~~	~~R-36 cont.~~	~~R-49[f]~~
	~~Wood Frame Wall R-Value~~	~~R-20+5[e] **OR** 13+10[e]~~	~~R-21 cont.~~	~~R-20+12[e]~~
	~~Common Wall Insulation~~	~~R-10~~	~~R-10~~	~~R-10~~
	~~Floor R-Value~~	~~R-30~~	~~R-30~~	~~R-30~~
	~~Basement/Crawl Space Wall[c] R-Value~~	~~R-20 (continuous) **OR** R-13+10[e]~~	~~R-20 (continuous) **OR** R-13+10[e]~~	~~R-20 (continuous) **OR** R-13+10[e]~~
	~~Slab Edge[d] R-Value~~	~~R-15, 4ft **OR** R10 perimeter + R-7.5 under entire rest of slab~~	~~R-15, 4 ft **OR** R10 perimeter + R-7.5 under entire rest of slab~~	~~R-15, 4ft **OR** R10 perimeter + R-7.5 under entire rest of slab~~
	~~Heated Slab[d] R-Value~~	~~R-15 (edge and under)~~	~~R-15 (edge and under)~~	~~R-15 (edge and under)~~
	~~Fenestration[b] (Window and Door) max. U-Value~~	~~U-0.28~~	~~U-0.28~~	~~U-0.30~~
	~~Skylight[b] max. U-Value~~	~~U-0.55~~	~~U-0.55~~	~~U-0.55~~
~~**Air Leakage and Ventilation**~~	~~Air Leakage[i]~~	~~≤3.0 ACH50[h] tested~~	~~≤3.0 ACH50[h] tested~~	~~≤3.0 ACH50[h] tested~~
	~~Ventilation~~	~~Balanced; ECM[l] fan plus ≥ 70% SRE[k] for HRV[j], ≥ 65% SRE for ERV[j]~~	~~Balanced; ECM[l] fan plus ≥ 70% SRE[k] for HRV[j], ≥ 65% SRE for ERV[j]~~	~~Balanced; ECM[l] fan plus ≥ 70% SRE[k] for HRV[j], ≥ 65% SRE for ERV[j]~~
~~**Mechanicals**~~	~~Duct Leakage~~	~~Inside thermal boundary~~	~~Inside thermal boundary~~	~~Inside thermal boundary~~
~~**Lighting**~~	~~Percent *High Efficacy Lamps*[i]~~	~~90%~~	~~90%~~	~~90%~~

~~For SI: 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.~~

~~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 not be less than the *R*-value specified in the table.~~

~~b. The fenestration *U*-factor row excludes skylights.~~

~~c. The continuous portion of basement and crawlspace insulation can be met through interior, exterior or a 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, so "13 + 10" means R-13 cavity insulation plus R-10 continuous insulation. These insulation requirements can be met through any combination of insulation R-values that yields an equivalent effective R-value using a series-parallel path calculation method.~~

~~f. Installing R-38 over 100 percent of the ceiling area requiring insulation shall be deemed to satisfy the requirement for R-49 insulation wherever the full height of uncompressed R-38 insulation extends over the~~

~~wall top plate at the eaves. (See Section R402.2.1.) Multifamily buildings using continuous insulation with a maximum U-factor of 0.023 for the ceiling assembly satisfies this requirement.~~

~~g. Installing R-49 over 100 percent of the ceiling area requiring insulation shall be deemed to satisfy the requirement for R-60 insulation wherever the full height of uncompressed R-49 insulation extends over the wall top plate at the eaves. (See Section R402.2.1.)~~

~~h. "ACH50" = air changes per hour at 50 Pascals building pressure as measured with a blower door.~~

~~i. See Table R402.4.1.1 for further details.~~

~~j. "H/ERV" = Heat or Energy Recovery Ventilation~~

~~k. "SRE" = System Recovery Efficiency~~

~~"ECM" = Electronically Commutated Motor~~

~~*add*~~

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.**

~~Determine the number of points required by building size from Table R402.1.2.2. Building size for this table is determined by the *finished conditioned floor area* per dwelling unit within the *building thermal envelope*, including unfinished basements and storage/utility spaces. The Multifamily < 2000 square feet point requirement cannot be used for semidetached (semiattached, side-by-side), row houses, and townhouses, as defined as *single-family dwellings* in Definitions R202. *Multifamily dwelling* unit size is based on the average dwelling size for the building.~~

~~*add* **TABLE R407.2.1.2**~~

delete **TABLE R407.2.1.2**

~~**REQUIRED POINTS BY BUILDING SIZE**~~

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 (ft^2)

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 *List insulation material type from Table 2*		Product R-Value		Surface Area (gross square feet)		Framing Factor ("1.0" for continuous, "0.8" for cavity)		Default Global Warming Potential (kg CO2e /sq.m. RSI-1) *Use Default GWP values from Table 2. Leave blank for products where product specific data will be*	Project has sourced Type III - Product-specific Environmental Product *Check box if project will be substituting default values with product specific data*	Product Specific Global Warming Potential (kg CO2e /sq.m. RSI-1) *Leave blank unless EPDs have been sourced. Use GWP values from product-specific EPDs.*		Conversion Factor	GWP Result (kg CO2e)
Below grade, slab/slab 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								Summary Metrics	Total Insulation GWP (kg CO2e)			
		Inputs for product-specific data									Conditioned Floor Area (sf)			
		Calculation outputs									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.

~~**Building/Dwelling Size**~~Material	~~**Required Points**~~Default Global Warming Potential (kg CO2e /sq.m. RSI-1)
Cellular glass - Aggregate	3.93[b]
Cellulose - Densepack	-2.10
Cellulose - Blown/loosefill	-1.10
~~Multifamily < 2000 square feet average unit size~~Cork - Board	-6 ~~points~~.80
EPS/graphite - Board, unfaced, Type II - 15psi	2.80
EPS/graphite - Board, unfaced, Type IX - 25psi,	3.40

graphite	
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
~~<2000 square feet~~Vacuum Insulated Panel	7 ~~points~~.40
~~2000 to 4000 square feet~~Wood fiber – Board, unfaced, European	~~9 points~~-6.50
~~>4000 square feet~~Wood fiber – Board, unfaced, North America	~~12 points~~-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~~*add* **R407.2.1.3 Points by Component.**~~

~~After determining the number of points required using Table R407.2.1.2, select the components from Table 407.2.1.3 to accumulate the required number of points. The total number of points selected from Table 407.2.1.3 must meet or exceed the required points from Table 407.2.1.2.~~

~~*add* **TABLE R407.2.1.3~~**

~~**Table R407.2.1.3**~~
~~**POINTS BY COMPONENT**~~

~~**Component**~~		~~**Description**~~	~~**Points**~~
~~**Envelope**~~	~~Slab~~	~~R-10 below entire slab~~	~~1~~
	~~Walls-Upgraded~~	~~Above Grade walls R-20+12 (or U-factor maximum 0.033 wall assembly) (Exception: not available for stretch package 3) **OR**[b]~~	~~2~~

	Walls — High-R	Above Grade walls ≥ R-40 (cavity + continuous) (or U-factor maximum 0.025 wall assembly)	3
	Ceiling	R-80 attic / R-60 sloped, vaulted and cathedral	1
	Windows	Average U-factor ≤ 0.22	2
Air Leakage and Ventilation	Pre-Drywall	ACH50 is tested with blower door after full insulation/primary air barrier completion but before insulation is fully enclosed/covered **OR**[b]	1
	Tight	ACH50 ≤ 2.0 and balanced ventilation with ECM[e] fans and ≥ 70% SRE[d] for HRV[e], ≥65% SRE[d] for ERV[e] **OR**[b]	1
	Very Tight	ACH50 ≤ 1.0 and balanced ventilation with ECM[e] fans and ≥ 80% SRE[d] for HRV[e], ≥75% SRE[d] for ERV[e]	4
Heating and Cooling[a]	Basic	ENERGY STAR basic: (1) Gas/propane furnace ≥95 AFUE, Oil furnace ≥85 AFUE, (2) Gas/Propane Boiler ≥90 AFUE, Oil Boiler ≥87 AFUE, (3) Heat pump HSPF ≥9.0; PLUS any AC is SEER ≥14.5 **OR**[b]	1
	Advanced	Advanced: Whole building heat/cool is (1) NEEP listed[j] heat pump combination, (2) GSHP[i], closed loop and COP ≥ 3.3, (3) ATWHP[f] COP ≥2.5 and 120F design temp, (4) Advanced wood heating system	3
Water	Basic	ENERGY STAR basic: Fossil fuel [EF 0.67 for ≤ 55 gal; EF 0.77 for > 55 gal] **OR**[b]	1
	Advanced	ENERGY STAR advanced: Electric [EF or UEF ≥ 2.00 for ≤ 55 gal; EF ≥2.20 for ≥ 55 gal]	2
	Low Flow	All showerheads ≤ 1.75 gpm[g], all lav. faucets ≤ 1.0 gpm[g], and all toilets ≤ 1.28 gpf[h] **OR**[b]	1
	Certified	Certified water efficient design per WERS, WaterSense, or RESNETH2O (for new construction only)	2
	Drain Heat Recovery	Drain water heat recovery system on primary showers and tubs	1
	User-Demand	Controlled hot water recirculation system with user-demand via push-button for furthest fixtures	1
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
	Solar Hot Water	Solar hot water system designed to meet at least 50% of annual hot water load	2
	Solar PV	Solar Photovoltaic (PV), 1 point per 1.5 kW per housing unit of renewable generation on site	1 per 1.5 kW, max. 4
	Solar Ready for Multifamily	Multifamily building complies with Solar Ready Zone R.407.5.	1

	Monitoring	Install whole-building energy monitoring system, min. 5 circuits and homeowner access to data	1
Other Measures	EV Ready	Level 2 electric vehicle charger-ready per 407.4 [k]	1
	Battery	Min. 6 kWh grid-connected dispatchable demand-response-enabled battery backup	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. "H/ERV" = Heat or Energy Recovery Ventilation
d. "SRE" = System Recovery Efficiency
e. "ECM" = Electronically Commutated Motor
f. "ATWHP" = Air to Water Heat Pump
g. "gpm" = gallons per minute
h. "gpf" = gallons per flush. Applies to new construction only.
i. "GSHP" = ground source heat pump
j.
k. Points are limited to one per dwelling. Additional Level 2 charging equipment receives no more points.

add **R407.2.2 ERI-based compliance for Stretch Code.** Compliance based on an ERI analysis requires that the *rated design* be shown to have an ERI less than or equal to 54 when compared to the *ERI reference design*. This includes all residential structures, including log homes. The ERI to be used to verify compliance is "HERS Index with IAF" using REM/Rate version 15.7. Up to 5 ERI points can be earned with renewables.

delete **R407.3 Electric vehicle charging**

delete **TABLE R407.3**

add **R407.3 Air Leakage Testing for Stretch Code.** In addition to the requirements in R402.1.2 for testing air leakage, air leakage testing shall be reported on the RBES Certificate in units of air changes per hour at 50 Pascals (ACH50) in addition to cubic feet per minute (cfm) at 50 Pascals (CFM50) per square foot of building thermal shell area. Building thermal shell area shall include all six (6) sides of the building.

add **R407.4 Electric vehicle charging for Stretch Code.**
For single family housing, one Level 1 parking space is required with accessible socket.

Parking lots serving *multifamily* developments of 10 or more dwelling units shall provide level 1 or level 2 electrical service to the required number of Electric Vehicle Charging Parking Spaces in Table R404.3. If level 1 service is provided, the required EV Charging Parking Spaces shall also be "Level 2 ready" as defined below in this Section R407.4. Electrical service capacity includes use of a listed cabinet, box or enclosure connected to a conduit linking the parking spaces with the electrical service.

Exception: Parking spaces are not counted in Table R404.3 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.
3. Parking spaces which are limited to parking durations of less than an hour.

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.

Level 1 Electric Vehicle Charging Parking requires one 120V 20 amp grounded AC receptacle, NEMA 5- 20R or equivalent, within 5 feet of the centerline of each EV Charging Parking Space.

Level 2 Electric Vehicle Charging Parking 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 of the centerline for each EV Charging Parking Space. Level 2 "ready" includes space in the panel for 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. The circuits shall have no other outlets. The service panel shall provide sufficient capacity and space to accommodate the circuit and over-current protective device. A permanent and visible label stating "EV READY" shall be posted in a conspicuous place at both the service panel and the circuit termination point.

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

add **R407.5.1 General.**

New detached one- and two-family dwellings, and multiple single-family dwellings (townhouses) with not less than 600 ft2 (55.74 m2) of roof area oriented between 110° and 270° of true north shall comply with sections 407.5.

EXCEPTIONS:

1. New residential buildings with a permanently installed on-site renewable energy system.
2. A building with a solar-ready zone that is shaded for more than 70% 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.

add **R407.5.2 Construction Document Requirements for Solar Ready Zone**

Construction documents shall indicate the solar ready zone where applicable.

add **R407.5.3 Solar-Ready Zone Area.**

The total solar-ready zone area shall consist of an area not less than 300 ft2 (27.87 m2) exclusive of mandatory access or set back 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 ft2 (185.8 m2) per dwelling shall have a solar-ready zone area of

not less than 150 ft2 (13.94 m2). Multifamily buildings should maximize the solar-ready zone by consolidating mechanicals, access, set back areas and other roof obstructions with a goal of 40% of the roof area available for the solar-ready zone. The solar-ready zone shall be composed of areas not less than five feet (1,524 mm) in width and not less than 80 ft2 (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 **R407.5.4 Obstructions.**

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

add **R407.5.5 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 **R407.5.6 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" 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 **R407.5.7 Electrical Service Reserved Space.**

The main electrical service panel shall have a reserved space to allow installation of a dual pole circuit breaker for future solar electric installation and shall be labeled "For Future Solar Electric." The reserved space shall be positioned at the opposite (load) end from the input feeder location or main circuit location. Note: this requirement is in addition to the electrical service reserved space for electric vehicle charging.

[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 General.~~

~~***Additions* to an existing *building*, *building* system or portion thereof shall conform to the provisions of this code as those provisions relate to new construction without requiring the unaltered portion of the existing *building* or *building* system to comply with this code. *Additions* shall not create an unsafe or hazardous condition or overload existing *building* systems. An *addition* shall be deemed to comply with this code where the *addition* alone complies, where the existing *building* and**~~*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*~~. *Additions* shall~~, testing must be performed in accordance with Section ~~R502.1.1 or R502~~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.

~~*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.~~

Exception: Where *unconditioned* space is changed to *conditioned* space, the building envelope of the addition shall comply where the UA, as determined in Section ~~402~~R402.1.~~4~~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*.

~~*delete and replace* **R502.1.1.2 Heating and cooling systems.**~~

~~New heating, cooling and duct systems that are part of the *addition* shall comply with Sections~~

R403.1, R403.2, R403.3, R403.5, R403.6 and R404. Connections or repairs to, or maintenance of existing mechanical systems do not constitute an alteration to that system.

Exception: Where ducts from an existing heating and cooling system are extended to an *addition*, duct systems with less than 40 linear feet (12.19 m) in *unconditioned spaces* shall not be required to be tested in accordance with Section R403.3.3.

delete and replace **R502.1.2 Existing plus addition compliance (Simulated Performance Alternative).**
Where *unconditioned* space is changed to *conditioned space*, the addition shall comply where the annual energy cost or energy use of the addition and the existing building, and any alterations that are part of the project, is less than or equal to the annual energy cost of the existing *building* when modeled in accordance with Section R405. The *addition* and any *alterations* that are part of the project shall comply with any of the Chapter 4 compliance options in its entirety.

SECTION R503
ALTERATIONS

delete and replace **R503.1.1 Building envelope.**
Building envelope assemblies that are part of the *alteration* shall comply with Section R402.1.2 or R402.1.4, Sections R402.2.1 through R402.2.13, R402.3.1, R402.3.2, R402.4.3 and R402.4.4. Uninsulated or under-insulated wall, floor and roof building cavities that are filled with insulation only need to fill that cavity with insulation and are not required to meet the *R*-value requirements in Table R402.1.2.

Exception: The following *alterations* need not comply with the requirements for new construction provided the energy use of the *building* is not increased:

1. Storm windows installed over existing fenestration.

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

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

4. Roof recover.

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

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

delete and replace **R503.1.1.1 Replacement fenestration.**
Where some or all of an existing fenestration unit is replaced with a new fenestration product, including sash and glazing, the replacement fenestration unit shall meet the applicable requirements for *U*-factor and SHGC as specified Table R402.1.2. Where more than one replacement *fenestration* unit is to be installed, an area-weighted average of the *U*-factor, SHGC

~~or both of all replacement *fenestration* units shall be an alternative that can be used to show compliance.~~

~~*delete and replace* **R503.1.2 Heating and cooling systems.**~~
~~New heating, cooling and duct systems that are part of the *alteration* shall comply with Sections R403.1, R403.2, R403.3, R403.6 and R404. Connections or repairs to, or maintenance of existing mechanical systems do not constitute an alteration to that system.~~

> ~~**Exception:** Where ducts from an existing heating and cooling system are extended, duct systems with less than 40 linear feet (12.19 m) in *unconditioned spaces* shall not be required to be tested in accordance with Section R403.3.3.~~

~~*delete and replace* **R503.1.3 Service hot water systems.**~~
~~New service hot water systems that are part of the *alteration* shall comply with Section R403.5.~~

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 throughR503.1.4.

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 ~~50~~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 ~~R503~~**R505.2** ~~Change in space conditioning.~~
General.
Any ~~unconditioned or low-energy~~ space that is ~~altered~~converted to ~~become *conditioned space*~~a dwelling unit or portion thereof from another use shall ~~be required to be brought into full compliance~~comply with this code.

> **Exception:** Where the simulated performance ~~(REScheck)~~ 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.~~3.~~

~~SECTION R504~~
~~REPAIRS~~

~~*delete and replace* **R504.1 General.**~~
~~*Buildings*, structures and parts thereof shall be repaired in compliance with Section R501.3 and this section. Work on nondamaged components necessary for the required *repair* of damaged components shall be considered part of the *repair* and shall not be subject to the requirements for *alterations* in this chapter. Routine maintenance required by Section R501.3, ordinary *repairs* exempt from *permit*, and abatement of wear due to normal service conditions shall not be subject to the requirements for *repairs* in this section and are exempt from meeting RBES requirements.~~

~~SECTION R505~~
~~CHANGE OF OCCUPANCY OR USE~~

add **R505.~~1.1 Hunting Camps and Summer Camps. If a *hunting camp* or a *summer camp* changes occupancy and becomes a residence, or is converted from an~~2.1 Unconditioned space.**

Any unconditioned or low-energy space that is altered to become a conditioned space~~, it must then be upgraded to~~ shall comply with ~~the code~~**Section R502.**

CHAPTER 6
REFERENCED STANDARDS

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

~~This chapter lists the standards that are referenced in various sections of this document. The standards are listed herein by the promulgating agency of the standard, the standard identification, the effective date and title, and the section or sections of this document that reference the standard. The application of the referenced standards shall be as specified in Section 106.~~

~~AAMA~~**ASHRAE**

~~American Arch~~

~~tectural Manufacturers Association 1827 Walden Office Square Su~~

		ite550Schaumburg, IL60173-4268
ASHRAE—2017 ASHRAE Handbook of Fundamentals		R402.1.5
Standard reference number	Title	Referenced in code section number**ASHRAE 62.2 Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings** R304.1.1
AAMA/WDMA/CSA 101/I.S.2/A C440—17	North American Fenestration Standard/ Specifications for Windows, Doors and Unit Skylights **ASHRAE 193—2010 (RA2014) Method of Test for**	R402.4.3

			Determining the Airtightness of HVAC Equipment R403.3.2.1

~~ACCA~~

~~Air Conditioning Contractors of America~~
~~2800 Shirlington Road, Suite 300~~
~~Arlington, VA 22206~~

~~Standard reference number~~	~~Title~~	~~Referenced in code section number~~
~~Manual J—16~~	~~Residential Load Calculation Eighth Edition~~	~~R403.7~~
~~Manual S—14~~	~~Residential Equipment Selection~~	~~R403.7~~

APSP

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

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

~~Standard reference number~~	~~Title~~		~~Referenced in code section number~~
~~ANSI/APSP/ICC 14—2014~~		**ANSI/APSP/ICC 14—2014 American National Standard for Portable Electric Spa Energy Efficiency**	~~R403.10.1, 403.11~~
	R403.11		
~~ANSI/APSP/ICC 15a—2011~~		**ANSI/APSP/ICC 15a—2013 American National Standard for Residential Swimming Pool and Spa Energy Efficiency—includes Addenda A Approved January 9, 2013**	~~R403.12~~
	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

E1827—2011(2017) Standard Test Methods for Determining Airtightness of Building Using an Orifice Blower Door

R402.4.1.2

E2178—2013: Standard Test Method for Air Permanence of Building Materials

R202 “Air-Impermeable Insulation”

~~ASHRAE~~CSA

~~American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.~~
~~1791 Tullie Circle, NE~~
~~Atlanta, GA 30329-2305~~

CSA Group 8501 Eastpoint Parkway, Cleveland, OH 44130

~~Standard reference number~~	~~Title~~	~~Referenced in code section number~~ OH4413 1-5575
~~ASHRAE 2017~~	~~ASHRAE Handbook of Fundamentals~~ -	R402.~~1.5~~4.3

		R403.5.4
ASHRAE 62.2**CSA B55.2—2020 Drain Water Heat Recovery Units**	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings	303.1.1
ASHRAE 193—2010 (RA 2014)	Method of Test for Determining the Airtightness of HVAC Equipment	R403.3.2.15.4

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

Standard reference number	Title	Referenced in code section number
C 1363—11	Standard Test Method for Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus	. R303.1.4.1
E 283—04(2012)	Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors Under Specified Pressure Differences Across the Specimen	R402.4.5
E 779—10	Standard Test Method for Determining Air Leakage Rate by Fan Pressurization	R402.4, 407.2
E 1827—11	Standard Test Methods for Determining Airtightness of Building Using an Orifice Blower Door	R402.4, 407.2
E 2357	Standard Test Method for Determining Air Leakage of Air Barrier Assemblies	Table 402.4.1.1

CSA

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

Standard reference number	Title	Referenced in code section number
AAMA/WDMA/CSA 101/I.S.2/A440—17	North American Fenestration Standard/Specification for Windows, Doors and Unit Skylights	R402.4.3
CSA 55.1—2015	Test Method for measuring efficiency and pressure loss of drain water heat recovery units	R403.5.4
CSA 55.2—2015	Drain water heat recovery units	R403.5.4

DASMA

Door and Access Systems Manufacturers Associatio

		n 1 3 0 0 S u m n e r A v e n u e C l e v e l a n d , O H 4 4 1 1 5 - 2 8 5 1
~~Standard reference number~~ **105 - 2017**	~~Title~~	~~R e f e r e n c e d i n c o d e s~~

~~Section number~~		
~~10-2016~~	~~Test Method for Thermal Transmittance and Air Infiltration of Garage Doors~~	R303.1.3

HVI	~~Home Ventilating Institute 1000 North Rand Road, Suite 214 Wauconda, IL 60084~~	Home Ventilating Institute 1000 North Rand Road, Suite 214 Wauconda, IL 60084
~~Standard reference number~~	~~Title~~	~~Referenced in code section number~~
~~916---09~~	~~Airflow~~**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		R304.5.1, R304.6

ICC

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

~~Standard reference number~~	~~Title~~	~~Referenced in code section number~~
ICC 400—17 Standard on the Design and Construction of Log Structures		
~~IBC--18~~	~~International Building Code®~~	~~T~~

~~Standard on the Design and Construction of Log Structures~~	Table R402.1.~~5~~2.1, R402.1.6, Table R402.1.6, Table 402.4.1.1	
~~I C C 4 0 0 1 - 1 7~~		
IBC—18 International Building Code®	R202 – Occupancy Classifications, R303.2, R402.1.1, R402.2.11,	
~~IECC—09~~ ~~IECC—06~~	~~2009 International Energy Conservation Code®~~ **IECC—06 2006 International Energy Conservation Code®**	~~R406.2~~ ~~R 4 0 6 . 3 . 1~~
	R406.2, R406.3.1	
IECC—09 2009 International Energy Conservation Code®	R406.2	
~~IFC-15~~ ~~IFGC—18~~	**IFC—21 International Fire Code®** ~~International Fuel Gas Code®~~ R201.3, R402.7.3, R402.7.10, R501.5	~~R201.3, R501.4~~ ~~R 2 0 1 . 3 . R 5 0 1 . 4~~
IFGC—21 International Fuel Gas Code®	R201.3,	
IMC—21 International Mechanical Code®		
~~I M C — 1 8~~	~~International Mechanical Code®~~ - R201.3, R402.4.1.2, R403.3.2, R403.6, ~~R501.4~~	

~~IPC—18~~	**IPC—21 International Plumbing Code®**	~~R2014.3,~~ ~~R5014.4~~	
~~IPSDC—18~~	~~International Private Sewage Disposal Code®~~ R201.3,	~~R5014.4~~	
~~IPMC—18~~	**IRC—21 International ~~Property Maintenance~~Residential Code®**	~~R5014.4~~	
~~IRC—18~~ ~~International Residential Code®~~	R201.3, R303.2, R402.1.1, R402.2.11, Table R402.4.1.1, R402.4.1.2, R402.4.4, R403.3.2, R403.6, R501.45		

IEEE	The Institute of Electrical and Electronic

Engineers, Inc. 3 Park Avenue New York, NY 10016-5997

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

R403.5.1.2

NEMA

National Electrical Manufa

cturers 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

~~IEEE~~ **FPA**

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

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

Standard reference number	Title	Referenced in code section number
515.1—2012	IEEE Standard for the Testing, Design, Installation, and Maintenance of Electrical Resistance Trace Heating for Commercial Applications**31—06 Installation of Oil-Burning Equipment** R305.1, R305.2, R305.3	R403.5.1.2
	54—09 National Fuel Gas Code R202, R305.1, R305.2, R305.3	

NFPA

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

Standard reference number	Title	Referenced in code section number
31—06	Installation of Oil-Burning Equipment	R305.1, R305.2, R305.3
54—09	National Fuel Gas Code	R305.1, R305.2, R305.3
70—17	National Electrical Code	R501.4

NFRC

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

Standard reference number	Title	Referenced in code section number
100—2017	**100—2020 Procedure for Determining Fenestration Products *U*-factors** R303.1.3	R303.1.3
200—2017	**200—2020 Procedure for Determining Fenestration Product Solar Heat Gain Coefficients and Visible Transmittance at Normal Incidence** R303.1.3	R303.1.3
400—2017	**400—2020 Procedure for Determining Fenestration Product Air Leakage** R402.4.3	R402.4.3

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

~~Standard reference number~~	~~Title~~	~~Referenced in code section number~~
		R406.3, R406.6.1 ~~R402.4.1.2~~
~~ANSI/RESNET/ICC 301-2014~~	**ANSI/RESNET/ICC 301—2019 Standard for the Calculation and Labeling of the Energy Performance of ~~Low-rise Residential Buildings~~Dwelling and Sleeping Units using an Energy Rating Index ~~First~~ Published ~~March 7, 2014 — Republished January 2016~~ December 18, 2018** R406.6.1, R406.7.3	
~~ANSI/RESNET/ICC 380-2016~~	**ANSI/RESNET/ICC 380—2016 Standard for Testing Airtightness ~~for~~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~~	UL LLC 333 Pfingsten Road Northbrook, IL 60062

~~Standard reference number~~	~~Title~~	~~Referenced in code section number~~
~~127—11~~	**127—2011 Standard for Factory Built Fireplaces —— with Revisions through ~~May 2015~~July 2016** R402.4.2	~~R402.4.2~~
~~515—11~~	**515—2015 Standards for Electrical Resistance ~~Heat Tracing~~Trace Heating for Commercial ~~and Industrial~~ Applications ~~including revisions through July 2015~~** R403.5.1.2	~~R403.5.1.2~~
	907—2016 Standard for Fireplace Accessories R402.4.2	

US-FTC

United States-Federal Trade Commission
600 Pennsylvania Avenue NW
Washington, DC 20580

Standard reference number	Title	Referenced in code section number
CFR Title 16 (2015)	R-value Rule	R303.1.4

WDMA

Window and Door Manufacturers Association
2025 M Street, NW Suite 800
Washington, DC 20036-3309

Standard reference number	Title	Referenced in code section number
AAMA/WDMA/CSA 101/I.S.2/A440—17	North American Fenestration Standard/Specification for Windows, Doors and Unit Skylights	R402.4.3

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