

Proposed Filing - Coversheet

Instructions:

In accordance with Title 3 Chapter 25 of the Vermont Statutes Annotated and the “Rule on Rulemaking” ([CVR 04-000-001](#)) adopted by the Office of the Secretary of State, this filing will be considered complete upon filing and acceptance of these forms and enclosures with the Office of the Secretary of State, and the Legislative Committee on Administrative Rules.

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

The data provided in text areas of Proposed Filing Coversheet will be used to generate a notice of rulemaking in the portal of “Proposed Rule Postings” online, and the newspapers of record. Publication of notices will be charged back to the promulgating agency.

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

Certification Statement: As the adopting Authority of this rule (see 3 V.S.A. § 801 (b) (11) for a definition), I approve the contents of this filing entitled:

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

_____/s/ June E. Tierney_____, on 9/23/2022
(signature) (date)

Printed Name and Title:

June Tierney, Commissioner, Vermont Department of Public Service

RECEIVED BY: _____

- ☐ Coversheet
- ☐ Adopting Page
- ☐ Economic Impact Analysis
- ☐ Environmental Impact Analysis
- ☐ Strategy for Maximizing Public Input
- ☐ Scientific Information Statement (if applicable)
- ☐ Incorporated by Reference Statement (if applicable)
- ☐ Clean text of the rule (Amended text without annotation)
- ☐ Annotated text (Clearly marking changes from previous rule)
- ☐ ICAR Filing Confirmed

1. TITLE OF RULE FILING:

Vermont Residential Building Energy Standards (RBES) Amendments

2. ADOPTING AGENCY:

Department of Public Service

3. PRIMARY CONTACT PERSON:

(A PERSON WHO IS ABLE TO ANSWER QUESTIONS ABOUT THE CONTENT OF THE RULE).

Name: Kelly Launder

Agency: Department of Public Service

Mailing Address: 112 State Street, Montpelier, VT 05620

Telephone: (802) 828-4039 Fax:

E-Mail: kelly.launder@vermont.gov

Web URL *(WHERE THE RULE WILL BE POSTED)*:

<http://publicservice.vermont.gov>

4. SECONDARY CONTACT PERSON:

(A SPECIFIC PERSON FROM WHOM COPIES OF FILINGS MAY BE REQUESTED OR WHO MAY ANSWER QUESTIONS ABOUT FORMS SUBMITTED FOR FILING IF DIFFERENT FROM THE PRIMARY CONTACT PERSON).

Name: Ben Civiletti

Agency: Department of Public Service

Mailing Address: 112 State Street, Montpelier, VT 05620

Telephone: (802) 622-4388 Fax:

E-Mail: Benjamin.Civiletti@vermont.gov

5. RECORDS EXEMPTION INCLUDED WITHIN RULE:

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

IF YES, CITE THE STATUTORY AUTHORITY FOR THE EXEMPTION:

PLEASE SUMMARIZE THE REASON FOR THE EXEMPTION:

6. LEGAL AUTHORITY / ENABLING LEGISLATION:

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

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

7. EXPLANATION OF HOW THE RULE IS WITHIN THE AUTHORITY OF THE AGENCY:

In accordance with 30 V.S.A. § 51(c), the Commissioner of the Department of Public Service is required to amend and update the RBES through administrative rules.

8. CONCISE SUMMARY (150 WORDS OR LESS):

The provisions of these standards regulate the design of building envelopes for adequate thermal resistance and low air leakage and the design and selection of mechanical, ventilation, electrical, service water-heating and illumination systems and equipment which will enable effective use of energy in residential building construction.

9. EXPLANATION OF WHY THE RULE IS NECESSARY:

The rule is necessary to achieve the effective utilization of energy in residential buildings. Per 30 V.S.A. § 51(c), the Commissioner of the Department of Public Service is required to amend the residential building energy standards after the issuance of updated standards for residential construction under the International Energy Conservation Code (IECC).

10. EXPLANATION OF HOW THE RULE IS NOT ARBITRARY AS DEFINED IN 3 V.S.A. § 801(b)(13)(A):

The Vermont Residential Building Energy Standards are based on the International Energy Conservation Code (IECC) and are reviewed and commented on by an Advisory Committee made up of Vermont builders, architects, Energy Efficiency Utilities, multi-family housing developers, and low-income housing advocates.

11. LIST OF PEOPLE, ENTERPRISES AND GOVERNMENT ENTITIES AFFECTED BY THIS RULE:

The Department of Public Safety, State Historic Preservation Office (SHPO)/ACCD, AHS Office of Economic Opportunity (OEO), Act 250 Commissions, new home owners/buyers, existing home owners, builders, building designers, home energy raters and municipalities.

12. BRIEF SUMMARY OF ECONOMIC IMPACT (150 WORDS OR LESS):

This rule is an update of an adopted residential building energy standard that has been in effect for all residential building construction since 1998. Adoption of the rule will have a modest cost impact on all of the parties involved in new home construction, purchase, and ownership, and

existing home renovation. It will assure the economic benefits of reduced energy costs, reduced environmental impacts, and improved indoor air quality for the lifetime of the home/building.

13. A HEARING WILL BE SCHEDULED.

IF A HEARING WILL NOT BE SCHEDULED, PLEASE EXPLAIN WHY.

14. HEARING INFORMATION

(THE FIRST HEARING SHALL BE NO SOONER THAN 30 DAYS FOLLOWING THE POSTING OF NOTICES ONLINE).

IF THIS FORM IS INSUFFICIENT TO LIST THE INFORMATION FOR EACH HEARING, PLEASE ATTACH A SEPARATE SHEET TO COMPLETE THE HEARING INFORMATION NEEDED FOR THE NOTICE OF RULEMAKING.

Date:

Time: AM

Street Address:

Zip Code:

Date:

Time: AM

Street Address:

Zip Code:

Date:

Time: AM

Street Address:

Zip Code:

Date:

Time: AM

Street Address:

Zip Code:

15. DEADLINE FOR COMMENT (NO EARLIER THAN 7 DAYS FOLLOWING LAST HEARING):

16. KEYWORDS (PLEASE PROVIDE AT LEAST 3 KEYWORDS OR PHRASES TO AID IN THE SEARCHABILITY OF THE RULE NOTICE ONLINE).

residential building energy standards

residential energy code

RBES

Adopting Page

Instructions:

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

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

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

1. TITLE OF RULE FILING:

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

2. ADOPTING AGENCY:

Department of Public Service

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

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

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

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

SOS LOG #:19-072

Title: Residential Building Energy Standards (RBES)

Effective Date: 09/01/2020

Economic Impact Analysis

Instructions:

In completing the economic impact analysis, an agency analyzes and evaluates the anticipated costs and benefits to be expected from adoption of the rule; estimates the costs and benefits for each category of people enterprises and government entities affected by the rule; compares alternatives to adopting the rule; and explains their analysis concluding that rulemaking is the most appropriate method of achieving the regulatory purpose. If no impacts are anticipated, please specify “No impact anticipated” in the field.

Rules affecting or regulating schools or school districts must include cost implications to local school districts and taxpayers in the impact statement, a clear statement of associated costs, and consideration of alternatives to the rule to reduce or ameliorate costs to local school districts while still achieving the objectives of the rule (see 3 V.S.A. § 832b for details).

Rules affecting small businesses (excluding impacts incidental to the purchase and payment of goods and services by the State or an agency thereof), must include ways that a business can reduce the cost or burden of compliance or an explanation of why the agency determines that such evaluation isn’t appropriate, and an evaluation of creative, innovative or flexible methods of compliance that would not significantly impair the effectiveness of the rule or increase the risk to the health, safety, or welfare of the public or those affected by the rule.

1. TITLE OF RULE FILING:

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

2. ADOPTING AGENCY:

Department of Public Service

3. CATEGORY OF AFFECTED PARTIES:

LIST CATEGORIES OF PEOPLE, ENTERPRISES, AND GOVERNMENTAL ENTITIES POTENTIALLY AFFECTED BY THE ADOPTION OF THIS RULE AND THE ESTIMATED COSTS AND BENEFITS ANTICIPATED:

The substantive changes to be implemented by this rule in comparison to the existing statute are listed below along with their impacts on each category of affected parties.

The following are the substantive changes that will affect home builders, developers, and homeowners. While

developers or builders may initially be impacted by the added cost of more energy efficient buildings due to the more stringent Residential Building Energy Standards (RBES), ultimately it will be the homebuyer who ends up paying for the improved home and also reaping the benefits of the more energy efficient and lower operating costs. In addition, society benefits from a lower-polluting home through reduced impacts on the climate relative to standard construction.

Below is a summary of the 2023 RBES enhancements and changes relative to the current 2020 RBES:

1. Multifamily Alignment

a. Aligned RBES and CBES standards for multifamily buildings to ensure that regardless of the building height, the energy standards would remain consistent

2. Packages

a. Combined Base Code and Stretch Code into a single "Standard Package" for simplicity and flexibility

b. Maintained a "Log Home Package"

3. Thermal Envelope Improvements

a. Increased insulation requirements for all surfaces

i. Require continuous insulation on walls

b. Reduced window U-factors

c. Tighter air leakage rates

i. Transitioning air leakage measurements from "air changes per hour (ACH) at 50 Pascals pressure" to "cubic feet per minute (CFM) at 50 Pascals pressure per square foot of building shell area of all six sides of the building"

4. Points

a. Adjusted the number of required points based on house size, while recognizing the inherent higher efficiency of multifamily buildings

b. Added additional options for points

i. Demand Response (DR) enabled appliances

- ii. Higher insulation levels
- iii. More efficient mechanical ventilation systems
- iv. Better windows

c. Insulation Embodied Carbon

- i. Developed new optional points for selecting low embodied carbon insulation materials

5. Mechanical Ventilation

- a. Now require an efficient balanced whole-house ventilation system with heat or energy recovery

6. Electrification

a. Electric Vehicles (EV)

- i. Included "EV Capable" requirements to ensure that it will be easy to install EV Supply Equipment in the future

b. Solar

- i. Included "Solar Ready" requirements to ensure that it will be easy to install solar photovoltaic panels in the future

c. Electric Service Panel

- i. Require an electric service panel capable of powering the whole home or apartment with all electric end-uses

7. Tiny Houses

- a. Recognized and added standards for tiny houses

8. Definitions

- a. Updated and added a number of definitions

9. New Specific Measures

- a. 100% LED lighting

b. Air-sealed electrical boxes

- c. All ducts must be placed inside the building thermal envelope

d. Exterior lighting controls

- e. Electric meter for every unit (except affordable multifamily housing)

f. Efficient electrical transformers

10. Home Energy Rating System (HERS)

a. Reduced (improved) HERS Index scores for Base Code (54) and Stretch Code (47)

b. Recognize additional HERS software tools

11. Additions and Alterations

a. Clarified that unaltered portions of buildings do not need to comply with RBES

12. Referenced Standards

a. Updated referenced standards

In order to price out the incremental cost of these proposed code improvements, we worked with a modular home builder and an affordable housing developer and one of their contractors to estimate two 2023 RBES compliant building configurations for the Base Code and two building configurations for the Stretch Code. The Stretch Code is slightly more stringent than the Base Code and is the required standard for Act 250 projects.

All of these building configurations start from the same basic "package" of building insulation, windows and doors, air tightness and HVAC systems that the RBES energy code requires. There is then a long list of measures with associated "points" from which the builder or homeowner may choose. Depending on the house type (e.g., single family, multifamily, addition) and size, a certain number of points are required. Two different configurations based on the average Vermont new home size and fuel type were used as examples in this analysis.

The standard base code "low cost" configuration is comprised of the required basic home "package" plus those points that would achieve code compliance at the lowest cost. The measures selected in this example to achieve the required five points include tightening up

the building's air leakage to 1 ACH50 and installing a more efficient heat recovery ventilation system. The second standard "all electric" home installed a cold climate air source heat pump and basic electric water heater instead of fossil fuel heating and hot water equipment. The total package costs, annual savings compared to the same home built to the 2020 RBES with the statewide mix of fuel types, simple payback, return on investment (ROI) and cash flow (assuming the incremental costs of building to the 2023 RBES are rolled into a 30-year 6% mortgage, and the annual mortgage payments are compared to the annual energy savings) are all presented in Table 1 - Standard Base Code Costs and Benefits Anticipated, in Appendix A. With a simple payback shorter than the life of the measures, an ROI greater than 5%, and positive cash flow in all cases, we have determined that these two example home configurations demonstrate that the 2023 RBES is cost effective.

Additionally, in order to show the benefits of the climate impacts, we have included the current societal cost of carbon for the saved energy. When considering the societal cost of carbon as a benefit, the savings and all of the cost effectiveness metrics increase significantly.

The stretch code standards for the 2023 RBES require improved energy performance at a slightly higher cost. In addition to the measures listed above for the standard home, the "low cost" stretch home also included points for low-flow water fixtures and a demand response enabled thermostat. The stretch "all electric" home swapped out the standard electric water heater for a more efficient heat pump water heater. Similar to the results for the standard "low cost" and "all electric" homes, these homes upgraded to the stretch code are also all cost effective, as shown in Table 2 - Stretch Code Costs and Benefits

Anticipated, in Appendix A. Adding in the social cost of carbon makes the results look even better.

This analysis for both the Base Code and the Stretch Code for two sample buildings demonstrate savings greater than costs and therefore the cost effectiveness of the 2023 RBES.

4. IMPACT ON SCHOOLS:

INDICATE ANY IMPACT THAT THE RULE WILL HAVE ON PUBLIC EDUCATION, PUBLIC SCHOOLS, LOCAL SCHOOL DISTRICTS AND/OR TAXPAYERS CLEARLY STATING ANY ASSOCIATED COSTS:

No impact, as school buildings are not covered under RBES.

5. ALTERNATIVES: CONSIDERATION OF ALTERNATIVES TO THE RULE TO REDUCE OR AMELIORATE COSTS TO LOCAL SCHOOL DISTRICTS WHILE STILL ACHIEVING THE OBJECTIVE OF THE RULE.

N/A

6. IMPACT ON SMALL BUSINESSES:

INDICATE ANY IMPACT THAT THE RULE WILL HAVE ON SMALL BUSINESSES (EXCLUDING IMPACTS INCIDENTAL TO THE PURCHASE AND PAYMENT OF GOODS AND SERVICES BY THE STATE OR AN AGENCY THEREOF):

No impact, as businesses are not covered under RBES.

7. SMALL BUSINESS COMPLIANCE: EXPLAIN WAYS A BUSINESS CAN REDUCE THE COST/BURDEN OF COMPLIANCE OR AN EXPLANATION OF WHY THE AGENCY DETERMINES THAT SUCH EVALUATION ISN'T APPROPRIATE.

N/A

8. COMPARISON:

COMPARE THE IMPACT OF THE RULE WITH THE ECONOMIC IMPACT OF OTHER ALTERNATIVES TO THE RULE, INCLUDING NO RULE ON THE SUBJECT OR A RULE HAVING SEPARATE REQUIREMENTS FOR SMALL BUSINESS:

An alternative to this rule would be to adopt the 2021 IECC code as is. The up-front cost of this alternative would likely be less than the proposed rule as the efficiency measures are less stringent, although the energy savings would be lower, resulting in a higher cost to the homeowner in the long run through added

energy costs. Adopting no rule would mean significant lost opportunities with each home being built if those additional savings weren't captured through an improved energy code and also would violate the statutory requirement that the Department "Commissioner shall ensure that appropriate revisions are made promptly after the issuance of updated standards for residential construction under the IECC."

9. SUFFICIENCY: *DESCRIBE HOW THE ANALYSIS WAS CONDUCTED, IDENTIFYING RELEVANT INTERNAL AND/OR EXTERNAL SOURCES OF INFORMATION USED.*

The cost - benefit analysis underlying this economic impact statement was prepared by the Department's contractor and has been extensively reviewed by stakeholders and experts including home builders, architects, developers, and affordable housing advocates. Feedback from these stakeholders and experts was incorporated into the estimates presented here.

External sources of information:

For development of fuel costs: the Energy Information Administration (EIA) - for information about electric rates and costs of delivered fuels; Vermont Gas Systems for natural gas costs; NMR VT Market Assessment Study for fuel incidence weighting in residential homes in Vermont.

For costs of new measures in 2023 RBES: Internet searches; Huntington Homes analysis; and Evernorth review.

For cost of carbon calculation: the Energy Information Administration (EIA) - for information about carbon intensity of fuels; Vermont Agency of Natural Resources for social cost of carbon in Vermont in 2023

Environmental Impact Analysis

Instructions:

In completing the environmental impact analysis, an agency analyzes and evaluates the anticipated environmental impacts (positive or negative) to be expected from adoption of the rule; compares alternatives to adopting the rule; explains the sufficiency of the environmental impact analysis. If no impacts are anticipated, please specify “No impact anticipated” in the field.

Examples of Environmental Impacts include but are not limited to:

- Impacts on the emission of greenhouse gases
- Impacts on the discharge of pollutants to water
- Impacts on the arability of land
- Impacts on the climate
- Impacts on the flow of water
- Impacts on recreation
- Or other environmental impacts

1. TITLE OF RULE FILING:

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

2. ADOPTING AGENCY:

Department of Public Service

3. GREENHOUSE GAS: *EXPLAIN HOW THE RULE IMPACTS THE EMISSION OF GREENHOUSE GASES (E.G. TRANSPORTATION OF PEOPLE OR GOODS; BUILDING INFRASTRUCTURE; LAND USE AND DEVELOPMENT, WASTE GENERATION, ETC.):*

The energy savings from homes built to the updated RBES will result in direct reductions in greenhouse gas emissions through reduced on-site fuel consumption and indirect greenhouse gas reductions through reduced electricity demand for the lifetime of the home. This rule also allows for the consideration of embodied carbon emissions from insulation materials used in the construction process (points may be earned for calculating estimated embodied carbon emissions from

insulation materials and for demonstrating lower insulation Global Warming Potential (GWP) intensity.)

4. **WATER:** *EXPLAIN HOW THE RULE IMPACTS WATER (E.G. DISCHARGE / ELIMINATION OF POLLUTION INTO VERMONT WATERS, THE FLOW OF WATER IN THE STATE, WATER QUALITY ETC.):*

No impact.

5. **LAND:** *EXPLAIN HOW THE RULE IMPACTS LAND (E.G. IMPACTS ON FORESTRY, AGRICULTURE ETC.):*

No impact.

6. **RECREATION:** *EXPLAIN HOW THE RULE IMPACT RECREATION IN THE STATE:*

No impact.

7. **CLIMATE:** *EXPLAIN HOW THE RULE IMPACTS THE CLIMATE IN THE STATE:*

The energy savings from homes built to the updated RBES will result in direct and indirect reductions in greenhouse gas emissions and minimize the other negative environmental impacts of energy use.

8. **OTHER:** *EXPLAIN HOW THE RULE IMPACT OTHER ASPECTS OF VERMONT'S ENVIRONMENT:*

This rule promotes improved insulation and air sealing in new residential construction and renovations to reduce building heating and cooling demands. This rule also promotes the use of efficient appliances and mechanical systems, which will further reduce electricity and fuel consumption. Additionally, the rule will improve building durability, resident comfort and indoor air quality in new homes.

9. **SUFFICIENCY:** *DESCRIBE HOW THE ANALYSIS WAS CONDUCTED, IDENTIFYING RELEVANT INTERNAL AND/OR EXTERNAL SOURCES OF INFORMATION USED.*

This environmental impact analysis covers the full range of environmental and climate impacts of the RBES updates.

Public Input Maximization Plan

Instructions:

Agencies are encouraged to hold hearings as part of their strategy to maximize the involvement of the public in the development of rules. Please complete the form below by describing the agency's strategy for maximizing public input (what it did do, or will do to maximize the involvement of the public).

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

1. TITLE OF RULE FILING:

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

2. ADOPTING AGENCY:

Department of Public Service

3. PLEASE DESCRIBE THE AGENCY'S STRATEGY TO MAXIMIZE PUBLIC INVOLVEMENT IN THE DEVELOPMENT OF THE PROPOSED RULE, LISTING THE STEPS THAT HAVE BEEN OR WILL BE TAKEN TO COMPLY WITH THAT STRATEGY:

The Department of Public Service undertook a broad-based consensus building process to develop this rule. Between April and May 2022, the Department held two online public meetings to present the proposed code language and gather input from the public for modifying the draft 2023 RBES, which included builders, architects, multi-family housing developers, low-income housing advocates, electric and gas utilities, energy efficiency utilities, state agency staff (SHPO, Dept. of Fire Safety), modular home manufacturers, and log home industry representatives.

The Department also convened an RBES Advisory Committee as required by statute to delve deeper into the technical aspects of the code. The full Advisory Committee met in March and June of 2022 and a multifamily subcommittee met in late May. The Department modified the proposed RBES to incorporate

Public Input

changes recommended by the stakeholders and the Advisory Committee.

Public meeting participants, Advisory Committee members and other stakeholders were also encouraged to comment on the proposed RBES language posted on the PSD website. The PSD accepted comments for over a month (the comment period was extended per stakeholder request).

PSD developed the proposed rule based on these meetings, public comments and other feedback.

Information is available on the Department of Public Service website at:

<https://publicservice.vermont.gov/content/building-energy-standards-update>

We also plan to hold a public hearing during the rule making period and have another public comment period.

4. BEYOND GENERAL ADVERTISEMENTS, PLEASE LIST THE PEOPLE AND ORGANIZATIONS THAT HAVE BEEN OR WILL BE INVOLVED IN THE DEVELOPMENT OF THE PROPOSED RULE:

The people and organizations below include Department staff and our contractors as well as those who participated in the Advisory Committee meetings, additional people (not listed below) also participated in the public stakeholder meetings.

Alex Weinhagen - Vermont Planners Association

Alison Stone - Vermont Natural Resources Board

Alyshia Jones - Snyder Homes

Anna Brannon - Guidehouse

Barry Murphy - VT Department of Public Service

Bob Duncan - Duncan Wisniewski Architecture

Brian Reilly - Burlington Electric Department

Charles Carpenter - Efficiency Vermont

Charlie Willner - EverNorth

Chris Burns - Burlington Electric Department

Chris Snyder - Home Builders & Remodelers Association

Craig Peltier - Vermont Housing and Conservation Board

Public Input

Chris West - Eco Houses of Vermont
Dave Mentzer - Dore + Whittier Architects
Diana Burk - New Buildings Institute
Enrique Bueno - VT Passive House
Erica Ko - AIA Vermont Chapter
Eveline Killian - Cx Associates
Gabrielle Stebbins - Energy Futures Group
Greg Montgomery - Cathedral Square
Jason Webster - Huntington Homes
Jay Pilliod - Efficiency Vermont
Keith Levenson - VT Department of Public Service
Kelly Launder - VT Department of Public Service
Ken Pulido - Vermont Housing Finance Agency
Jake Yanulavich - Burlington Electric Department
Kathy Beyer - EverNorth
Keith Downes - Guidehouse
Liz Bourguet - Energy Futures Group
Malcolm Gray - Building Performance Professionals Association
Matt Cota - Vermont Fuel Dealers Association
Matt Musgrave - Associated General Contractors of Vermont
Michael Gifford - Vermont Gas Systems
Richard Faesy - Energy Futures Group
Rob Pickett - Log Homes Council
Robert Sponable - Vermont Division of Fire Safety
Sean Denniston - New Buildings Institute
Steve O'Malley - Efficiency Vermont
Tim Perrin - Vermont Gas Systems
Will Fontaine - Snyder Homes
Will Reed- Vermont Foam Insulation

Scientific Information Statement

THIS FORM IS ONLY REQUIRED IF THE RULE RELIES ON SCIENTIFIC INFORMATION FOR ITS VALIDITY.

PLEASE REMOVE THIS FORM PRIOR TO DELIVERY IF IT DOES NOT APPLY TO THIS RULE FILING:

Instructions:

In completing the Scientific Information Statement, an agency shall provide a summary of the scientific information including reference to any scientific studies upon which the proposed rule is based, for the purpose of validity.

1. TITLE OF RULE FILING:

Vermont Residential Building Energy Standards (RBES) Amendments

2. ADOPTING AGENCY:

Department of Public Service

3. BRIEF EXPLANATION OF SCIENTIFIC INFORMATION:

30 V.S.A. § 51 RESIDENTIAL BUILDING ENERGY STANDARDS, requires the update of the Standards after the issuance of updated standards for residential construction under the International Energy Conservation Code (IECC). This rule for RBES is based on the 2015, 2018, and 2021 edition of the International Energy Conservation Code which has been extensively vetted by an international committee of code professionals.

The Vermont Legislature adopted Act 89 of 2013, and (Section 6 of 30 V.S.A. § 51) which allowed the adoption of Vermont's first stretch code for application in proceedings under 10 V.S.A. chapter 151 (Act 250), and to be available for adoption by municipalities under 24 V.S.A. chapter 117.

This rule is based on a review of current residential construction practices in Vermont and incorporates more stringent insulation, window u-values, and air leakage

rates, as well as 2021 IECC requirements. The primary substantive differences between the 2020 VT RBES and the proposed 2023 VT RBES is the requirement for continuous wall insulation and balanced ventilation. Also points were added for the following measures: Demand Response (DR) enabled appliances, higher insulation levels, more efficient mechanical ventilation systems, better windows, and points for selecting low embodied carbon insulation materials. Each of these provisions has been reviewed by builders, architects and building scientists for technical feasibility and impacts on energy use, building durability and indoor air quality.

4. CITATION OF SOURCE DOCUMENTATION OF SCIENTIFIC INFORMATION:

Energy modeling was provided using REM/Rate version v16.3.3 software, published by NORESO, LLC. The ventilation standard support was published in two papers; "Mechanical Ventilation for Residential New Construction in Vermont: A Review of Codes, Standards, and Research With Recommendations for a Vermont Ventilation Standard" (August 18, 1999) and "A Field Study of Exhaust Only Ventilation Systems Performance in Residential New Construction in Vermont" (August 26, 1999).

5. INSTRUCTIONS ON HOW TO OBTAIN COPIES OF THE SOURCE DOCUMENTS OF THE SCIENTIFIC INFORMATION FROM THE AGENCY OR OTHER PUBLISHING ENTITY:

REM/Rate software can be accessed and purchased at www.remrate.com. The ventilation studies are available by request to the DPS.

Incorporation by Reference

THIS FORM IS ONLY REQUIRED WHEN INCORPORATING MATERIALS BY REFERENCE. PLEASE REMOVE PRIOR TO DELIVERY IF IT DOES NOT APPLY TO THIS RULE FILING:

Instructions:

In completing the incorporation by reference statement, an agency describes any materials that are incorporated into the rule by reference and how to obtain copies.

This form is only required when a rule incorporates materials by referencing another source without reproducing the text within the rule itself (e.g., federal or national standards, or regulations).

Incorporated materials will be maintained and available for inspection by the Agency.

1. TITLE OF RULE FILING:

Vermont Residential Building Energy Standards (RBES) Amendments

2. ADOPTING AGENCY:

Department of Public Service

3. DESCRIPTION (*DESCRIBE THE MATERIALS INCORPORATED BY REFERENCE*):

The 2020 Vermont Residential Building Energy Standards published by International Code Council (ICC).

4. FORMAL CITATION OF MATERIALS INCORPORATED BY REFERENCE:

2020 Vermont Residential Building Energy Standards.
International Code Council(ICC), Inc.: July 2020.
First Printing. ISBN: 978-1-952468-32-2

5. OBTAINING COPIES: (*EXPLAIN WHERE THE PUBLIC MAY OBTAIN THE MATERIAL(S) IN WRITTEN OR ELECTRONIC FORM, AND AT WHAT COST*):

The 2020 VT Residential Building Energy Standards can be obtained from the ICC website at: www.iccsafe.org. An electronic view only copy is available for free. The Department of Public Service has hard copies available

for free. Hard copies are available to order from the ICC for \$27.50 (non-member) or \$22 (member). Pdf downloads are available from ICC for \$27.50 (non-member) or \$18.95 (member).

6. MODIFICATIONS (*PLEASE EXPLAIN ANY MODIFICATION TO THE INCORPORATED MATERIALS E.G., WHETHER ONLY PART OF THE MATERIAL IS ADOPTED AND IF SO, WHICH PART(S) ARE MODIFIED*):

There are Vermont amendments to the 2020 VT Residential Building Energy Standards throughout the document. Vermont amendments are attached.

Run Spell Check

2023 Vermont Residential Building Energy Standard AMENDMENTS



112 State Street
Montpelier, VT 05620

802-828-2811

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

These rules are adopted under 30 V.S.A. § 51. This document shall be known and cited as the *2023 Vermont Residential Building Energy Standard Amendments*. The *2020 Vermont Residential Building Energy Standards* (First Printing: July 2020) published by International Code Council (ICC), Inc., as amended herein, are incorporated by reference and are available on the ICC website at: www.iccsafe.org

PREFACE

delete and replace Preface as follows:

Introduction

The *2023 Vermont Residential Building Energy Standards* (RBES) is based on the *2020 Vermont Residential Building Energy Standards*, which are based on the 2018 and 2015 *International Energy Conservation Code*[®] (IECC[®]). The 2023 RBES also includes 2021 and 2018 IECC energy efficiency requirements as well as select language updates and additional, more stringent Vermont energy efficiency requirements.

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

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

Development

This 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 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 2023 RBES is based on the language in the 2015 edition of the IECC and includes efficiency improvements included in the 2018 and 2021 IECC to ensure continued progression in efficiency in the Vermont RBES. The 2023 RBES builds on the “Package Plus Points” approach to code compliance, initiated in 2020. (Previous code compliance was achieved through a “prescriptive package” approach). The addition of “points” provides builders and designers greater flexibility in complying with the RBES. The 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 2023 VERMONT RESIDENTIAL BUILDING ENERGY STANDARDS

The 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 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 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 2023 RBES

The 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 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

The following is a chapter-by-chapter synopsis of the scope and intent of the provisions of the 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 authority having jurisdiction*, where one exists, reasonably expect to demonstrate that “equal protection under the law” has been provided.

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

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

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

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

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

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

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

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

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

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

Italicized Terms

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

Marginal Markings

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

Abbreviations and Notations

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

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

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

CHAPTER 1

ADMINISTRATION

PART 1—SCOPE AND APPLICATION

SECTION R101

SCOPE AND GENERAL REQUIREMENTS

delete and replace R101.1 Title.

This code shall be known as the 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 multifamily housing three stories or less in height.

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

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

delete and replace R101.7 Base and Stretch Code.

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

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

delete and replace R101.8 Compliance options.

There are three thermal efficiency compliance options:

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

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

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

PART 2—ADMINISTRATION AND ENFORCEMENT

SECTION R103 CONSTRUCTION DOCUMENTS

delete and replace **R103.1 General.**

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

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

delete and replace **R103.2 Information on construction documents.**

Where required, construction documents shall be drawn to scale upon suitable material. Electronic media documents are permitted to be submitted where *approved* by the *code official or authority having jurisdiction*, where one exists. Construction documents shall be of sufficient clarity to indicate the location, nature and extent of the work proposed, and show in sufficient detail pertinent data and features of the *building*, systems and equipment as herein governed. Details shall include, but are not limited to, the following as applicable:

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

SECTION R104 INSPECTIONS

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

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

CHAPTER 2 DEFINITIONS

SECTION R202 GENERAL DEFINITIONS

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

delete **LEVEL 1 ELECTRIC VEHICLE CHARGING**.

delete **LEVEL 2 ELECTRIC VEHICLE CHARGING**.

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

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

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

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

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

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

delete **RENEWABLE ENERGY SOURCES**.

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

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

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

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

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

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

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

CHAPTER 3 GENERAL REQUIREMENTS

SECTION R302 DESIGN CONDITIONS

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

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

Adjustments may be made only in the following cases:

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

SECTION R303 MATERIALS, SYSTEMS AND EQUIPMENT

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

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

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

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

SECTION 304 DESIGN CRITERIA FOR RESIDENTIAL VENTILATION SYSTEMS

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

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

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

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

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

Exceptions: *Tiny houses* may install an exhaust-only ventilation system.

delete and replace **304.2 Local ventilation.**

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

TABLE 304.2 MINIMUM REQUIRED LOCAL EXHAUST

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

delete and replace R304.3 Whole house balanced ventilation.

Every home and dwelling unit built to RBES shall be mechanically ventilated by a *whole house balanced ventilation system* as defined in Chapter 2.

delete and replace R304.5.2 Fan power consumption.

Single-port ventilation equipment shall not exceed 50 watts as listed by the manufacturer on the fan motor or as listed in accordance with HVI 911. Power used for lights, sensors, heaters, timers or night lights shall not be included in the determination of power consumption.

delete and replace R304.6 Net capacity requirements.

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

**TABLE R304.6
PRESCRIPTIVE FAN CAPACITY REQUIREMENTS**

NUMBER OF BEDROOMS	MINIMUM NOMINAL RATED TOTAL FAN CAPACITY ^a (at 0.1 inches w.g.)	MINIMUM NUMBER OF FANS TO MEET WHOLE HOUSE AIRFLOW RATES
1	50 cfm	Centrally ducted systems—1
2	75 cfm	Centrally ducted systems—1
3	100 cfm	Centrally ducted systems—1
4	125 cfm	Centrally ducted systems—1
5	150 cfm	Centrally ducted systems—1
Homes > 3,000 ft ²	cfm = 0.05 · ft ²	Centrally ducted systems—1

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

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

delete and replace R304.6.1 Testing option.

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

delete and replace R304.8 Controls.

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

All whole house ventilation controls shall be readily accessible.

Exception: Fans installed expressly for local ventilation purposes.

delete and replace **R304.9.3 Ducts.**

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

add **R304.9.9 Exhaust Dampers.**

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

Exception: Mechanical ventilation systems designed for continuous operation.

delete and replace **R304.11 Makeup air required.**

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

CHAPTER 4 RESIDENTIAL ENERGY EFFICIENCY

SECTION R401 GENERAL

delete and replace **R401.1 Scope.**

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

delete and replace **R401.2 Compliance.**

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

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

SECTION R402 BUILDING THERMAL ENVELOPE

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

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

Exception: The following *buildings*, or portions thereof, separated from the remainder of the building by *building thermal envelope* assemblies complying with this section shall be exempt from the *building thermal envelope* provisions of Section R402.

1. **Low energy use buildings.** Those with a peak design rate of energy usage less than 3.4 Btu/h per square foot of floor space for space conditioning purposes (10.7 W/m^2 or 1.0 watt/ft^2 of floor area for space-conditioning purposes
2. **Unconditioned buildings.** Those that do not contain *conditioned space*.
3. **Mobile homes.** Homes subject to Title VI of the National Manufactured Housing Construction and Safety Standards Act of 1974 (42 U.S.C. §§ 5401–5426).
4. **Hunting camps.** Residential buildings shall not include hunting camps.
5. **Summer camps.** Residential buildings constructed for nonwinter occupation with only a biomass (wood) or other on-site renewable heating system.
6. **Yurts** with only a biomass (wood) or other on-site renewable heating and hot water system.
7. **Owner-built homes.** Residential construction by an owner, if all of the following apply:
 - 7.1. The owner of the residential construction is the *builder*, as defined in 30 V.S.A. § 51.
 - 7.2. The residential construction is used as a dwelling by the owner.
 - 7.3. The owner in fact directs the details of construction with regard to the installation of materials not in compliance with the RBES.
 - 7.4. The owner discloses in writing to a prospective buyer, before entering into a binding purchase and sales agreement, with respect to the nature and extent of any noncompliance with the RBES.

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

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

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

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

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

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

1. Package Plus Points Approach: Tables R402.1.2.1, R402.1.2.2 and R402.1.2.3.
2. U-Factor Alternative Approach: Section R402.1.4.
3. Total UA Approach: Section R402.1.5.
4. Log Home Approach: Section R402.1.6.
5. *Tiny House* Approach: Section R402.8.

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

delete and replace **R402.1.2.1 Package Plus Points Approach.**

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

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

delete and replace **R402.1.2.1 Package Plus Points Approach.**

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

1. Select one of the packages listed in Table R402.1.2.1. These standard packages apply to both *Base Code* and *Stretch Code*.

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

Delete and replace **TABLE R402.1.2.1**

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

Component	Package 1	Package 2
	"Standard Package"	"Log Homes"
Ceiling – flat attic ^g	U-0.020: R-49 ^g	
Ceiling – slope (no attic)	U-0.023: R-44	
Above Grade Wall ^b	U-0.033: R-21+12ci ^e OR R-23'+10ci OR R-15+15ci OR R-28 8 ¼" ci (SIP)	Construct log home walls to ICC 400—2022 Standard on the Design and Construction of Log Structures or Table R402.1.6
Frame Floor	U-0.027: R-38	
Basement/Crawl ^c	R-20ci OR R13+10ci	
Slab, on grade ^d	R-20,4' (edge) OR R-15,4'(edge) + R-15 (under entire slab)	
Slab, on grade, Heated ^d	R-20,4' (edge) + R-15 (under entire slab)	
Windows	U-0.27	
Skylights	U-0.41	
Doors	U-0.37	
Air Leakage	0.15 CFM50/Sq. Ft. of Building Shell (~2 ACH50)	
Ducts	Inside thermal boundary	

For SI: 1 foot = 304.8 mm.

- a. *R*-values are minimums. *U*-factors are maximums. Where insulation is installed in a cavity that is less than the label or design thickness of the insulation, the installed *R*-value of the insulation shall be not less than the *R*-value specified in the table. See Section R402.1.4 for alternative compliance methods.
- b. These are *example* wall assemblies. Any wall assembly would need to meet required *U* values and should consider building science to avoid moisture concerns. See RBES Handbook for building science guidance and more example wall assemblies.
- c. The continuous portion of basement and crawlspace insulation can be met through interior, exterior or combination.
- d. "4 ft" can be horizontal or vertical coverage including slab edge. "Edge and under" requires complete coverage. Up to 8 lineal feet of exposed slab edge may be insulated to R-10. "Heated slab" are those with embedded radiation.
- e. The first value is cavity insulation, the second value is continuous insulation, or "ci", so "13 + 10ci" means R-13 cavity insulation plus R-10 continuous insulation.
- f. R-23 could be met with dense-pack cellulose or spray foam in a 2x6 cavity. g. 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.
- h. "ACH50" = air changes per hour at 50 Pascals building pressure as measured with a blower door. CFM50/Sq. Ft. of Building Shell = amount of air leakage (in cubic feet per minute, or CFM) that leaks out of each square foot of the exterior surface all six sides of the building measured at 50 Pascals of pressure with a blower door.
- i. Installing R-38 (*U*-value 0.023) over 100 percent of the ceiling sloped area requiring insulation shall be deemed to satisfy the requirement for R-44 where there is insufficient space in framing rafters for more than R-38. See R402.2.2 for more detail.

***delete* R402.1.2.2 Required Points by Building Size.**

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

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

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

***delete and replace* TABLE R402.1.2.2**

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

BUILDING/DWELLING SIZE	BASE CODE REQUIRED POINTS	STRETCH CODE REQUIRED POINTS
Alterations	0	0
Additions < 250 square feet	0	0
Additions 250 to 500 square feet	1	2

Addition 501 to 1,000 square feet	2	3
Addition > 1,000 square feet	3	4
Multifamily <1,250 square feet	2	3
Multifamily 1,250 to 2,500 square feet	4	5
< 2,500 square feet	5	7
2,500 to 4,000 square feet	7	12
> 4,000 square feet	10	15

delete and replace **TABLE R402.1.2.3**

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

Component		Description	Points
Envelope	Slab (on or below grade, heated or unheated)	R-20 around perimeter and below entire slab OR^b	2
		R-25 around perimeter and below entire slab	3
	Walls	R-35 double stud or similar (cavity and continuous) (U-0.028 wall assembly) OR^b	1
		R-40 double stud or similar (cavity and continuous) (U-0.025 wall assembly) OR^b	2
		R-48 SIP 10 1/4" XPS or similar (cavity and continuous) (U-0.021 wall assembly)	3
	Ceiling	R-80 attic flats (U-0.013) and R-60 slopes, vaulted and cathedral (U-.018)	1
	Floors - Exposed	R-49 (U-0.021)	1
	Windows- Triple Pane	Average U-factor ≤ 0.25 OR^b	1
		Average U-factor ≤ 0.21 OR^b	2
		Average U-factor ≤ 0.18 OR^b	3
		Average U-factor ≤ 0.15	4
	Doors - Exterior	U-0.26	1
Air Leakage	Tight	Tested to ≤ 0.11 CFM50/Sq. Ft. of Building Shell (6-sided) (~1.5 ACH50) OR^b	1
	Tighter	Tested to ≤ 0.07 CFM50/Sq. Ft. of Building Shell (6-sided) (~1.0 ACH50) OR^b	2
	Tightest	Tested to ≤ 0.03 CFM50/Sq. Ft. of Building Shell (6-sided) (~0.5 ACH50)	3
Mechanical Ventilation	Better Heat Recovery OR	Balanced ventilation with ECM fans and $\geq 80\%$ SRE and ≥ 1.2 cfm/watt OR^b	3

	Better Electrical Efficiency	Balanced ventilation with ECM fans and $\geq 70\%$ SRE, and ≥ 2.0 cfm/watt	
	Mechanical Ventilation Testing	Mechanical ventilation systems shall be tested and verified to provide the minimum ventilation flow rates required by Section R403.6. Testing shall be performed according to the ventilation equipment manufacturer's instructions, or by using a flow hood or box, flow grid, or other airflow measuring device at the mechanical ventilation fan's inlet terminals or grilles, outlet terminals or grilles, or in the connected ventilation ducts.	1
Heating and Cooling ^a	Basic Equipment	ENERGY STAR basic: (1) Gas/propane furnace ≥ 95 AFUE, Oil furnace ≥ 85 AFUE; (2) Gas/propane boiler ≥ 90 AFUE, Oil boiler ≥ 87 AFUE; OR ^b	1
	Cold Climate Air Source Heat Pump	Whole building heating /cooling is ENERGY STAR v.6 labeled ^d	5
	Ground Source Heat Pump	Whole building heating /cooling is Ground Source Heat Pump (GSHP), closed loop and COP ≥ 3.3	10
	Air-to-Water Heat Pump	Whole building heating/cooling is Air-to-Water Heat Pump (ATWHP) COP ≥ 2.5	5
	Advanced Wood Heating System	Whole building heating/cooling is Advanced wood heating system from http://www.nerc-vt.org/advanced-wood-heating-system/eligible-equipment-inventory-eei	5
	Low-Temperature Hydronic Distribution System	Hydronic distribution system designed to meet building peak heating demand with 120-degree water	1
	Demand Responsive Thermostats	All electric heating thermostats provided with <i>demand responsive controls</i>	1
Water	Heat Pump Basic	Electric Heat Pump Water Heater UEF ≥ 2.20 OR ^b	3
	Heat Pump Advanced	Electric Heat Pump Water Heater UEF ≥ 3.30	5
	Low flow	All showerheads ≤ 1.75 gpm, all lavatory faucets ≤ 1.0 gpm, and all toilets ≤ 1.28 gpf ^c OR ^b	1
	Certified ^e	Certified water efficient design per WERS, WaterSense, or RESNET HERS _{H2O}	2

	Drain heat recovery	Drain water heat recovery system on <i>primary showers</i> and tubs	1
	Recirculation User-demand	Controlled hot water recirculation system with user-demand via push-button for furthest fixtures	1
	Pipe Insulation	All service hot water piping is insulated to at least R-4 from the hot water source to the fixture shutoff.	1
	Demand Responsive Controls	Electric storage water heater(s) provided with <i>demand responsive controls</i>	1
	Point of Use Electric Water Heater	Remote fixtures requiring hot water supplied from a localized source of hot water with no recirculating system.	1
	Solar Hot Water	Solar hot water system designed to meet at least 50% of the annual hot water load	2
Renewables	On-Site Generation	Solar photovoltaic (PV) (or other on-site renewable energy system), 1 point per 1.5 kW per housing unit of renewable generation on site	1 per 1.5 kW, max. 4
Other Measures	Monitoring	Whole-building energy monitoring system installed, minimum 5 circuits and homeowner access to data	1
	Radon Mitigation System	Radon mitigation designed to https://www.epa.gov/radon/radon-standards-practice is installed and documented to homeowner	1
	Energy Model	Building energy model with projected annual energy use and costs developed, used in design and construction decisions, and provided to homeowner	1
	Battery	Minimum 6 kWh grid-connected dispatchable demand-response-enabled battery	1
	Advanced Lighting Controls	All lighting for at least 50% of floor area is controlled and/or continuously dimmed based by occupancy, daylight, load shedding, and/or schedule.	2
Insulation Embodied Carbon Emissions	Global Warming Potential (GWP)/square footage (kg CO ₂ e/ft ²)	Report the global warming potential (GWP) impact of project insulation materials as described in Section R408. Use calculation table R408.1.1 to summarize insulation GWP intensity (kg CO ₂ e/ft ²) for the project. Default global warming potential (GWP) values for common insulation products are provided in table R408.1.2. The calculation may utilize Type III, product-specific environmental product declaration (EPD) in lieu of default values for insulation products. If EPD values	1

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

For SI: 1 foot = 304.8 mm.

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

delete and replace R402.1.3 R-value computation.

Insulation material used in layers, such as framing cavity insulation, or continuous insulation Cavity insulation alone shall be used to determine compliance with the cavity insulation R-value requirements in Tables R402.1.1 and R402.1.3. Where cavity insulation is installed in multiple layers, the R-values of the cavity insulation layers shall be summed to compute the corresponding component R-value determine compliance with the cavity insulation R-value requirements. The manufacturer's settled R-value shall be used for blown insulation. Continuous insulation (ci) alone shall be used to determine compliance with the continuous insulation R-value requirements in Tables R402.1.1 and R402.1.3. Where continuous insulation is installed in multiple layers, the R-values of the continuous insulation layers shall be summed to determine compliance with the continuous insulation R-value requirements. Cavity insulation R-values shall not be used to determine compliance with the continuous insulation R-value requirements in Tables R402.1.1

and R402.1.3. Computed *R*-values shall not include an *R*-value for other building materials or air films. Where insulated siding is used for the purpose of complying with the continuous insulation requirements of Tables R402.1.1 and R402.1.3, the manufacturer's labeled *R*-value for insulated siding shall be reduced by R-0.6.

delete and replace R402.1.4 U-factor alternative.

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

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

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

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

delete and replace TABLE R402.1.4

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

FENESTRATION <i>U</i> -FACTOR	SKYLIGHT <i>U</i> -FACTOR	CEILING <i>U</i> -FACTOR	FRAME WALL <i>U</i> -FACTOR	MASS WALL <i>U</i> -FACTOR ^b	FLOOR <i>U</i> -FACTOR	BASEMENT WALL <i>U</i> -FACTOR	CRAWL SPACE WALL <i>U</i> -FACTOR	SLAB ON GRADE & UNHEATED SLAB <i>U</i> -FACTOR & DEPTH
0.27	0.41	0.020	0.033	0.060	0.027	0.05	0.05	0.05, 4 ft

For SI: 1 foot = 304.8 mm.

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

delete and replace R402.1.5 Total UA alternative.

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

UA calculation shall be performed using a method consistent with the ASHRAE *Handbook of Fundamentals* and shall include the thermal bridging effects of framing materials.

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

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

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

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

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

delete and replace **TABLE R402.1.6**

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

FENESTRATION U-FACTOR ^b	SKYLIGHT U-FACTOR	CEILING R-VALUE	LOG WALL ^d	FLOOR R-VALUE ^e	BASEMENT/ CRAWL SPACE WALL U-VALUE ^f	SLAB R-VALUE & DEPTH	HEATED SLAB R-VALUE ^g	AIR LEAKAGE ⁱ	HEATING SYSTEM AFUE ^h
0.27	0.41	49	□ ≥ 5 in. log	38	R-20ci OR R13+10ci	R-20,4' (edge) OR R-15,4' (edge) + R-7.5 (under)	R-20,4' (edge) OR R-15,4' (edge) + R-15 (under)	0.15 CFM50/Sq. Ft. of Building Shell (~2 ACH50)	ENERGY STAR basic: (1) Gas/propane furnace ≥ 95 AFUE, Oil furnace ≥ 85 AFUE; (2)

									Gas/propane boiler ≥ 90 AFUE, Oil boiler ≥ 87 AFUE;
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For SI: 1 foot = 304.8 mm.

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

delete and replace R402.2.1 Ceilings with attic spaces.

Where Section R402.1. would require R-49 insulation in the ceiling, 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. Where Section R402.1 would require R-60 insulation in the ceiling, 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. 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 would require insulation levels above R-38 and 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 R-38. Insulation shall extend over the top of the wall plate to the outer edge of such plate and shall not be compressed. This reduction of insulation from the requirements of Section R402 shall be limited to 500 square feet (46 m²) or 20 percent of the total insulated attic and sloped ceiling area, whichever is less. This reduction shall not apply to the *U*-factor alternative approach in Section R402.1.4 and the Total UA alternative in Section R402.1.5.

delete and replace R402.2.3 Eave baffle.

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

The baffle shall be installed to the outer edge of the exterior wall top plate so as to provide maximum space for attic insulation coverage over the top plate. Where soffit venting is not

continuous, baffles shall be installed continuously to prevent ventilation air in the eave soffit from bypassing the baffle.

delete and replace **R402.2.4 Access hatches and doors.**

Access hatches and doors from conditioned spaces to unconditioned spaces such as attics and crawl spaces shall be weatherstripped and insulated to the same R-value required by Section R402 for the wall or ceiling in which they are installed. Access shall be provided to all equipment that prevents damaging or compressing the insulation. A wood-framed or equivalent baffle or retainer is required to be provided when loose-fill insulation is installed, the purpose of which is to prevent the loose-fill insulation from spilling into the living space when the attic access is opened, and to provide a permanent means of maintaining the installed R-value of the loose-fill insulation.

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

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

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

Steel-frame ceilings, walls, and floors shall comply with the U-factor requirements of Table R402.1.2.1. The calculation of the U-factor for steel-framed ceilings and walls in an envelope assembly shall be determined in accordance with AISI S250 as modified herein.

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

delete **TABLE R402.2.6**

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

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

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

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

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

is insulated in accordance with Sections R402.1.2.1 and R402.2.8.

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

Slab-on-grade floors with a floor surface less than 12 inches (305 mm) below grade shall be insulated in accordance with Table R402.1.2.1. The insulation shall extend downward from the top of the slab on the outside or inside of the foundation wall. Insulation located below grade shall be extended the distance provided in Table R402.1.2.1 by any combination of vertical insulation, insulation extending under the slab or insulation extending out from the building. Insulation extending away from the building shall be protected by pavement or by not less than 10 inches (254 mm) of soil. The top edge of the insulation installed between the *exterior wall* and the edge of the interior slab shall be permitted to be cut at a 45-degree (0.79 rad) angle away from the *exterior wall*. Slab-edge insulation is not required in jurisdictions designated by the *code official or authority having jurisdiction*, where one exists, as having a very heavy termite infestation.

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

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

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

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

delete and replace R402.3 Fenestration.

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

delete and replace R402.3.2 Glazed fenestration SHGC.

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

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

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

delete and replace R402.3.3 Glazed fenestration exemption.

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

apply to the *U*-factor alternative approach in Section R402.1.4 and the Total UA alternative in Section R402.1.5.

delete and replace R402.3.4 Opaque door exemption.

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

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

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

Exception: *sunrooms and conditioned garages with thermal isolation* and enclosing *conditioned space*, the fenestration *U*-factor shall not exceed 0.27 and the *skylight U*-factor shall not exceed 0.41.

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

delete and replace R402.4 Air leakage.

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

delete and replace R402.4.1 Building thermal envelope.

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

delete and replace R402.4.1.1 Installation.

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

delete and replace TABLE R402.4.1.1

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

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
General conditions and appropriate materials for air barriers	A continuous, durable air barrier shall be installed in the building envelope. Breaks or joints in the air barrier shall be sealed. The air barrier should be continuous and be durably connected to all penetrations, windows and other (structural)	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.

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

		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 and slab foundations	<p>Exposed earth in unvented crawl spaces shall be covered with a Class I vapor retarder/air barrier in accordance with Section R402.2.10 with overlapping joints taped in accordance with Section R402.2.10.</p> <p>Penetrations through concrete foundation walls and slabs shall be air sealed.</p> <p>Class 1 vapor retarders shall not be used as an air barrier on below-grade walls and shall be installed in accordance with Section R702.7 of the <i>International Residential Code</i>.</p>	<p>Where provided instead of floor insulation, vapor barrier shall be installed in accordance with Section R402.2.10.</p> <p>Conditioned basement foundation wall insulation shall be installed in accordance with Section R402.2.8.</p> <p>Slab-on-grade floor insulation shall be installed in accordance with Section R402.2.10.</p>
Shafts, penetrations	<p>Duct and flue shafts, and other penetrations to exterior or unconditioned space shall be sealed to allow for expansion, contraction, and mechanical vibration.</p> <p>Utility penetrations of the air barrier shall be caulked, gasketed or otherwise sealed and shall allow for expansion, contraction of materials and mechanical vibration.</p> <p>Doors or hatches in knee walls opening to exterior or unconditioned space shall be insulated and gasketed.</p>	<p>Insulation shall be fitted tightly around utilities passing through shafts and penetrations in the building thermal envelope to maintain required <i>R</i>-value.</p>

(continued)

TABLE R402.4.1.1—continued
AIR BARRIER AND INSULATION INSTALLATION

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

	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.	junctions with outside walls and at the top pressure plane of the house.
HVAC register boots	HVAC register boots that penetrate building thermal envelope shall be sealed to the subfloor or drywall.	—
Concealed sprinklers	When required to be sealed, concealed fire sprinklers shall only be sealed in a manner that is recommended by the manufacturer. Caulking or other adhesive sealants shall not be used to fill voids between fire sprinkler cover plates and walls or ceilings.	—
Fireplace	A durable air barrier shall be installed in contact with insulation. Fireplaces shall have compression closure doors and combustion air supplied from the outdoors.	—

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

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

The *building* or dwelling unit shall be tested *and* verified as having an air leakage rate not exceeding two (2) air changes per hour or 0.15 CFM50/Sq. Ft. Building Shell area of all six sides of the building. Testing shall be conducted in accordance with **ANSI/RESNET/ICC 380, ASTM E779 or ASTM E1827** and reported at a pressure of 0.2 inches w.g. (50 Pascals) for buildings up to five (5) stories of height above grade, and at 75 Pascals for buildings six (6) stories and taller. Testing and verification shall be conducted by an applicable Building Performance Institutes (BPI) Professional, a Home Energy Rating System (HERS) Energy Rater, HERS Field Inspector, or a Vermont Department of Public Service approved air leakage tester. A written report of the results of the test shall be signed by the party conducting the test. Testing shall be performed at any time after creation of all penetrations of the *building thermal envelope*.

During testing:

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

5. Heating and cooling systems, where installed at the time of the test, shall be turned off.
6. Supply and return registers, where installed at the time of the test, shall be fully open.
7. Plumbing and drainage traps shall be filled with water as normally found, but not otherwise sealed.

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

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

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

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

New wood-burning fireplaces shall have tight-fitting doors and outdoor combustion air. Where using tight-fitting doors on factory-built fireplaces *listed* and *labeled* in accordance with UL 127, the doors shall be tested and *listed* for the fireplace. Where using tight-fitting doors on masonry fireplaces, the doors shall be listed and labeled in accordance with UL 907 2019.

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

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

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

The area-weighted average maximum *fenestration* U-factor permitted using tradeoffs from Section R402.1.5 or R405 shall be 0.27 for *vertical fenestration*, and 0.41 for skylights.

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

add **R402.7.1 General.**

New detached one- and two-family dwellings, and multiple single-family dwellings (townhouses) with not less than 600 square feet (55.74 m²) of roof area oriented between 110 and 270 degrees of true north shall comply with Section R407.5.

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.

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 in height above 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 1 1/4 inches (32 mm).

add R402.7.7 Roof load documentation.

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

add R402.7.8 Interconnection pathway.

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

add R402.7.9 Electrical service reserved space.

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

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

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

add R402.7.11 Construction documentation certificate.

A permanent certificate, indicating the solar-ready zone and other requirements of this section, shall be posted near the electrical distribution panel, water heater or other conspicuous location by the builder or registered design professional.

add R402.8 Tiny houses.

Tiny Houses as defined in Chapter 2 must comply with the envelope, insulation and fenestration requirements below. All other code provisions are still required with the exception that the mechanical ventilation system is not required to be a *balanced ventilation system* and may be exhaust-only.

Tiny houses require the following:

- ceiling flat attic U-0.033 (R-30);
- ceiling slope U-0.04 (R-24);
- above grade walls U-0.08 (R-13);
- frame floors U-0.05 (R-21);
- basement/crawl space walls R-20 continuous (ci) or R13+10ci;
- slab on grade R-20 for 4' on edge or under, OR R-15,4'(edge) + R-15 (under entire slab);
- heated slab on grade R-20,4' (edge) + R-15 (under entire slab);

- windows U-0.27;
- doors U-0.37;
- air leakage 0.15 CFM50/Sq. Ft. of Building Shell (~2 ACH50);
- ducts inside thermal boundary.

Compliance with all other provisions of this code is required.

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

SECTION R403 SYSTEMS

delete and replace **R403.1.1 Programmable thermostat.**

The thermostat controlling the primary heating or cooling system of the *dwelling unit* shall be capable of controlling the heating and cooling system on a daily schedule to maintain different temperature set points at different times of the day and different days of the week. This thermostat shall include the capability to set back or temporarily operate the system to maintain *zone* temperatures down to 55°F (13°C) or up to 85°F (29°C). The thermostat shall initially be programmed by the manufacturer with a heating temperature set point no higher than 70°F (21°C) and a cooling temperature set point no lower than 78°F (26°C). Adjustments to these settings for elderly, disabled or those with special needs is permissible.

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

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

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

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

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

delete and replace **R403.3 Ducts.**

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

delete **R403.3.1 Ducts located outside conditioned space.**

add **R403.3.1 Duct placement.**

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

delete **R403.3.3 Duct testing.**

delete **R403.3.4 Duct leakage**

delete **R403.3.5 Building cavities**

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

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

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

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

delete and replace **R403.5.1.1 Circulation systems.**

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

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

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

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

R403.6 Mechanical ventilation.

Buildings and *dwelling units* shall be provided with ducted balanced mechanical ventilation that meets the requirements of the *International Residential Code* or *International Mechanical Code*, as applicable, or with other approved means of ventilation. Except for mechanical ventilation systems designed for continuous operation, outdoor air intakes and exhausts shall have automatic or gravity dampers that close when the ventilation system is not operating.

delete and replace **R403.6.1 Heat or energy recovery ventilation.** Dwelling units shall be provided with a heat recovery or energy recovery ventilation system. The system shall be balanced with a minimum sensible recovery efficiency (SRE) of 75 percent at 32°F (0°C) at a flow greater than or equal to the design airflow.

delete and replace **TABLE R403.6.1**

TABLE R403.6.1
MECHANICAL VENTILATION SYSTEM FAN EFFICACY^a

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

For SI: 1 cfm = 28.3 L/min.

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

***add* R403.6.2 Whole-dwelling mechanical ventilation system fan efficacy.**

Fans used to provide whole- dwelling mechanical ventilation shall meet the efficacy requirements of Table R403.6.1 at one or more rating points. Fans shall be tested in accordance with HVI 916 and listed. The airflow shall be reported in the product listing or on the label. Fan efficacy shall be reported in the product listing or shall be derived from the input power and airflow values reported in the product listing or on the label. Fan efficacy for fully ducted HRV, ERV, balanced, and in-line fans shall be determined at a static pressure of not less than 0.2 inch w.c. (49.85 Pa). Fan efficacy for ducted range hoods, bathroom and utility room fans shall be determined at a static pressure of not less than 0.1 inch w.c. (24.91 Pa).

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

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

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

Outdoor heated pools and outdoor permanent spas shall be provided with an insulated vapor-retardant cover of at least R-12 or other *approved* vapor-retardant means.

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

SECTION R404 ELECTRICAL POWER AND LIGHTING SYSTEMS

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

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

delete **R404.1.1 Lighting equipment**

add **R404.1.1 Exterior lighting.**

Exterior lighting for residential buildings shall comply with Sections and C405.5 (Exterior Lighting Power Requirements).4.

Exceptions:

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

delete and replace **R404.1.2 Lighting equipment for multifamily spaces**

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

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

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

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

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

delete **R404.2 Electric resistance heating equipment.**

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

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

Building heating with electric-resistance heating equipment is prohibited.

Exceptions:

1. Replacement of existing electrical resistance units.
2. Limited areas where other heating sources are cost prohibitive or impractical (for example, a small interior space such as a bathroom or stairwell, which is distant from the distribution system).
3. Buildings with cold-climate heat pump(s) as the primary heating system, provided that:
 - a. The supplemental electric-resistance heat is controlled to prevent it from operating at an outside air temperature of 5°F or higher.
 - b. The building has a tested air tightness of less than or equal to 0.15 CFM50/Sq. Ft. of Building Shell (~2 ACH50).
4. Multifamily buildings with heating loads less than or equal to 6.0 Btu/h/ft² at design temperature.

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

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

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

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

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

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

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

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

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

add R404.4 200 Amp Electrical Service.

Each dwelling unit except multifamily units shall be supplied with at least 200 amp electrical service in anticipation of increased electrical services that will need to be provided in the future.

add R404.5 Dwelling electrical meter.

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

Exception: Buildings serving low-income occupants.

add R404.6 Electrical transformers.

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

Exception: The following transformers are exempt:

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

9. Regulating transformers.
10. Sealed and nonventilating transformers.
11. Machine tool transformers.
12. Welding transformers.
13. Grounding transformers.
14. Testing transformers.

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

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

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

SECTION R405

ALTERNATIVE USING REScheckTM SOFTWARE

delete and replace R405.2 Mandatory requirements.

Compliance with this section requires that the applicable provisions in Sections R401.3, R402, R403 and R404 be met, and the building airtightness is less than or equal to 0.15 CFM50/Sq. Ft. of Building Shell (~2 ACH50) tested, and the ventilation system is: balanced, with ECM fan(s), plus greater than or equal to 75-percent SRE.

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

COMPLIANCE ALTERNATIVE”

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

delete and replace R406.2 Mandatory requirements.

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

delete R406.4 ERI-based compliance.

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

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

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

BASE CODE	STRETCH CODE
54	47

delete R406.6.3 Additional documentation.

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

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

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

add R406.6.4 Additional documentation.

The *code official or authority having jurisdiction*, where one exists shall be permitted to require the following documents:

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

SECTION R407 VERMONT STRETCH CODE

delete and replace R407.2 Compliance

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

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

delete R407.2.1 Package Plus Points Approach.

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

delete R407.2.1.2 Required points by building size.

delete TABLE R407.2.1.2

delete R407.2.1.3 Points by Component.

delete TABLE R407.2.1.3

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

delete R407.3 Air Leakage Testing for Stretch Code.

delete R407.4 Electric vehicle charging

delete R407.5 Solar Ready Zone for Stretch Code.

SECTION R408 INSULATION EMBODIED CARBON EMISSIONS

R408.1 Insulation Embodied Carbon

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

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

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

TABLE R408.1.1
INSULATION GLOBAL WARMING POTENTIAL CALCULATION

A	B	C	D	E	F	G (Optional)		H	I
Assembly	Material	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)	Project has sourced Type III - Product-specific Environmental Product Declaration (EPD)	Product Specific Global Warming Potential (kg CO2e /sq.m. RSI-1)	Conversion Factor	GWP Result (kg CO2e)
	List insulation material type from Table 2					Use Default GWP values from Table 2. Leave blank for products where product specific data will be provided.	EPD Declaration Number	Leave blank unless EPDs have been sourced. Use GWP values from product-specific EPDs.	
	Below grade, slab/slab edge		X	1.0	X		X	0.0164	=
	Basement walls		X	1.0	X		X	0.0164	=
	Above grade walls, cavity		X	0.8	X		X	0.0164	=
	Above grade walls, continuous		X	1.0	X		X	0.0164	=
	Roof, flat		X	1.0	X		X	0.0164	=
	Roof, sloped, cavity		X	0.8	X		X	0.0164	=
	Roof, sloped, continuous		X	1.0	X		X	0.0164	=
		Input for basic calculation					Total Insulation GWP (kg CO2e)		
		Inputs for product-specific data					÷ Conditioned Floor Area (ft2)		
		Calculation outputs					OUTPUT: Insulation GWP Intensity (kg CO2e/ ft2)		

TABLE R408.1.2
DEFAULT INSULATION GLOBAL WARMING POTENTIAL VALUES

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

Material	Default Global Warming Potential (kg CO ₂ e /sq.m. RSI-1)
Cellular glass - Aggregate	3.93 ^b
Cellulose - Densepack	-2.10
Cellulose - Blown/loosefill	-1.10
Cork - Board	-6.80
EPS/graphite - Board, unfaced, Type II - 15psi	2.80
EPS/graphite - Board, unfaced, Type IX - 25psi, graphite	3.40
EPS - Board, unfaced, Type I - 10psi	2.80
EPS - Board, unfaced, Type II- 15psi	3.80
EPS - Board, unfaced, Type IX- 25psi	4.80
Fiberglass - Batt, unfaced	0.70
Fiberglass - Blown/loosefill	1.00
Fiberglass - Blown/spray	1.93 ^c
Hemp - Batt	-0.50
HempCrete	-3.00
Mineral wool - Batt, unfaced	1.70
Mineral wool - Blown	1.60
Mineral wool - Board, unfaced, "light" density	3.30
Mineral wool - Board, unfaced, "heavy" density	8.10
Phenolic foam - Board	1.54 ^d
Polyiso - Wall Board	4.10
Polyiso - Roof Board	2.90
SPF – Spray, open cell	1.40
SPF – Spray, closed cell HFO	4.20
SPF – Spray, high density HFO	4.90
SPF – Spray, closed cell HFC	13.10
SPF – Spray, high density HFC	17.00
Straw – Panel	-6.50
Vacuum Insulated Panel	7.40
Wood fiber – Board, unfaced, European	-6.50
Wood fiber – Board, unfaced, North America	-10.30
Wood fiber – Batt, unfaced	-2.40
Wool (Sheep) – Batt	1.00
Wool (Sheep) – Loosefill	0.80
XPS – Board, 25psi HFC	55.50
XPS – Board, 25psi “Low GWP” (HFO/HFC)	4.90

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

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

^c EPD Declaration Number 4788647002.102.1

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

CHAPTER 5

EXISTING BUILDINGS

SECTION R501 GENERAL

delete **R501.2 Existing buildings.**

***add* R501.2 General**

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

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

Additions, alterations, or changes of occupancy to, or relocation of, an existing building, building system or portion thereof shall comply with Section R502, R503, R504 or R505, respectively, in this code. Changes where unconditioned space is changed to conditioned space shall comply with Section R502.

SECTION R502 ADDITIONS

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

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

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

SECTION R503 ALTERATIONS

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

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

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

delete and replace **R503.1.4 Lighting.**

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

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

SECTION R505 CHANGE OF OCCUPANCY OR USE

delete and replace **R505.2 General.**

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

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

add **R505.2.1 Unconditioned space.**

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

CHAPTER 6 REFERENCED STANDARDS

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

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

R402.4.4

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

R402.4.1.2

E1554/E1554M—E2013: Standard Test Methods for Determining Air Leakage of Air Distribution Systems by Fan Pressurization

R403.3.5

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

R402.4.1.2

ICC

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

Standard reference number	Title	Referenced in code section number
<u>IBC--18</u>	<u>International Building Code®</u>	Table R403.6.1
ICC 400 1-17	Standard on the Design and Construction of Log Structures	Table R402.1.5, Table 402.4.1.1
IECC--09	2009 International Energy Conservation Code®	R406.2
IECC—06	2006 International Energy Conservation Code®	R406.3.1
IFC-15	International Fire Code®	R201.3, R501.4
IFGC—18	International Fuel Gas Code®	R201.3, R501.4
IMC—18	International Mechanical Code®	R201.3, R403.3.2, R403.6, R501.4
IPC—18	International Plumbing Code®	R201.3, R501.4
IPSDC—18	International Private Sewage Disposal Code®	R501.4
IPMC—18	International Property Maintenance Code®	R501.4
IRC— 18	International Residential Code®	R201.3, R402.1.1, R402.2.11, R402.4.4, R403.3.2, R403.6, R501.4

NEMA

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

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

R402.4.6

NFPA

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

31—06 Installation of Oil-Burning Equipment

R305.1, R305.2, R305.3

54—09 National Fuel Gas Code

R305.1, R305.2, R305.3

70—20 National Electrical Code

R501.5

NFRC

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

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

R303.1.3

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

R303.1.3

400—2020 Procedure for Determining Fenestration Product Air Leakage

R402.4.3

RESNET

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

ANSI/RESNET/ICC 301—2019 Standard for the Calculation and Labeling of the Energy Performance of Low-rise Residential Buildings using an Energy Rating Index First Published March 7, 2014 — Republished January 2016

R406.3, R406.6.1

**ANSI/RESNET/ICC 380—2016 Standard for Testing Airtightness of Building Dwelling Unit and
Sleeping Unit Enclosures, Airtightness of Heating and Cooling Air Distribution Systems, and
Airflow of Mechanical Ventilation Systems — Republished January 2016**
R402.4.1.2

UL

UL LLC
333 Pfingsten Road
Northbrook, IL 60062

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

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

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



112 State Street
Montpelier, VT 05620

802-828-2811

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

These rules are adopted under 30 V.S.A. § 51. This document shall be known and cited as the 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 “Base Code” that applies statewide, and a “Stretch Code” that is more stringent. The *Stretch Code* applies to all Act 250 development projects and is also available for municipalities that choose to adopt a higher energy standard.

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

Chapter 6 Referenced Standards. The code contains numerous references to standards that are used to regulate materials and methods of construction. Chapter 6 contains a comprehensive list of all standards that are referenced in the code. The standards are part of the code to the extent of the reference to the standard. Compliance with the referenced standard is necessary for compliance with this code. By providing specifically adopted standards, the construction and installation requirements necessary for compliance with the code can be readily determined. The basis for code compliance is, therefore, established and available on an equal basis to the *code official, or 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
<u>ATWHP</u>	<u>Air-to-water heat pump</u>
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
<u>CFA</u>	<u>Conditioned floor area</u>
cfm	Cubic feet per minute
cfm/ft ²	Cubic feet per minute per square foot
ci	Continuous insulation
COP	Coefficient of performance
<u>CO₂e</u>	<u>Carbon dioxide equivalent</u>
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
<u>ECM</u>	<u>Electronically commutated motor</u>
EER	Energy efficiency ratio
EF	Energy factor
ERI	Energy rating index
<u>EPD</u>	<u>Environmental product declaration</u>

<i>F</i> -factor	See Chapter 2—Definitions
FDD	Fault detection and diagnostics
FEG	Fan efficiency grade
FL	Full load
ft ²	Square foot
<u>GPF</u>	<u>Gallons per flush</u>
GPM	Gallons per minute
<u>GSHP</u>	<u>Ground-source heat pump</u>
<u>GWP</u>	<u>Global warming potential</u>
HDD	Heating degree days
HERS	Home Energy Rating System
hp	Horsepower
<u>H/ERV</u>	<u>Heat or energy recovery ventilation</u>
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
<i>R</i> -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
<u>SRE</u>	<u>System recovery efficiency</u>
SRI	Solar reflectance index
SWHF	Service water heat recovery factor
<i>U</i> -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 20202023 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 $3.4 \text{ Btu/h} \cdot \text{ft}^2$ (10.7 W/m^2) or 1.0 watt/ft^2 (10.7 W/m^2) of floor area. Code that is applicable throughout Vermont, except for space conditioning purposes.~~
- ~~2. **Unconditioned Buildings**. Those that do not contain conditioned space.~~
- ~~3. **Mobile homes**. Homes projects subject to Title VI of the National Manufactured Housing Construction and Safety Standards 10 V.S.A. Chapter 151 (Act of 1974 (42 U.S.C. §§ 5401–5426). On-site constructed basements 250), 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 owner in fact directs the details of construction with regard in any municipalities that have adopted the more stringent "Stretch Code."~~

~~All *Base Code* requirements shall be met in addition to the installation of materials not requirements in the *Stretch Code* section R407 in order to be in compliance with the RBES, and; *Stretch Code*.~~

~~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.~~

delete and replace R101.8 Compliance options.

There are three thermal efficiency compliance options:

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

3. Home Energy Rating System (HERS): A HERS energy rating that demonstrates compliance with Section 406.4 for the *Base Code* ~~or Section 407.2.2 for the *Stretch Code*. (All HERS Index values in this code are based on REM/Rate version 15.7.)~~ or *Stretch Code* based on REM v16.3.3 or later or Ekotrope version 4.0 or later that is accredited by RESNET at <https://www.resnet.us/providers/accredited-providers/hers-software-tools/>.

PART 2—ADMINISTRATION AND ENFORCEMENT

SECTION R102 **ALTERNATIVE MATERIALS, DESIGN AND** **METHODS OF R103** **CONSTRUCTION AND EQUIPMENT DOCUMENTS**

delete and replace **R102R103.1 General.**

~~The provisions of this code are not intended to prevent the installation of any material or to prohibit any design or method of~~Where required, construction not specifically prescribed documents, technical reports and other supporting data shall be submitted in one or more sets, or in a digital format where allowed by this code.~~the code official or other authority having jurisdiction, where one exists, may approve an alternative material, design or method of with each application for a permit. The construction upon application of documents and technical reports shall be prepared by a registered design professional where required by the owner or statutes of the owner's authorized agent jurisdiction in which the project is to be constructed. Where special conditions exist, 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~~authority having jurisdiction, where one exists, is authorized to require necessary construction~~is not approved, documents to be prepared by a registered design professional.~~

Exception: ~~The code official or other authority having jurisdiction shall respond, where one exists, is authorized to waive the applicant, in writing, stating requirements for construction documents or other supporting data if 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 determines they are not necessary 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 confirm 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 **R103.2 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 <http://www.rerc-vt.org/advanced-wood-heating-system/eligible-equipment-inventory-eei>.

~~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 · m² 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 FLOOR/CEILING AREA**. The horizontal projection sum 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*. Wall height shall be measured from the finished floor of the *dwelling unit* to the underside of the floor above.~~

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

~~*delete and replace* **CONTINUOUS AIR BARRIER-BUILDING SITE**. A ~~combination~~contiguous area of materials and assemblies~~and that prevents~~is under the passage~~ownership or control 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 from a heated water supply pipe to the heated water fixture upon user demand via push button at the fixture~~entity~~.~~

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

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

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

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

~~add DEMAND RESPONSE SIGNAL.~~ A signal that indicates a price or a request to modify electricity ~~and a refrigeration cycle~~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 move heat from~~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 ambient air~~centerline for each EV charging parking space. ~~A conduit or other unobstructed path to heat water instead of directly heating water~~easily run a future wire to the parking spot shall also be provided.

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

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

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

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

~~delete and replace 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 5565 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 LEVEL 1 ELECTRIC VEHICLE CHARGING.** Level ~~delete~~ **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 LEVEL 2 ELECTRIC VEHICLE CHARGING.**~~

~~**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 www.census.gov).~~

~~**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 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 in nature and which are adjacent vertically or horizontally. If built side-by-side, at least one of the following is true: (1) they do not have a wall that extends from ground to roof, (2) they share a heating system, or (3) they have interstructural public utilities such as water supply/sewage disposal.~~

~~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 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 they are 50 percent or greater opaque in surface area.~~

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

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

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

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

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

delete RENEWABLE ENERGY SOURCES.

add RENEWABLE ENERGY SOURCES. Means **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~~ asutilizes 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 mullied 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 ($\text{Btu/h} \cdot \text{ft}^2 \cdot ^\circ\text{F}$) [$\text{W}/(\text{m}^2 \cdot \text{K})$].~~

~~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 • ft² • °F) [W/(m² • 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. ~~4.~~ 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-m²) 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 $\text{h} \cdot \text{ft}^2 \cdot ^\circ\text{F}/\text{Btu}$ 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 **304R304.1 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 balanced whole house ventilation system with minimum 75 SRE and 1.2 cfm/Watt 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

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 standards referenced above, or Section 304.6.1.1.

Exceptions: 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 **304R304.6** and must meet all other requirements listed in Section **304R304.3**, as applicable.

**TABLE 304.2
MINIMUM REQUIRED LOCAL EXHAUST**

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

~~delete and replace 304.6.1.1 Minimum outdoor air.~~

~~Automatic operation of the R304.3 Whole house balanced ventilation.~~

~~Every home and dwelling unit built to RBES shall be mechanically ventilated by a whole house balanced ventilation system as defined in Chapter 2.~~

~~delete and replace R304.5.2 Fan power consumption.~~

~~Single-port ventilation equipment shall not reduce exceed 50 watts as listed by the manufacturer on the fan motor or as listed in accordance with HVI 911. Power used for lights, sensors, heaters, timers or night lights shall not be included in the determination of power consumption.~~

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

~~Whole house ventilation system fans shall be installed according to the manufacturer's installation instructions and shall have the manufacturer's fan flow ratings as listed in accordance with HVI 911. Unless the whole house system is tested according to procedures in Section R304.6.1, the minimum continuous ventilation rate below 15 cfm of outdoor airflow 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

<u>NUMBER OF BEDROOMS</u>	<u>MINIMUM NOMINAL RATED TOTAL FAN CAPACITY^a (at 0.1 inches w.g.)</u>	<u>MINIMUM NUMBER OF FANS TO MEET WHOLE HOUSE AIRFLOW RATES</u>
<u>1</u>	<u>50 cfm</u>	<u>Centrally ducted systems—1</u>
<u>2</u>	<u>75 cfm</u>	<u>Centrally ducted systems—1</u>
<u>3</u>	<u>100 cfm</u>	<u>Centrally ducted systems—1</u>
<u>4</u>	<u>125 cfm</u>	<u>Centrally ducted systems—1</u>
<u>5</u>	<u>150 cfm</u>	<u>Centrally ducted systems—1</u>
<u>Homes > 3,000 ft²</u>	<u>cfm = 0.05 · ft²</u>	<u>Centrally ducted systems—1</u>

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

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

~~delete and replace R304.6.1 Testing option.~~

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

~~delete and replace R304.8 Controls.~~

~~Whole house ventilation systems (balanced 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~~ **304R304.9.3 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 JointsR304.11 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 purposeclothes dryers capable of applying the provisions of Section 305 to fuel gas, kerosene and oil burning equipment, buildings constructedexhausting in compliance with the RBES~~excess of 400 cubic feet per minute (0.19 m³/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 fireplaces~~the 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 *Stretch Code*. *Stretch Code* requires compliance with all Base Code requirements throughout RBES, plus achieving the additional points specified in Table R402.1.2.2, following all requirements of the following sections, and complying with Section R407 Vermont Stretch Code.~~

~~delete and replace R401.2 Compliance.~~

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

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

~~delete and replace R401.3 Certificate of Compliance (Mandatory).~~

~~A certification 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/m² or 1.0 watt/ft²). 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~~ 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.**

~~1.~~ 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	Package 2	Package 3	Package 4	Package 5
		"Standard"	"SIPS"	"Thick Wall"	"Cavity Only"	"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, 4 ft OR R10	R-15, 4 ft OR R10 perimeter	R-10, 4 ft	R-15, 4 ft OR R10	
		perimeter + R-7.5 under entire rest of slab	+ R-7.5 under entire rest of slab		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 ^j	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-0.023: R-44	
Above Grade Wall ^b	U-0.033: R-21+12ci ^e OR R-23 ^f +10ci OR R-15+15ci OR R-28 8 1/4" ci (SIP)	Construct log home walls to ICC 400—2022 Standard on the Design and Construction of Log Structures or Table R402.1.6
Frame Floor	U-0.027: R-38	

<u>Basement/Crawl^c</u>	<u>R-20ci</u> <u>OR</u> <u>R13+10ci</u>
<u>Slab, on grade^d</u>	<u>R-20,4' (edge)</u> <u>OR</u> <u>R-15,4'(edge) + R-15 (under entire slab)</u>
<u>Slab, on grade, Heated^d</u>	<u>R-20,4' (edge) + R-15 (under entire slab)</u>
<u>Windows</u>	<u>U-0.27</u>
<u>Skylights</u>	<u>U-0.41</u>
<u>Doors</u>	<u>U-0.37</u>
<u>Air Leakage</u>	<u>0.15 CFM50/Sq. Ft. of Building Shell (~2 ACH50)</u>
<u>Ducts</u>	<u>Inside thermal boundary</u>

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 + 10ci" means R-13 cavity insulation plus R-10 continuous insulation. When used, continuous insulation values shall
~~b. f. R-23 could be at least R-5.~~
- met with dense-pack cellulose or spray foam in a 2x6 cavity. g. 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.
- ~~c. 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.)~~
- d. ~~h.~~ "ACH50" = air changes per hour at 50 Pascals building pressure as measured with a blower door
- e. "CFA" = conditioned floor area
- f. See Table R402.4.1.1 for further details.
- ~~Insulation systems complying with Table R402.1.4 shall be deemed to comply. 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 the R-value requirements of Table 402.1.2-1a blower door.~~
- i. Installing R-38 (U-value 0.023) over 100 percent of the ceiling sloped area requiring insulation shall be deemed to satisfy the requirement for R-44 where there is insufficient space in framing rafters for more than R-38. 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 m²) and 1,250-2,500 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	<u>BASE CODE</u> REQUIRED POINTS	STRETCH CODE REQUIRED POINTS
<u>Alterations</u>	<u>0</u>	<u>0</u>
<u>Additions < 250 square feet</u>	<u>0</u>	<u>0</u>
<u>Additions 250 to 500 square feet</u>	<u>1</u>	<u>2</u>
<u>Addition 501 to 1,000 square feet</u>	<u>2</u>	<u>3</u>
<u>Addition > 1,000 square feet</u>	<u>3</u>	<u>4</u>
Multifamily <2000 <u>1,250</u> square feet	4 points <u>2</u>	3
<2000 <u>Multifamily 1,250 to 2,500</u> square feet	4	5 points
<u>< 2,500 square feet</u>	<u>5</u>	<u>7</u>
2000 <u>2,500</u> to 4000 <u>4,000</u> square feet	7 points	12
>4000 <u>4,000</u> 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	Slab <u>Slab (on or below grade, heated or unheated)</u>	R-40 <u>R-20 around perimeter and below entire slab</u> OR^b	4 <u>2</u>
		<u>R-25 around perimeter and below entire slab</u>	<u>3</u>
	Walls—Upgraded	Above-grade walls R-20+12 (35 double stud or similar (cavity and continuous) (U-factor maximum 0.033) 2x8 wall assembly) (Not available for base package 3) OR^b	2 <u>1</u>
	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 <u>2</u>
		<u>R-48 SIP 10 1/4" XPS or similar (cavity and continuous) (U-0.021 wall assembly)</u>	<u>3</u>
	Ceiling	<u>R-80 attic flat / flats (U-0.013) and R-60 sloped slopes, vaulted and cathedral (U-.018)</u>	<u>1</u>
	Floors - Exposed	<u>R-49 (U-0.021)</u>	<u>1</u>
	<u>Windows- Triple Pane</u>	Average U-factor ≤ 0. 27 <u>25</u> OR^b	<u>1</u>
		Average U-factor ≤ 0. 22 <u>21</u> OR^b	<u>2</u>
		Average U-factor ≤ 0.18 OR^b	<u>3</u>
		Average U-factor ≤ 0.15	<u>4</u>
	<u>Doors - Exterior</u>	<u>U-0.26</u>	<u>1</u>
<u>Air Leakage</u>	<u>Tight</u>	<u>Tested to ≤0.11 CFM50/Sq. Ft. of Building Shell (6-sided) (~1.5 ACH50) OR^b</u>	<u>1</u>
	<u>Tighter</u>	<u>Tested to ≤0.07 CFM50/Sq. Ft. of Building Shell (6-sided) (~1.0 ACH50) OR^b</u>	<u>2</u>
	<u>Tightest</u>	<u>Tested to ≤0.03 CFM50/Sq. Ft. of Building Shell (6-sided) (~0.5 ACH50)</u>	<u>3</u>
<u>Air Leakage and Mechanical Ventilation</u>	Pre-Drywall <u>Better Heat Recovery OR</u>	ACH50 is tested with blower door after full insulation/primary air barrier completion but before insulation is fully enclosed/covered OR^b <u>Balanced ventilation with ECM fans and ≥80% SRE and ≥1.2 cfm/watt OR^b</u>	
	Tight <u>Better Electrical Efficiency</u>	ACH50 ≤ 2.0 and <u>Balanced ventilation with ECM^e fans and ≥70% SRE^d for HRV^e, ≥65% SRE^d for ERV^e OR^b SRE, and ≥2.0 cfm/watt</u>	
	Very-Tight <u>Mechanical Ventilation Testing</u>	ACH50 ≤ 1.0 and <u>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</u>	<u>4</u> <u>1</u>

		<u>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.</u>	
Heating and Cooling ^a	Basic <u>Equipment</u>	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
	<u>Cold Climate Air Source Heat Pump</u>	<u>Whole building heating /cooling is ENERGY STAR v.6 labeled^d</u>	<u>5</u>
	<u>Ground Source Heat Pump</u>	<u>Whole building heating /cooling is Ground Source Heat Pump (GSHP), closed loop and COP ≥ 3.3</u>	<u>10</u>
	<u>Air-to-Water Heat Pump</u>	<u>Whole building heating/cooling is Air-to-Water Heat Pump (ATWHP) COP ≥ 2.5</u>	<u>5</u>
	Advanced <u>Wood Heating System</u>	Whole building heat/cool heating/cooling is (1) NEEP listed air source heat pump combinationⁱ, (2) GSHPⁱ, closed loop and COP ≥ 3.3, (3) ATWHP^f COP ≥ 2.5 and 120F design temp, (4) Advanced wood heating system from http://www.nerc-vt.org/advanced-wood-heating-system/eligible-equipment-inventory-eei	35
	<u>Low-Temperature Hydronic Distribution System</u>	<u>Hydronic distribution system designed to meet building peak heating demand with 120-degree water</u>	<u>1</u>
	<u>Demand Responsive Thermostats</u>	<u>All electric heating thermostats provided with demand responsive controls</u>	<u>1</u>
Water	<u>Heat Pump</u> 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	43
	<u>Heat Pump</u> Advanced	ENERGY STAR advanced: Electric [EF 0.67 for ≤ 55 gal; EF 0.77 for > 55 gal] OR^b Heat Pump Water Heater UEF ≥ 2.00 for ≤ 55 gal; EF ≥ 2.20 for > 55 gal] <u>3.30</u>	25
	Low flow	All showerheads ≤ 1.75 gpm ^g <u>gpm</u> , all lav-lavatory faucets ≤ 1.0 gpm ^g <u>gpm</u> , and all toilets ≤ 1.28 gpf ^g <u>gpf</u> OR^b	1

	Certified ^k <u>Certified</u> ^e	Certified water efficient design per WERS, WaterSense, or RESNET ^{H2O} <u>RESNET</u> <u>HERS</u> _{H2O}	2
	Drain heat recovery	Drain water heat recovery system on <i>primary showers</i> and tubs	1
	<u>Recirculation</u> User-demand	Controlled hot water recirculation system with user-demand via push-button for furthest fixtures	1
	<u>Pipe Insulation</u>	<u>All service hot water piping is insulated to at least R-4 from the hot water source to the fixture shutoff.</u>	<u>1</u>
	<u>Demand Responsive Controls</u>	<u>Electric storage water heater(s) provided with demand responsive controls</u>	<u>1</u>
	<u>Point of Use Electric Water Heater</u>	<u>Remote fixtures requiring hot water supplied from a localized source of hot water with no recirculating system.</u>	<u>1</u>
Renewables	Solar Ready ^{Hot} <u>Water</u>	Home is Solar Ready per R407.5, OR ^b <u>Solar hot water system designed to meet at least 50% of the annual hot water load</u>	4 <u>2</u>
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. <u>installed, minimum</u> 5 circuits and homeowner access to data	1
	EV Ready <u>Radon Mitigation System</u>	Level 2 electric vehicle charger ready per R407.4 ¹ <u>Radon mitigation designed to https://www.epa.gov/radon/radon-standards-practice is installed and documented to homeowner</u>	1
	<u>Energy Model</u>	<u>Building energy model with projected annual energy use and costs developed, used in design and construction decisions, and provided to homeowner</u>	<u>1</u>
	Battery	Min. <u>Minimum</u> 6 kWh grid-connected dispatchable demand-response-enabled battery backup	1
	<u>Advanced Lighting Controls</u>	<u>All lighting for at least 50% of floor area is controlled and/or continuously dimmed based by occupancy, daylight, load shedding, and/or schedule.</u>	<u>2</u>
<u>Insulation Embodied Carbon</u>	<u>Global Warming Potential (GWP)/square</u>	<u>Report the global warming potential (GWP) impact of project insulation materials as described in Section R408. Use calculation</u>	<u>1</u>

<u>Emissions</u>	<u>footage (kg CO2e/ft²)</u>	<u>table R408.1.1 to summarize insulation GWP intensity (kg CO2e/ft²) 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</u>	
	<u>Global Warming Potential (GWP)/square footage (kg CO2e/ft²)</u>	<u>Demonstrate a calculated insulation GWP intensity (kg CO2e/ft²) less than 0.5. Product-specific EPDs may be used in place of default values, subject to requirements in R408. OR^b</u>	<u>2</u>
		<u>Demonstrate a calculated insulation GWP intensity (kg CO2e/ft²) less than 0. Product-specific EPDs may be used in place of default values, subject to requirements in R408.</u>	<u>3</u>
<u>Multifamily Buildings</u>	<u>Efficient Elevator Equipment</u>	<u>Elevators in the building qualify with Energy Efficiency Class A per ISO 25745-2, Table 7.</u>	<u>1</u>
	<u>Residential Kitchen Equipment</u>	<u>All dishwashers, refrigerators, and freezers comply with the most recent ENERGY STAR Most Efficient label.</u>	<u>2</u>
	<u>Water Heating System Submeters</u>	<u>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.</u>	<u>1</u>

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.~~

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.

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 R402.1.2.43. The building must still comply with ~~Table~~Tables R402.1.2.1, R402.1.2 and Table R402.1.2, 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 ~~≤ 2.0~~less than or equal to 0.15 CFM50/Sq. Ft. of Building Shell (~2 ACH50) tested, and (b) ~~the ventilation system is: Balanced; with ECM fan(s) plus ≥ 70% SRE for HRV, or ≥ 65% SRE for ERV.~~complies with section R304.

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

1. Alterations.

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

delete and replace TABLE R402.1.4

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

FENESTRATION U-FACTOR	SKY-LIGHT SKYLIGHT U-FACTOR	CEILING U-FACTOR	FRAME WALL U-	MASS WALL U-	FLOOR U-FACTOR	BASEMENT WALL U-FACTOR	CRAWL SPACE WALL	SLAB & <u>ON</u> <u>GRADE &</u>
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			FACTOR	FACTOR ^b			U-FACTOR	UNHEATED SLAB U-FACTOR & DEPTH
0.27	0.5541	0.022020	0.044033	0.060	0.030027	0.03505	0.03505	0.06605, 4 ft

For SI: 1 foot = 304.8 mm.

- Nonfenestration *U*-factors shall be obtained from measurement, calculation or an approved source.
- When more than half the insulation is on the interior, the mass wall *U*-factors shall be a maximum of 0.057.
- 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 <i>U</i> -FACTOR ^b	SKYLIGHT <i>U</i> -FACTOR	MAXIMUM GLAZING AREA ^c <i>CEILING</i> <i>R</i> -VALUE	CEILING <i>R</i> -VALUE LOG WALL ^d	LOG WALL <i>R</i> -VALUE ^e	FLOOR- VALUE ^g BASEMENT/ CRAWL SPACE WALL <i>U</i> -VALUE ^f	BASEMENT/ CRAWL SPACE WALL <i>U</i> -VALUE ^f SLAB <i>R</i> -VALUE & DEPTH	HEATED SLAB <i>R</i> -VALUE & DEPTH ^g	HEATED SLAB <i>R</i> -VALUE ^g AIR LEAKAGE ⁱ	HEATING SYSTEM AFUE ^h
0.3027	0.5541	20%49	49 ≥ 5 in. log	≥ 5" Log38	38R-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.

- U*-factors are maximums, *R*-values are minimums.
- The fenestration *U*-factor column excludes skylights.
- 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.
- 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.
- ~~Or~~Alternatively, insulation sufficient to fill the framing cavity, with R-38 as the absolute maximum.
- Basement walls shall be R-15 continuous insulation or R-20 cavity full basement height.
- 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 1 Ceilings with attic spaces.**

Where Section R402.1. would require R-49 insulation requirements (Prescriptive). In addition to the requirements of Section R402.1, in the ceiling, installing R-38 over 100 percent of the ceiling area requiring insulation shall meet the specific requirements of Sections R402.2.1 through 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. Where Section R402.1 would require R-60 insulation in the ceiling, 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. This reduction shall not apply to the U-factor alternative approach in Section R402.2.1.4 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 insulation levels above R-~~30~~38 and 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 R-~~30~~38. Insulation shall extend over the top of the wall plate to the outer edge of such plate and shall not be compressed. This reduction of insulation from the requirements of Section R402.1.2 shall be limited to 500 square feet (46 m²) or 20 percent of the total insulated attic and sloped ceiling area, whichever is less. 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 ana 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% foaming factors the AISI S250 shall be used without any modifications.
4. Where the steel-framed wall contains other than standard C-shape framing members the AISI S250 calculation option for other than standard C-shape framing is permitted to be used.

~~delete TABLE R402.2.6~~

~~delete and replace R402.2.8 Floors.~~

Floor framing-cavity insulation 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.~~

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

~~delete and replace R402.3.4 Opaque door exemption.~~

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

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

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

~~Exception: For sunrooms and conditioned garages with thermal isolation and enclosing conditioned space, the maximum fenestration U-factor shall be not exceed 0.4527 and the maximum skylight U-factor shall not exceed 0.5541.~~

~~New fenestration separating the 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 Sections R402.4.1 through R402.4.4.5 this Section.~~

delete and replace R402.4.1 Building thermal envelope.

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

delete and replace R402.4.1.1 Installation.

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

delete and replace **TABLE R402.4.1.1**

TABLE R402.4.1.1
AIR BARRIER, AIR SEALING AND INSULATION ~~INSTALLATION~~^aINSTALLATION

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
General conditions and appropriate materials for air barriers	<p>A continuous, durable air barrier shall be installed in the building envelope.</p> <p>The exterior thermal envelope contains a continuous, durable air barrier.</p> <p>Breaks or joints in the air barrier shall be sealed.</p> <p>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 <u>≥greater than or equal to</u> 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 <u>in accordance with</u> 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 <u>≥greater than or equal to</u> 6 mil. Materials meeting ASTM E2357 Standard Test Method for Determining Air Leakage of Air Barrier Assemblies are acceptable.</p>	<p>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.</p>
Dropped ceilings/soffits	<p>The air barrier in any dropped ceiling/soffit shall be aligned with (in contact with) the insulation and any gaps in the air barrier shall be sealed. Access openings, drop down stairs<u>downstairs</u> or knee wall doors to unconditioned attic spaces shall be sealed, insulated and gasketed.</p>	<p>The insulation in any dropped ceiling/soffit shall be aligned with (in contact with) the air barrier and shall be enclosed on five sides and in contact with a durable, interior air barrier. A top-side air barrier is</p>

		not required in a flat attic.
Framing junctions and cavities	<p>The junction of the foundation and sill plate shall be sealed. The junction of the top plate and the top of exterior wall sheathing shall be sealed.</p> <p>Knee walls shall be air sealed. When part of the thermal envelope, knee wall insulation shall be enclosed on all six sides and in contact with a durable, interior air barrier.</p>	<p>Cavities within corners and headers of frame walls shall be insulated by completely filling the cavity with a material having a <u>minimum</u> thermal resistance of R-3 per inch minimum.</p> <p>Exterior thermal envelope insulation for framed walls shall be installed in substantial contact and continuous alignment with the air barrier.</p> <p>Exterior thermal envelope insulation for framed walls shall be enclosed on all six sides and in contact with a durable, air barrier.</p>
Windows, skylights and doors	The space between window/door jambs and framing, and skylights and framing shall be sealed with minimally-expanding foam.	—
Rim joists	<p>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.</p> <p>When air permeable insulation is installed, a durable, interior air barrier shall be installed at the rim joist.</p>	Rim joists shall be insulated and air sealed so that the insulation <u>maintains permanent contact with the exterior rim board.^b</u>
Floors (including above garage and cantilevered cantilevered 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.
<u>Basement crawl space walls and slab foundations</u>	<p>Exposed earth in unvented crawl spaces shall be covered with a Class I vapor retarder <u>air barrier in accordance with Section R402.2.10</u> with overlapping joints taped. <u>in accordance with Section R402.2.10.</u></p> <p><u>Penetrations through concrete foundation walls and slabs shall be air sealed.</u></p> <p><u>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.</u></p>	<p>Where provided instead of floor insulation, vapor barrier shall be permanently attached to the crawlspace walls <u>installed in accordance with Section R402.2.10.</u></p> <p><u>Conditioned basement foundation wall insulation shall be installed in accordance with Section R402.2.8.</u></p> <p><u>Slab-on-grade floor insulation shall be installed in accordance with Section R402.2.10.</u></p>
Shafts, penetrations	Duct shafts, utility penetrations, and flue shafts opening to exterior or unconditioned space shall be sealed. 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 Shafts, penetrations	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" from combustible material and not less than 3" from insulation material, or as required by manufacturer's installation requirements. Duct and flue shafts, 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. Doors or hatches in knee walls opening to exterior or unconditioned space shall be insulated and gasketed.	Recessed light fixtures installed <u>Insulation shall be fitted tightly around utilities passing through shafts and penetrations 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) to maintain required R-value.</u>
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

<u>COMPONENT</u>	<u>AIR BARRIER CRITERIA</u>	<u>INSULATION INSTALLATION CRITERIA</u>
<u>Narrow cavities</u>	<u>Narrow cavities of 1 inch or less that are not able to be insulated shall be air sealed.</u>	<u>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.</u>
<u>Garage separation</u>	<u>Air sealing shall be provided between the garage and conditioned spaces.</u>	<u>Insulated portions of the garage separation assembly shall be installed in accordance with Sections R303 and R402.2.7 and R402.2.7.</u>
<u>Recessed lighting and appliances</u>	<u>Recessed light fixtures installed in the building thermal envelope shall be air sealed in accordance with Section R402.4.5. Recessed light fixtures and other appliances (speakers, exhaust fans, light shafts, etc.) installed in the building thermal envelope shall be ICAT (Insulation Contact and Air Tight) rated, airtight labeled (or “Washington State Approved”) and sealed with a gasket or caulk between the housing and the interior wall or ceiling cover. Fixtures and appliances shall maintain required clearances of not less than $\frac{1}{2}$ inch from combustible material and not less than 3 inches from insulation material, or as required by manufacturer’s installation requirements.</u>	<u>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.</u>
<u>Plumbing and wiring</u>	<u>All holes created by wiring, plumbing or other penetrations in the air barrier assembly shall be air sealed.</u>	<u>Insulation shall be installed to fill</u>

		<u>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.</u>
<u>Shower/tub on exterior wall</u>	<u>Exterior walls adjacent to showers and tubs shall have insulation filling any gaps or voids between tub or shower walls and unconditioned space.</u>	<u>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.</u>
<u>Electrical/phone box on exterior walls</u>	<u>The air barrier shall be installed behind electrical, or communication boxes or air-sealed boxes shall be installed.</u>	<u>Insulation completely fills voids between the box and exterior sheathing.</u>
<u>Common wall</u>	<u>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.</u>	<u>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.</u>
<u>HVAC register boots</u>	<u>HVAC register boots that penetrate building thermal envelope shall be sealed to the subfloor or drywall.</u>	<u>==</u>
<u>Concealed sprinklers</u>	<u>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.</u>	<u>==</u>
<u>Fireplace</u>	<u>A durable air barrier shall be installed in contact with insulation. Fireplaces shall have compression closure doors and combustion air supplied from the outdoors.</u>	<u>==</u>

- 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) for buildings up to five (5) stories of height above grade, and at 75 Pascals for buildings six (6) stories and taller. 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~~ **R402.4.5 Recessed lighting.**

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

Electrical and communication outlet boxes installed in the building thermal envelope 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~~ Sealed Boxes for Electrical and ~~labeled as having~~ 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 **NEMA OS 4**. Electrical and communication outlet boxes shall be installed ~~per the housing and 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)-(I).**

The area-weighted average maximum *fenestration* U-factor permitted using tradeoffs from Section R402.1.5 or R405 shall be 0. ~~30~~ 27 for *vertical fenestration*, and 0. ~~55~~ 41 for skylights.

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

~~add~~ **R402. ~~6~~ Vestibules.**

~~Multifamily buildings 3 stories or less built above a parking garage require a vestibule in accordance with C402.4.7 from the Vermont Commercial Building Energy Standards (CBES).~~

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

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

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. This thermostat shall include the capability to set back or temporarily operate the system to maintain Solar-ready 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.~~

~~The following exceptions are allowed as long as 5-wire connection to thermostat location is provided:~~

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

~~delete and replace R403.1.2 Heat pump supplementary heat~~

~~Heat pumps shall not have integrated supplementary electric-resistance heat other than that provided for frost control. See R404.2 for guidance on electric-resistance heating equipment other than heat pumps.~~

~~delete and replace R403.3.2 Sealing (Mandatory).~~

~~Ducts, air handlers and filter boxes shall be sealed. Joints and seams shall comply with either the *International Mechanical Code* or *International Residential Code*, as applicable.~~

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

~~Ducts shall be pressure tested to determine air leakage by one of the following methods:~~

- ~~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:~~

- ~~1. A structure where the ducts and air handlers are located entirely within the *building thermal envelope*.~~
- ~~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 R403.3.4 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 m²) 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 m²) of conditioned floor area.~~

~~add 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 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 m²) 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.~~

~~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 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 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 will allow shutoff when the outdoor temperature is above 40°F (4.8°C).

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

Residential swimming pools and residential permanent 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 in accordance with 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, 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 permanently installed lighting fixtures shall be high-efficacy lamps. Where multiple replaceable lamps are connected to a permanently installed lighting fixture, the number of lamps is to be used in calculating the percentage.~~

~~add R404.1.2 Lighting equipment for multifamily spaces (Mandatory).~~

~~Multifamily buildings three stories or less with 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 C405.3.2; for uncovered parking areas and drives, see C405.4.2.~~

~~delete and replace R404.2 Electric resistance 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., 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:~~
 - ~~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 ≤ 2.0 ACH50.~~
- ~~4. Multifamily buildings with heating loads ≤ 6.0 Btu/hour/square foot at design temperature.~~

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

~~add 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 Electric Vehicle Charging Parking Spaces in 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: 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.~~

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

TABLE R404.3

REQUIRED ELECTRIC VEHICLE CHARGING PARKING SPACES FOR MULTIFAMILY BUILDINGS (BASE and STRETCH CODE)

NUMBER OF PARKING SPOTS	REQUIRED NUMBER OF EV CHARGING PARKING SPACES
10–25	4
26–50	2
51–75	3
76–100	4
>100	4% of parking spots, rounded up to the nearest whole number

~~modify “**SECTION R405 SIMULATED PERFORMANCE ALTERNATIVE USING RESCHECK™ SOFTWARE (PERFORMANCE)**” to “**SECTION R405 ALTERNATIVE USING RESCHECK™ SOFTWARE**”~~

~~delete and replace **R405.2 Mandatory requirements.**~~

~~Compliance with this section requires that the 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. 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.~~

**SECTION R406
ENERGY RATING INDEX
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.~~

~~delete and replace R406.2 Mandatory requirements.~~

~~Compliance with this section requires that the 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.~~

~~Compliance based on an ERI analysis requires that the *rated design* be shown to have an ERI less than or equal to 61 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 version 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**

Component ^a		Package 1	Package 2	Package 3
		"Standard"	"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 R-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 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 foot 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

**TABLE R407.2.1.2
REQUIRED POINTS BY BUILDING SIZE**

Building/Dwelling Size	Required Points
Multifamily < 2000 square foot-average unit size	6 points

<2000 square feet	7 points
2000 to 4000 square feet	9 points
>4000 square feet	12 points

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	4
	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 \geq R-40 (cavity + continuous) (or U-factor maximum 0.025 wall assembly)	3
	Ceiling	R-80 attic / R-60 sloped, vaulted and cathedral	4
	Windows	Average U-factor \leq 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	4
	Tight	ACH50 \leq 2.0 and balanced ventilation with ECM ^e fans and \geq 70% SRE ^d for HRV ^e , \geq 65% SRE ^d for ERV ^e OR^b	4
	Very Tight	ACH50 \leq 1.0 and balanced ventilation with ECM ^e fans and \geq 80% SRE ^d for HRV ^e , \geq 75% SRE ^d for ERV ^e	4
Heating and Cooling^a	Basic	ENERGY STAR basic: (1) Gas/propane furnace \geq 95 AFUE, Oil furnace \geq 85 AFUE, (2) Gas/Propane Boiler \geq 90 AFUE, Oil Boiler \geq 87 AFUE, (3) Heat pump HSPF \geq 9.0; PLUS any AC is SEER \geq 14.5 OR^b	4
	Advanced	Advanced: Whole building heat/cool is (1) NEEP-listed ⁱ heat pump combination, (2) GSHP ^j , closed-loop and COP \geq 3.3, (3) ATWHP ^f COP \geq 2.5 and 120F design temp, (4) Advanced wood heating system	3
Water	Basic	ENERGY STAR basic: Fossil fuel [EF 0.67 for \leq 55 gal; EF 0.77 for $>$ 55 gal] OR^b	4
	Advanced	ENERGY STAR advanced: Electric [EF or UEF \geq 2.00 for \leq 55 gal; EF \geq 2.20 for \geq 55 gal]	2
	Low-Flow	All showerheads \leq 1.75 gpm ^g , all lav. faucets \leq 1.0 gpm ^g , and all toilets \leq 1.28 gpf ^h OR^b	4

	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. <https://neep.org/initiatives/high-efficiency-products/emergingtechnologies/ashp/cold-climate-air-source-heat-pump>
- 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.~~

add R402.7.1 General.

New detached one- and two-family dwellings, and multiple single-family dwellings (townhouses) with not less than 600 ft²square feet (55.74 m²) of roof area oriented between 110° and 270° degrees of true north shall comply with ~~sections 407~~Section R407.5.

Exceptions:

1. New residential buildings with a permanently installed on-site renewable energy system.
2. A building ~~with a solar-ready zone~~where all areas of the roof that is shaded 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.

~~add R407.5~~R402.7.2 Construction document requirements for solar-Ready Zone-ready zone.

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

~~add R407.5~~R402.7.3 Solar-ready zone area.

The total solar-ready zone area shall consist of an area not less than 300 ft²square feet (27.87 m²) per dwelling exclusive of mandatory access or ~~set back~~setback areas. New multiple single-family dwellings (townhouses) three stories or less in height above grade plane and with a total floor area less than or equal to 2,000 ft²square feet (185.8 m²) per dwelling shall have a solar-ready zone area of not less than 150 ft²square feet (13.94 m²). ~~Multifamily buildings should maximize-) per dwelling. The solar-ready zone area shall be not less than 40 percent of the solar-ready zone by consolidating mechanicals, access, set back areas and other roof obstructions with a goal of 40% of area calculated as the horizontally projected gross roof area available for less the solar-ready zone 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 ~~five~~5 feet (~~4,524~~1524 mm) in width and not less than 80 ft²square feet (7.44 m²) exclusive of access or required set back areas.

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

add ~~R407.5~~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 ~~R407~~R402.7.5.5 Shading.

The solar-ready zone shall be set back from any existing or new permanently affixed object on the building or site that is located south, east or west of the solar zone a distance not less than two times the object's height above the nearest point on the roof surface. Such objects include, but are not limited to, taller portions of the building itself, parapets, chimneys, antennas, signage, rooftop equipment, trees, and roof plantings.

add R402.7.6 Capped roof penetration sleeve.

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

add R402.7.7 Roof load documentation.

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

add ~~R407.5-6~~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 ~~R407.5~~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.

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

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

add R402.7.11 Construction documentation certificate.

A permanent certificate, indicating the solar-ready zone and other requirements of this section, shall be posted near the electrical distribution panel, water heater or other conspicuous location by the builder or registered design professional.

add **R402.8 Tiny houses.**

Tiny Houses as defined in Chapter 2 must comply with the envelope, insulation and fenestration requirements below. All other code provisions are still required with the exception that the mechanical ventilation system is not required to be a *balanced ventilation system* and may be exhaust-only.

Tiny houses require the following:

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

Compliance with all other provisions of this code is required.

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

SECTION R403 **SYSTEMS**

delete and replace **R403.1.1 Programmable thermostat.**

The thermostat controlling the primary heating or cooling system of the *dwelling unit* shall be capable of controlling the heating and cooling system on a daily schedule to maintain different temperature set points at different times of the day and different days of the week. This thermostat shall include the capability to set back or temporarily operate the system to maintain *zone* temperatures down to 55°F (13°C) or up to 85°F (29°C). The thermostat shall initially be programmed by the manufacturer with a heating temperature set point no higher than 70°F (21°C) and a cooling temperature set point no lower than 78°F (26°C). Adjustments to these settings for elderly, disabled or those with special needs is permissible.

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

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

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

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

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

~~delete and replace R403.3 Ducts.~~

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

~~delete R403.3.1 Ducts located outside conditioned space.~~

~~add R403.3.1 Duct placement.~~

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

~~delete R403.3.3 Duct testing.~~

~~delete R403.3.4 Duct leakage~~

~~delete R403.3.5 Building cavities~~

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

~~delete R403.3.7 Ducts located in conditioned space.~~

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

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

~~delete and replace R403.5.1.1 Circulation systems.~~

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

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

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

- ~~1. Piping $\frac{3}{4}$ inch (19.1 mm) and larger in nominal diameter located inside the conditioned space~~
- ~~2. Piping serving more than one dwelling unit.~~
- ~~3. Piping located outside the conditioned space.~~

4. Piping from the water heater to a distribution manifold.
5. Piping located under a floor slab.
6. Buried piping.
7. Supply and return piping in circulation and recirculation systems other than cold water pipe return demand recirculation systems.

R403.6 Mechanical ventilation.

Buildings and dwelling units shall be provided with ducted balanced mechanical ventilation that meets the requirements of the International Residential Code or International Mechanical Code, as applicable, or with other approved means of ventilation. Except for mechanical ventilation systems designed for continuous operation, outdoor air intakes and exhausts shall have automatic or gravity dampers that close when the ventilation system is not operating.

delete and replace R403.6.1 Heat or energy recovery ventilation. Dwelling units shall be provided with a heat recovery or energy recovery ventilation system. The system shall be balanced with a minimum sensible recovery efficiency (SRE) of 75 percent at 32°F (0°C) at a flow greater than or equal to the design airflow.

delete and replace TABLE R403.6.1

TABLE R403.6.1
MECHANICAL VENTILATION SYSTEM FAN EFFICACY^a

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

For SI: 1 cfm = 28.3 L/min.

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

add R403.6.2 Whole-dwelling mechanical ventilation system fan efficacy.

Fans used to provide whole- dwelling mechanical ventilation shall meet the efficacy requirements of Table R403.6.1 at one or more rating points. Fans shall be tested in accordance with HVI 916 and listed. The airflow shall be reported in the product listing or on the label. Fan efficacy shall be reported in the product listing or shall be derived from the input power and airflow values reported in the product listing or on the label. Fan efficacy for fully ducted HRV, ERV, balanced, and in-line fans shall be determined at a static pressure of not less than 0.2 inch w.c. (49.85 Pa). Fan efficacy

for ducted range hoods, bathroom and utility room fans shall be determined at a static pressure of not less than 0.1 inch w.c. (24.91 Pa).

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

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

delete and replace R403.10.4 Covers.

Outdoor heated pools and outdoor permanent spas shall be provided with an insulated vapor-retardant cover of at least R-12 or other *approved* vapor-retardant means.

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

SECTION R404 **ELECTRICAL POWER AND LIGHTING SYSTEMS**

delete and replace R404.1 Lighting equipment.

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

delete R404.1.1 Lighting equipment

add R404.1.1 Exterior lighting.

Exterior lighting for residential buildings shall comply with Sections and C405.5 (Exterior Lighting Power Requirements).4.

Exceptions:

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

delete and replace R404.1.2 Lighting equipment for multifamily spaces

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

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

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

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

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

~~delete R404.2 Electric resistance heating equipment.~~

add R404.2 Electric heating equipment.

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

Building heating with electric-resistance heating equipment is prohibited.

Exceptions:

1. Replacement of existing electrical resistance units.
2. Limited areas where other heating sources are cost prohibitive or impractical (for example, a small interior space such as a bathroom or stairwell, which is distant from the distribution system).
3. Buildings with cold-climate heat pump(s) as the primary heating system, provided that:
 - a. The supplemental electric-resistance heat is controlled to prevent it from operating at an outside air temperature of 5°F or higher.
 - b. The building has a tested air tightness of less than or equal to 0.15 CFM50/Sq. Ft. of Building Shell (~2 ACH50).
4. Multifamily buildings with heating loads less than or equal to 6.0 Btu/h/ft² at design temperature.

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

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

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

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

1. Parking spaces intended exclusively for storage of vehicles for retail sale or vehicle service.

2. Parking spaces are separated from the meter by a public right-of-way
1. Parking spaces which are limited to parking durations of less than one hour.
2. EV Capable Spaces are not required where no parking spaces are provided.

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

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

delete and replace TABLE R4043 REQUIRED LEVEL 2 CAPABLE ELECTRIC VEHICLE CHARGING PARKING SPACES FOR ALL BUILDINGS (BASE CODE and STRETCH CODE)

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

add R404.4 200 Amp Electrical Service.

Each dwelling unit except multifamily units shall be supplied with at least 200 amp electrical service in anticipation of increased electrical services that will need to be provided in the future.

add R404.5 Dwelling electrical meter.

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

Exception: Buildings serving low-income occupants.

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

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

a. kiloVolt-Amp rating.

b. Nominal efficiencies shall be established in accordance with the DOE 10 CFR 431 test procedure for low-voltage

dry-type transformers.

SECTION R405 **ALTERNATIVE USING REScheck™ SOFTWARE**

delete and replace R405.2 Mandatory requirements.

Compliance with this section requires that the applicable provisions in Sections R401.3, R402, R403 and R404 be met, and the building airtightness is less than or equal to 0.15 CFM50/Sq. Ft. of Building Shell (~2 ACH50) tested, and the ventilation system is: balanced, with ECM fan(s), plus greater than or equal to 75-percent SRE.

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

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

delete and replace R406.2 Mandatory requirements.

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

delete R406.4 ERI-based compliance.

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

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

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

<u>BASE CODE</u>	<u>STRETCH CODE</u>
<u>54</u>	<u>47</u>

delete R406.6.3 Additional documentation.

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

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

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

add R406.6.4 Additional documentation.

The *code official or authority having jurisdiction*, where one exists shall be permitted to require the following documents:

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

SECTION R407 **VERMONT STRETCH CODE**

delete and replace R407.2 Compliance

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

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

delete R407.2.1 Package Plus Points Approach.

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

delete R407.2.1.2 Required points by building size.

delete TABLE R407.2.1.2

delete R407.2.1.3 Points by Component.

delete TABLE R407.2.1.3

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

delete R407.3 Air Leakage Testing for Stretch Code.

delete R407.4 Electric vehicle charging

delete R407.5 Solar Ready Zone for Stretch Code.

SECTION R408 **INSULATION EMBODIED CARBON EMISSIONS**

R408.1 Insulation Embodied Carbon

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

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

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

TABLE R408.1.1 **INSULATION GLOBAL WARMING POTENTIAL CALCULATION**

TABLE R408.1.2
DEFAULT INSULATION GLOBAL WARMING POTENTIAL VALUES

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

<u>Material</u>	<u>Default Global Warming Potential (kg CO₂e /sq.m. RSI-1)</u>
<u>Cellular glass - Aggregate</u>	<u>3.93^b</u>
<u>Cellulose - Densepack</u>	<u>-2.10</u>
<u>Cellulose - Blown/loosefill</u>	<u>-1.10</u>
<u>Cork - Board</u>	<u>-6.80</u>
<u>EPS/graphite - Board, unfaced, Type II - 15psi</u>	<u>2.80</u>
<u>EPS/graphite - Board, unfaced, Type IX - 25psi, graphite</u>	<u>3.40</u>
<u>EPS - Board, unfaced, Type I - 10psi</u>	<u>2.80</u>
<u>EPS - Board, unfaced, Type II- 15psi</u>	<u>3.80</u>
<u>EPS - Board, unfaced, Type IX- 25psi</u>	<u>4.80</u>
<u>Fiberglass - Batt, unfaced</u>	<u>0.70</u>
<u>Fiberglass - Blown/loosefill</u>	<u>1.00</u>
<u>Fiberglass - Blown/spray</u>	<u>1.93^c</u>
<u>Hemp - Batt</u>	<u>-0.50</u>
<u>HempCrete</u>	<u>-3.00</u>
<u>Mineral wool - Batt, unfaced</u>	<u>1.70</u>
<u>Mineral wool - Blown</u>	<u>1.60</u>
<u>Mineral wool - Board, unfaced, "light" density</u>	<u>3.30</u>
<u>Mineral wool - Board, unfaced, "heavy" density</u>	<u>8.10</u>
<u>Phenolic foam - Board</u>	<u>1.54^d</u>
<u>Polyiso - Wall Board</u>	<u>4.10</u>
<u>Polyiso - Roof Board</u>	<u>2.90</u>
<u>SPF – Spray, open cell</u>	<u>1.40</u>
<u>SPF – Spray, closed cell HFO</u>	<u>4.20</u>
<u>SPF – Spray, high density HFO</u>	<u>4.90</u>
<u>SPF – Spray, closed cell HFC</u>	<u>13.10</u>
<u>SPF – Spray, high density HFC</u>	<u>17.00</u>
<u>Straw – Panel</u>	<u>-6.50</u>
<u>Vacuum Insulated Panel</u>	<u>7.40</u>
<u>Wood fiber – Board, unfaced, European</u>	<u>-6.50</u>
<u>Wood fiber – Board, unfaced, North America</u>	<u>-10.30</u>
<u>Wood fiber – Batt, unfaced</u>	<u>-2.40</u>
<u>Wool (Sheep) – Batt</u>	<u>1.00</u>
<u>Wool (Sheep) – Loosefill</u>	<u>0.80</u>
<u>XPS – Board, 25psi HFC</u>	<u>55.50</u>
<u>XPS – Board, 25psi “Low GWP” (HFO/HFC)</u>	<u>4.90</u>

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

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

^c EPD Declaration Number 4788647002.102.1

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

CHAPTER 5

EXISTING BUILDINGS

SECTION R501 GENERAL

~~delete R501.2 Existing buildings.~~

add R501.2 General

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

~~delete and replace R501.4 Compliance.~~

Additions, alterations, or changes of occupancy to, or relocation of, an existing building, building system or portion thereof shall comply with Section R502, R503, R504 or R505, respectively, in this code. Changes where unconditioned space is changed to conditioned space shall comply with Section R502.

SECTION R502 ADDITIONS

~~delete and replace R502.1 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 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 R502R402.4.1.2 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~~R402.1.45, 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 through R503.1.4.~~

~~delete and replace R503.1.4 Lighting.~~

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

~~**Exception:** Alterations that replace less than 50 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.~~

AAM AAST M

American Architectural Manufacturers Association
1827 Walden Office Square
Suite 550
Schaumburg, IL 60173-4268

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

Standard

reference

number **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

R402.4.4

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

R402.4.1.2

North American Fenestration Standard/
Specifications for Windows, Doors and Unit Skylights

E1554/E1554M—E2013: Standard Test Methods for Determining Air Leakage of Air Distribution Systems by Fan Pressurization

R403.3.5

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

R402.4.1.2

ACGA

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

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

ASHRAE

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

Standard reference number	Title	Referenced in-code section number
ASHRAE—2017	ASHRAE Handbook of Fundamentals	
	-	R402.1.5
ASHRAE 62.2	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings	303.1.1
ASHRAE 193—2010 (RA2014)	Method of Test for Determining the Airtightness of HVAC Equipment	R403.3.2.1

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 Association
1300 Sumner Avenue
Cleveland, OH 44115-2851

Standard reference number	Title	Referenced in-code section number
105—2016	Test Method for Thermal Transmittance and Air Infiltration of Garage Doors	R303.1.3



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

<u>Standard reference number</u>	<u>Title</u>	<u>Referenced in code section number</u>
<u>916--09</u>	<u>Airflow Test Procedure</u>	



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

Standard reference number	Title	Referenced in code section number
<u>IBC--18</u>	<u>International Building Code®</u>	Table R403.6.1
ICC 400 1-17	Standard on the Design and Construction of Log Structures	Table R402.1.5, Table 402.4.1.1
IECC--09	2009 International Energy Conservation Code®	R406.2
IECC—06	2006 International Energy Conservation Code®	R406.3.1
IFC-15	International Fire Code®	R201.3, R501.4
IFGC—18	International Fuel Gas Code®	R201.3, R501.4
IMC—18	International Mechanical Code®	R201.3, R403.3.2, R403.6, R501.4
IPC—18	International Plumbing Code®	R201.3, R501.4
IPSDC—18	International Private Sewage Disposal Code®	R501.4
IPMC—18	International Property Maintenance Code®	R501.4
IRC— 18	International Residential Code®	R201.3, R402.1.1, R402.2.11, R402.4.4, R403.3.2, R403.6, R501.4



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

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

Standard reference number-IEEE Standard	Title	Referenced in-code section number
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<u>OS 4—2016: Requirements for the Testing, Design, Installation, and Maintenance of Air-Sealed Boxes for Electrical Resistance Trace Heating for Commercial and Communication Applications</u>		
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R402.4.6

NFPA

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

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

Standard reference number

31—06 Installation of Oil-Burning Equipment

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

R305.1, R305.2, R305.3

54—09 National Fuel Gas Code

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

R305.1, R305.2, R305.3

70—20 National Electrical Code

R501.5

NFRC

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

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

Standard reference number

100—2020 Procedure for Determining Fenestration Products U-factors

R303.1.3

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

R303.1.3

400—2020 Procedure for Determining Fenestration Product Air Leakage

R402.4.3

RESNET

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

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

Standard

reference

number **ANSI/RESNET/ICC 301—2019 Standard for the Calculation and Labeling of the Energy Performance of Low-rise Residential Buildings using an Energy Rating Index First Published March 7, 2014 — Republished January 2016**

R406.3, R406.6.1

R406.3, R406.6.1

ANSI/RESNET/ICC 380—2016 Standard for the Calculation and Labeling of the Energy Performance of Low-rise Residential Buildings using an Energy Rating Index First Published March 7, 2014 — Heating and Cooling Air Distribution Systems, and Airflow of Mechanical Ventilation Systems — Republished January 2016

ANSI/RESNET/ICC
380-2016

Standard for Testing Airtightness for Building 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—2011 Standard for Factory Built Fireplaces — with Revisions through May 2015 **July 2016**

R402.4.2

515—2015 Standards for Electrical Resistance Heat Tracing for Commercial and Industrial Heating for Commercial Applications **including revisions through July 2015**

R403.5.1.2

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



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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APPENDIX A

Table 1 - Standard Base Code Costs and Benefits Anticipated

	Average Annual Weighted Savings	Package Costs (over 2020 RBES)	Simple Payback	ROI	Cash Flow
Standard Low Cost 2023	\$917	\$12,081	13.2	8%	\$39
Standard Low Cost 2023 (with Social Cost of Carbon)	\$1,227	\$12,081	9.8	10%	N/A
Standard All Electric 2023	\$1,469	\$12,481	8.5	12%	\$562
Standard All Electric 2023 (with Social Cost of Carbon)	\$1,967	\$12,481	6.3	16%	N/A

Table 2 - Stretch Code Costs and Benefits Anticipated

	Average Annual Weighted Savings	Package Costs (over 2020 RBES)	Simple Payback	ROI	Cash Flow
Stretch Low Cost 2023	\$930	\$12,281	13.2	8%	\$38
Stretch Low Cost 2023 (with Social Cost of Carbon)	\$1,244	\$12,281	9.9	10%	N/A
Stretch All Electric 2023	\$1,592	\$13,481	8.5	12%	\$613
Stretch All Electric 2023 (with Social Cost of Carbon)	\$2,127	\$13,481	6.3	16%	N/A