FINAL PROPOSED RULE # _____.

Final Proposed Filing - Coversheet

Instructions:

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

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

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

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 4/25/23
(signature) (date)

Printed Name and Title:
June E. 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 Minutes
- ☐ Copy of Comments
- ☐ Responsiveness Summary

1. TITLE OF RULE FILING:
   Vermont Residential Building Energy Standards (RBES) Amendments

2. PROPOSED NUMBER ASSIGNED BY THE SECRETARY OF STATE
   22P028

3. ADOPTING AGENCY:
   Department of Public Service

4. 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/content/building-energy-standards-update

5. 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

6. 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:

7. 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

8. 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 residential building energy standards (RBES) through administrative rules.
9. THE FILING HAS CHANGED SINCE THE FILING OF THE PROPOSED RULE.
10. THE AGENCY HAS INCLUDED WITH THIS FILING A LETTER EXPLAINING IN DETAIL WHAT CHANGES WERE MADE, CITING CHAPTER AND SECTION WHERE APPLICABLE.
11. SUBSTANTIAL ARGUMENTS AND CONSIDERATIONS WERE RAISED FOR OR AGAINST THE ORIGINAL PROPOSAL.
12. THE AGENCY HAS NOT INCLUDED COPIES OF ALL WRITTEN SUBMISSIONS AND SYNOPSES OF ORAL COMMENTS RECEIVED.
13. THE AGENCY HAS INCLUDED A LETTER EXPLAINING IN DETAIL THE REASONS FOR THE AGENCY'S DECISION TO REJECT OR ADOPT THEM.
14. CONCISE SUMMARY (**150 WORDS OR LESS**):
    These standards regulate the design and construction of residential buildings to require adequate thermal insulation, low air leakage, effective and efficient mechanical, ventilation, electrical, service water-heating and illumination systems and equipment to enable effective use of energy in residential buildings. This is an update of the 2020 Vermont Residential Building Energy Standards (RBES). Among the more significant changes from 2020 RBES are: Increased insulation R- values for basements; tighter air sealing requirements; efficient balanced whole-house ventilation system with heat recovery requirement; and EV Capable requirements.
15. 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), since 1997 the Commissioner of the Department of Public Service is required to amend the RBES after the issuance of updated standards for residential construction under the International Energy Conservation Code (IECC).

16. EXPLANATION OF HOW THE RULE IS NOT ARBITRARY:

The RBES are based on the 2015, 2018, and 2021 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.

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

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

18. 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 result in an incremental cost increase for the parties involved in new home construction, purchase, and ownership, and existing home renovation compared to the 2020 RBES, currently in effect. On the other hand, adoption of the rule will provide economic benefits of reduced energy costs, reduced environmental impacts, and improved indoor air quality for the lifetime of the home/building. Assuming a 30-year 6% APR mortgage including the additional cost of construction under the proposed rule, the increase in annual mortgage payments is more than offset by the annual energy savings, resulting in a positive cash flow and a return on investment (ROI) of 8% to 27% (35% including the social cost of carbon) compared to the same home built to the current standard (see Economic Impact Analysis section for details).

19. A HEARING WAS HELD.

20. 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.

Date: 12/2/2022

Time: 02:00 PM

Street Address: VIRTUAL HEARING, MICROSOFT TEAMS

Zip Code:

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

Date:

Time: AM

Street Address:

Zip Code:

URL for Virtual:

Date:

Time: AM

Street Address:

Zip Code:

URL for Virtual:

Date:

Time: AM

Street Address:

Zip Code:

URL for Virtual:

21. DEADLINE FOR COMMENT (NO EARLIER THAN 7 DAYS FOLLOWING LAST HEARING):
12/9/2022

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.

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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:

   This rule will primarily affect new home builders, developers, and buyers. For the home buyer or home owner, this rule will result in a positive cash flow and an 8% to 27% (35% including the social cost of carbon) return on investment (ROI) for a typical new home compared to the same home built to the 2020 RBES,

currently in effect. Modifications to the proposed 2023 RBES since the proposed filing with the Secretary of State on 10/27/2022 were necessary to ensure a cost-effective set of improvements compared to RBES 2020. These changes were necessary after the 2020 code reference home used in the model for comparison to the proposed 2023 code was changed to better reflect a 2020 RBES-compliant home, and cost estimates were updated based on feedback from stakeholders. Specifically, the baseline reference home used in the proposed filing was the 2020 RBES Package 1 only, without the added components that provide the required points for 2020 RBES compliance. Using this improved 2020 RBES reference home in the cost effectiveness model results in a more efficient baseline, which in turn means less energy savings when a 2023 RBES-compliant home is compared to this more efficient baseline. Additionally, new cost estimates were received for the proposed wall insulation measure, which made both the measure and the RBES package of recommendations as a whole not cost-effective. Accordingly, the Department found it necessary to make changes to certain components of the proposed 2023 RBES to arrive at a cost-effective package of improvements. These changes were: 1) window U-factor requirements (changing from 0.27 back to the former 2020 RBES value of 0.30); 2) wall U-factor requirements (changing from the proposed 0.033 back to 2020 RBES value of 0.044); and 3) requiring "solar ready" for Stretch Code only and not for the base code.

These changes resulted in a reduction of the total incremental package costs from $12,081 (for the standard low cost package) to $1,018 (for standard low cost package) as compared to RBES 2020 (See Attachment A, Tables 1 and 2).

The Department took a conservative approach for the analysis by not including any projected increase in fossil fuel heating prices or consideration of available incentives from Efficiency Vermont, federal tax credits, or impending rebates from the Inflation Reduction Act.

An addition made to the cost-effectiveness analysis from the previous filing with the Secretary of State is it considers three scenarios; a fossil fueled home, an all-electric home, and a blend of the two (the blending of the two is new). The all-electric home is significantly more cost effective than the fossil fuel home. The recently completed PSD market assessment study found 19% of new homes were electrically heated and 81% were heated with fossil fuels. So, when weighted at 19%/81%, the blended results (16% ROI) are between the fossil fuel home (8% ROI) and the all-electric home (27% ROI). We present the results of the cost effectiveness analysis in Attachment A, Tables 1 and 3, for each of the three scenarios. All the scenarios are cost-effective.

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 savings and benefits of the more energy efficient home 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 substantive changes relative to the current 2020 RBES:

1. Multifamily Alignment

a. Aligned RBES and CBES standards for multifamily buildings as much as possible to provide consistency regardless of whether they fall under RBES or CBES.

2. Packages

a. Combined Base Code and Stretch Code into a single "Standard Package" for simplicity and flexibility with just a different level of points required for each.

b. Maintained a "Log Home Package"

3. Thermal Envelope Improvements

a. Increased insulation requirements for some surfaces

b. Tighter air leakage rates

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

v. Solar ready zone (for base only, required for stretch)

c. Insulation Embodied Carbon

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

5. Mechanical Ventilation

a. Now requires 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. 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. Updated HERS Index scores for Base Code(60) and Stretch Code (59)

b. Recognize additional HERS rating 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 typical 2023 RBES compliant building configurations for the Base Code and the same 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 required to meet the 2020 RBES. 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% APR mortgage, and the annual mortgage payments are compared to the annual energy savings) are all presented in Attachment A, Table 1. With a simple payback shorter than the life of the measures, an ROI greater than 8%, and positive cash flow in all cases, we have determined that these example home configurations demonstrate that the 2023 RBES is cost effective.

Additionally, in order to show the benefits of the climate impacts, Table 1 also shows the calculations when current societal cost of carbon for the saved energy are included. When considering the societal cost of carbon as a benefit, the savings and 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

Attachment A, Table 3. Adding in the social cost of carbon makes the results look even better.

This analysis for both the Base Code and the Stretch Code demonstrates 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 also 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 built if those additional savings weren't captured through an

improved energy code. Adopting no rule would also run afoul of the statutory requirement under 30 V.S.A. Section 51 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: Green Mountain Power. For costs of natural gas: Vermont Gas Systems. For fuel incidence weighting: NMR VT Market Assessment Study. 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 and social cost of carbon in Vermont in 2023: Vermont Agency of Natural Resources.

ATTACHMENT A

Table 1: Revised Costs and Benefits Anticipated for 2023 RBES Standard Base Code

	Average Annual Weighted Savings	Package Costs (over 2020 RBES)	Simple Payback	ROI	Cash Flow
Standard Low Cost 2023	$83	$1,018	12.2	8%	$9
Standard Low Cost 2023 (with Social Cost of Carbon)	$127	$1,018	8.0	12%	N/A
Standard All Electric 2023	$785	$2,951	3.8	27%	$570
Standard All Electric 2023 (with Social Cost of Carbon)	$1,042	$2,951	2.8	35%	N/A
Standard Blended (81% Fossil & 19% Electric)	$216	$1,385	6.4	16%	$116
Standard Blended (81% Fossil & 19% Electric) (with Social Cost of Carbon)	$301	$1,385	4.6	22%	N/A

Table 2: Previously Filed Costs and Benefits Anticipated for 2023 RBES Standard Base Code

	Average Annual Weighted Savings	Package Costs (over 2020 RBES)	Simple Payback (Years)	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 3: Revised Costs and Benefits Anticipated for 2023 RBES Stretch Code

	Average Annual Weighted Savings	Package Costs (over 2020 RBES)	Simple Payback (years)	ROI	Cash Flow
Stretch Low Cost 2023	$158	$1,718	10.9	9%	$33
Stretch Low Cost 2023 (with Social Cost of Carbon)	$227	$1,718	7.6	13%	N/A
Stretch All Electric 2023	$908	$4,551	5.0	20%	$577
Stretch All Electric 2023 (with Social Cost of Carbon)	$1,203	$4,551	3.8	26%	N/A
Stretch Blended (81% Fossil & 19% Electric)	$301	$2,256	7.5	13%	$137
Stretch Blended (81% Fossil & 19% Electric) (with Social Cost of Carbon)	$412	$2,256	5.5	18%	N/A

Table 4: Previously Filed Costs and Benefits Anticipated for 2023 RBES Stretch Code

	Average Annual Weighted Savings	Package Costs (over 2020 RBES)	Simple Payback (Years)	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

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)).

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 IMPACTS 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

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

After the proposed rule filing with the Secretary of State, we held a virtual public hearing and accepted comments for the duration of the 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 and submitted comments.

   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

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

Public Input

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 and air leakage rates, as well as

2021 IECC requirements. The primary substantive differences between the 2020 RBES and the proposed 2023 RBES is the requirement for balanced ventilation and more stringent air leakage rates. Also points were added for the following measures: Demand Response (DR) enabled appliances, higher insulation levels, more efficient mechanical ventilation systems, better windows, solar ready, 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 16.3.3 software, published by NORESCO, 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 Department of Public Service.

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*):

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

   (2) Chapter 6 of the proposed rule lists the section number, full title, edition year, and address of the promulgator for all other standards that are referenced in the proposed rule. The attached "referenced standards" document reproduces that information with the addition of links to where copies can either be accessed or purchased.

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
For all other standards, see attached "referenced standards" document.

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).

   All other standards: links have been provided in the attached "referenced standards" document where copies of the texts can either be accessed or purchased. The costs for obtaining these references range from $0 to $750.

   The Department of Public Service also has this information available on its website at http://publicservice.vermont.gov/content/building-energy-standards-update.

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)*:

   The proposed rule modifies the 2020 VT Residential Building Energy Standards by making Vermont amendments throughout the document. Vermont amendments are attached.

Run Spell Check

CHAPTER 6
REFERENCED STANDARDS

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

AAMA

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

AAMA/WDMA/CSA 101/I.S.2/A C440—17 North American Fenestration Standard/Specifications for Windows, Doors and Unit Skylights
R402.4.3
<https://store.fgiaonline.org/pubstore/PWDMAroductResults.asp?cat=0&src=440-17

ACCA

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

Manual J—16 Residential Load Calculation, Eighth Edition
R403.7

Manual S—14 Residential Equipment Selection
R403.7

https://www.acca.org/store#/productDetail/DB68FDFC-BB20-E511-80F5-C4346BAC9A78/

APSP

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

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

https://webstore.ansi.org/Search/Find?in=1&st=ANSI%2FAPSP%2FICC+14-2014

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

https://webstore.ansi.org/Search/Find?in=1&st=ANSI%2FAPSP%2FICC+15a-2013

ASHRAE

ASHRAE
1791 Tullie
Circle, NE
Atlanta, GA
30329-2305

ASHRAE—2017 ASHRAE Handbook of Fundamentals
R402.1.5

https://www.ashrae.org/technical-resources/ashrae-handbook

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

https://www.techstreet.com/ashrae/standards/ashrae-62-2-2022?product_id=2501064

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

https://www.techstreet.com/standards/ashrae-193-2010-ra-2014?product_id=1873282

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

https://www.astm.org/c1363-11.html

E283—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
R202 "Air-Impermeable Insulation," R402.4.5

https://www.astm.org/e0283-04r12.html

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

https://www.astm.org/e0779-10.html

E1827—2011(2017) Standard Test Methods for Determining Airtightness of Building Using an Orifice Blower Door
R402.4.1.2

https://www.astm.org/e1827-11r17.html

E2178—2013: Standard Test Method for Air Permanence of Building Materials
R202 "Air-Impermeable Insulation"
https://www.astm.org/e2178-13.html

CSA

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

R402.4.3

R403.5.4

CSA B55.2—2020 Drain Water Heat Recovery Units

R403.5.4

https://www.csagroup.org/store/product/2703427/

DASMA

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

105 - 2017

R303.1.3

https://www.dasma.com/wp-content/uploads/2022/03/ANSI-DASMA-105-2017-DASMA.pdf

HVI

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

HVI Publication 916 - Air Flow Test Procedure

Table R403.6.1

https://hvi.iwrapper.com/HVI_Certification_Program_Policies/Publication_916

HVI Publication 920 - Product Performance Certification Procedure

R304.1.1, R403.6.1

https://www.hvi.org/hvi-certified-ratings-programs/hvi-certification-program-policies-and-procedures/

HVI Publication 911: Certified Home Ventilating Products Directory - Section III - HRV/ERV Directory Listing

R304.5.1, R304.6

https://www.hvi.org/hvi-certified-products-directory/section-iii-hrv-erv-directory-listing/

ICC

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

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

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

https://shop.iccsafe.org/icc-400-2017-standard-on-the-design-and-construction-of-log-structures-1.html

https://codes.iccsafe.org/content/ICC5002020P1

IBC—18 International Building Code®

R202 – Occupancy Classifications, R303.2, R402.1.1, R402.2.11,

https://codes.iccsafe.org/content/IBC2018P6

IECC—06 2006 International Energy Conservation Code®

R406.2, R406.3.1

https://codes.iccsafe.org/content/IECC2006

IECC—09 2009 International Energy Conservation Code®

R406.2

https://codes.iccsafe.org/content/IECC2009PDF

IFC—21 International Fire Code®

R201.3, R402.7.3, R402.7.10, R501.5

https://standards.ieee.org/standard/515_1-2012.html

IFGC—21 International Fuel Gas Code®

R201.3,

https://codes.iccsafe.org/content/IFGC2021P1

IMC—21 International Mechanical Code®
R201.3, R402.4.1.2, R403.3.2, R403.6,

https://codes.iccsafe.org/content/IMC2021P3

IPC—21 International Plumbing Code®
R201.3,

https://codes.iccsafe.org/content/IPC2021P3

IRC—21 International Residential Code®
R201.3, R303.2, R402.1.1, R402.2.11, Table R402.4.1.1, R402.4.1.2, R402.4.4, R403.3.2, R403.6, R501.5

IEEE

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

515.1—2012 IEEE Standard for the Testing, Design, Installation, and Maintenance of Electrical Resistance Trace Heating for Commercial Applications
R403.5.1.2

https://standards.ieee.org/standard/515_1-2012.html

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

https://www.nema.org/docs/default-source/standards-document-library/nema-os-4-2016-contents-and-scope.pdf

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

https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=31&year=2006

54—09 National Fuel Gas Code

R202, R305.1, R305.2, R305.3

https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=54&year=2009

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

https://nfrccommunity.org/store/viewproduct.aspx?id=1380591

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

R303.1.3

https://nfrccommunity.org/store/viewproduct.aspx?id=1402116

400—2020 Procedure for Determining Fenestration Product Air Leakage

R402.4.3

https://nfrccommunity.org/store/viewproduct.aspx?id=1402431

RESNET

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

ANSI/RESNET/ICC 301—2019 Standard for the Calculation and Labeling of the Energy Performance of Dwelling and Sleeping Units using an Energy Rating Index Published December 18, 2018

R406.6.1, R406.7.3

http://www.resnet.us/wp-content/uploads/archive/resblog/2019/01/ANSIRESNETICC301-2019_vf1.23.19.pdf

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

ANSI-RESNET-ICC_380-2016-posted-on-website-6-15-16.pdf

UL

UL LLC
333 Pfingsten Road
Northbrook, IL 60062

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

R402.4.2

https://www.shopulstandards.com/ProductDetail.aspx?productId=UL127_9_S_20110421

515—2015 Standards for Electrical Resistance Trace Heating for Commericial Applications

R403.5.1.2

907—2016 Standard for Fireplace Accessories

R402.4.2

https://www.shopulstandards.com/ProductDetail.aspx?productId=UL907_4_S_20160311

US-FTC

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

CFR Title 16 (2015) R-value Rule

R303.1.4

https://www.ecfr.gov/current/title-16/chapter-I/subchapter-D/part-460

WDMA

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

AAMA/WDMA/CSA 101/I.S.2/A440—17 North American Fenestration Standard/Specification for Windows, Doors and Unit Skylights

R402.4.3

<https://store.fgiaonline.org/pubstore/PWDMAroductResults.asp?cat=0&src=440-17

2023 Vermont Residential Building Energy Standard AMENDMENTS

VERMONT
DEPARTMENT OF PUBLIC SERVICE

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 "B*ase Code*" that applies statewide, and a "*Stretch Code*" that is more stringent. The *Stretch Code* applies to all Act 250 development projects and is also available for municipalities that choose to adopt a higher energy standard.

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

Chapter 6 Referenced Standards. The code contains numerous references to standards that are used to regulate materials and methods of construction. Chapter 6 contains a comprehensive list of all standards that are referenced in the code. The standards are part of the code to the extent of the reference to the standard. Compliance with the referenced standard is necessary for compliance with this code. By providing specifically adopted standards, the construction and installation requirements necessary for compliance with the code can be readily determined. The basis for code compliance is, therefore, established and available on an equal basis to the *code official or 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_2e	Carbon dioxide equivalent
DCV	Demand control ventilation
°C	Degrees Celsius
°F	Degrees Fahrenheit
DWHR	Drain water heat recovery
DX	Direct expansion
E_c	Combustion efficiency
E_v	Ventilation efficiency
E_t	Thermal efficiency
ECM	Electronically commutated motor
EER	Energy efficiency ratio
EF	Energy factor
ERI	Energy rating index
EPD	Environmental product declaration
F-factor	See Chapter 2—Definitions
FDD	Fault detection and diagnostics
FEG	Fan efficiency grade
FL	Full load
ft^2	Square foot
GPF	Gallons per flush
GPM	Gallons per minute
GSHP	Ground-source heat pump
GWP	Global warming potential
HDD	Heating degree days
HERS	Home Energy Rating System
hp	Horsepower
H/ERV	Heat or energy recovery ventilation
HSPF	Heating seasonal performance factor
HVAC	Heating, ventilating and air conditioning

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

CHAPTER 1
ADMINISTRATION

PART 1—SCOPE AND APPLICATION

SECTION R101
SCOPE AND GENERAL REQUIREMENTS

delete and replace **R101.1 Title.**
This code shall be known as the 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 *Strech Code*, Table R402.2.1.1 lists the options for insulation and fenestration packages. Table R402.1.2.2 lists the additional points required for compliance based on building square footage for both *Base Code* and *Stretch Code*, and Table R402.1.2.3 lists the components and respective point values to be used to meet the point requirement in Table R402.1.2.2.

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

3. Home Energy Rating System (HERS): A HERS energy rating that demonstrates compliance with Section 406.4 for the Base 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 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 (CO_2E).** A measure used to compare the impact of various greenhouse gases based on their global warming potential (GWP). CO_2e approximates the warming effect of a unit mass of a given greenhouse gas relative to that of carbon dioxide (CO_2).

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

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

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

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

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

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

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

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

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

add **GLOBAL WARMING POTENTIAL (GWP).** GWP is an index for estimating the relative global warming contribution of atmospheric emissions of 1 kg of a particular greenhouse gas compared to emissions of 1 kg of CO_2. The following GWP values are used based on a 100-year time horizon: 1 for CO_2, < 10 for pentane (e.g., C_5H_{12}), and 1430 for R-134a (CH_2FCF_3).

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

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

add **HIGH-EFFICACY LIGHT SOURCES.** Non-linear medium screw- and pin-base lamps with a minimum efficacy of not less than65 lumens per watt; or light fixtures of not less than 65 lumens per watt. In determining the number or percent of lamps, each replaceable lamp (or light string) connected to a permanently installed lighting fixture shall count as one lamp.

delete **LEVEL 1 ELECTRIC VEHICLE CHARGING.**

delete **LEVEL 2 ELECTRIC VEHICLE CHARGING.**

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

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

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

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

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

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

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

delete **RENEWABLE ENERGY SOURCES.**

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

(A) Methane gas and other flammable gases produced by the decay of sewage treatment plant wastes or landfill wastes and anaerobic digestion of agricultural products, byproducts, or wastes shall be considered renewable energy resources, but no form of solid waste, other than agricultural or silvicultural waste, shall be considered renewable.

(B) The only portion of electricity produced by a system of generating resources that shall be considered renewable is that portion generated by a technology that utilizes a renewable fuel or energy source.

(C) The following fuels shall not be considered renewable energy sources: coal, oil, propane, and fossil natural gas.

(D) *Biomass* is considered renewable.

(E) *Biodiesel* is considered renewable.

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

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

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

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

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

CHAPTER 3
GENERAL REQUIREMENTS

SECTION R302
DESIGN CONDITIONS

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

Adjustments may be made only in the following cases:

1. Winter heating design temperatures for projects either:

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

   ii. Located in Caledonia, Essex or Orleans counties.

   iii. Adjustments shall be made as listed in the National Climate Data Center for the specific weather station: http://www.ncdc.noaa.gov/cdo-web/.

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

SECTION R303
MATERIALS, SYSTEMS AND EQUIPMENT

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

add **R303.1.5 Air-impermeable insulation.**
Insulation having an air permeability not greater than 0.004 cubic feet per minute per square foot [0.002 L/(s × m2)] under pressure differential of 0.3 inch water gauge (75 Pa) when tested in accordance with **ASTME2178** shall be determined air-impermeable insulation.

SECTION 304
DESIGN CRITERIA FOR RESIDENTIAL VENTILATION SYSTEMS

delete and replace **R304.1 Scope.**
This section shall govern ventilation of the dwelling unit(s) within Type R-1 *residential buildings*, Type R-2 *residential buildings* and multiple single-family attached dwellings (townhouses and *multifamily* buildings) not more than three stories in height.

delete and replace **R304.1.1 Compliance.**
Compliance with Section 304 shall be achieved by installing a *whole house balanced ventilation system* with minimum 75 *SRE* and 1.2 cfm/Watt, determined in accordance with HVI Publication 920 and listed in HVI Publication 911, while also meeting compliance with Sections 304.2 through 304.11 or demonstrating compliance with one of the following alternatives:

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

2. Passive house ventilation requirements (PHI or PHIUS)

Exceptions:

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

2. Tiny houses may install an exhaust-only ventilation system.

delete and replace **304.2 Local ventilation.**

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

TABLE 304.2
MINIMUM REQUIRED LOCAL EXHAUST

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

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

delete and replace **R304.5 Fan motor requirements.**
Fans installed for the purpose of providing whole house ventilation must meet the minimum requirements as specified in this section.

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

delete **R304.5.34 Performance verification.**

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

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

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

For SI: 1 cubic foot per minute = 0.0004719 m^3/s, 1 cubic foot per minute per square foot = 0.00508 $m^3/(s \cdot m^2)$.

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

delete and replace **R304.6.1 Testing option.**
Testing may be done for Points to verify that the whole house ventilation system satisfies the ventilation requirements of this section in accordance with Sections R304.6.1.1 and R304.6.1.2.

delete and replace **R304.8 Controls.**
Whole house ventilation systems (balanced 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 m^3/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 S*tretch Code*. *Stretch Code* requires compliance with all Base Code requirements throughout RBES, plus achieving the additional points specified in Table R402.1.2.2, following all requirements of the following sections, and complying with Section R407 Vermont Stretch Code.

delete and replace **R401.2 Compliance.**
Projects for both *Base Code* and *Stretch Code* shall comply with one of the following:

1. **Package Plus Points:** Sections R402 through R404.

2. **RES*check*™ software:** Section R405 and the provisions of Sections R401 through R404 indicated as "Mandatory."

3. **Home Energy Rating System (HERS):** An energy rating index (ERI) approach in Section R406.

delete and replace **R401.3 Certificate of Compliance**
An *RBES certificate* is required to be issued. The *certificate* should be issued upon completion and before occupancy of any project subject to the Residential Building Energy Standards. A *certificate* may be issued by a builder, a licensed professional engineer, a licensed architect or an accredited home energy rating organization. If certification is not issued by a licensed professional engineer, a licensed architect or an accredited home energy rating organization, it shall be issued by the builder. Any certification shall certify that residential construction meets the RBES. The Department of Public Service will develop and make available to the public a certificate that lists key features of the RBES. Any person certifying shall use this certificate or one substantially like it to certify compliance with the RBES. Certification shall be issued by completing and signing a certificate and affixing it to the electrical service panel, without covering or obstructing the visibility of the circuit directory label, service disconnect label or other required labels. The certificate shall certify that the residential building has been constructed in compliance with the requirements of the RBES. The person certifying under this subsection shall provide a copy of the certificate to the Department of Public Service and shall assure that a certificate is recorded and indexed in the town land records. A builder may contract with a licensed professional engineer, a licensed architect or an accredited home energy rating organization to issue certification and to indemnify the builder from any liability to the owner of the residential construction caused by noncompliance with the RBES.

SECTION R402
BUILDING THERMAL ENVELOPE

delete and replace **R402.1 General.**
The *building thermal envelope* shall meet the requirements of Sections R402.1.1 through R402.1.6. for compliance with the *Base Code* and the *Stretch Code*.

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

1. **Low energy use buildings.** Those with a peak design rate of energy usage less than 3.4 Btu/h per square foot of floor space for space conditioning purposes (10.7 W/m^2 or 1.0 watt/ft^2 of floor area for space-conditioning purposes

2. **Unconditioned buildings.** Those that do not contain *conditioned space*.

3. **Mobile homes.** Homes subject to Title VI of the National Manufactured Housing Construction and Safety Standards Act of 1974 (42 U.S.C. §§ 5401–5426).

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

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

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

7. **Owner-built homes.** Residential construction by an owner, if all of the following apply:

    7.1. The owner of the residential construction is the *builder*, as defined in 30 V.S.A. § 51.

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

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

    7.4. The owner discloses in writing to a prospective buyer, before entering into a binding purchase and sales agreement, with respect to the nature and extent of any noncompliance with the RBES.

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

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

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

delete and replace **R402.1.2 Insulation and fenestration criteria.**
The *building thermal envelope* shall **comply** with one of the following only:

1. Package Plus Points Approach: Tables R402.1.2.1, R402.1.2.2 and R402.1.2.3.

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

3. Total UA Approach: Section R402.1.5.

4. Log Home Approach: Section R402.1.6.

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

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

delete and replace **R402.1.2.1 Package Plus Points Approach.**
Projects shall comply with Items 1 through 4: for both *Base Code* and *Stretch Code*:

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

2. Determine the number of points needed to comply with Table R402.1.2.2 based on building size and whether the building needs to comply with *Base Code* or *Stretch Code*.

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

4. . Points can only be earned from measures that are not already required in the chosen standard package.

delete and replace **R402.1.2.1 Package Plus Points Approach.**
Projects shall comply with Items 1 through 4: for both *Base Code* and *Stretch Code*:

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

2. Determine the number of points needed to comply with Table R402.1.2.2 based on building size and whether the building needs to comply with *Base Code* or *Stretch Code*.

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

4. . Points can only be earned from measures that are not already required in the chosen standard package.

Delete and replace **TABLE R402.1.2.1**

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

Component	Package 1	Package 2
	"Standard Package"	"Log Homes"
Ceiling – flat attic[g]	**U-0.020:**	

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

For SI: 1 foot = 304.8 mm.

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

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

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

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

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

Determine the number of points required by building or addition size from Table R402.1.2.2. Building size for this table is determined by the *finished conditioned floor* area per dwelling unit inside the *building thermal envelope*, including unfinished basements and storage/utility spaces. The Multifamily less than 1,250 square feet (185.8 m^2) and 1,2500-2,500 square feet point requirement categories cannot be used for semi-detached (semi-attached, side-by-side), row houses, and townhouses, as defined as *single-family dwellings* in Section R202, General Definitions. *Multifamily dwelling* unit size is based on the average *finished conditioned floor* area dwelling size for the building, excluding common areas, hallways, stairwells, etc..

delete and replace **TABLE R402.1.2.2**

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

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

delete and replace **TABLE R402.1.2.3**

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

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

Heating and Cooling[a]	Basic Equipment	ENERGY STAR basic: (1) Gas/propane furnace ≥ 95 AFUE, Oil furnace ≥ 85 AFUE; (2) Gas/propane boiler ≥ 90 AFUE, Oil boiler ≥ 87 AFUE; **OR**[b]	1
	Cold Climate Air Source Heat Pump	Whole building heating /cooling is ENERGY STAR v.6 labeled[d]	5
	Ground Source Heat Pump	Whole building heating /cooling is Ground Source Heat Pump (GSHP) and ENERGY STAR labeled[d]	10
	Air-to-Water Heat Pump	Whole building heating/cooling is Air-to-Water Heat Pump (ATWHP) COP ≥ 2.5	5
	Advanced Wood Heating System	Whole building heating/cooling is Advanced wood heating system from http://www.rerc-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 *demand responsive controls*	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 *primary showers* and tubs	1
	Recirculation User-demand	Controlled hot water recirculation system with user-demand via push-button for furthest fixtures	1
	Pipe Insulation	All service hot water piping is insulated to at least R-4 from the hot water source to the fixture shutoff.	1
	Demand Responsive Controls	Electric storage water heater(s) provided with *demand responsive controls*	1

	Point of Use Electric Water Heater	Remote fixtures requiring hot water supplied from a localized source of hot water with no recirculating system.	1
	Solar Ready Zone	Follow R402.7 Solar –ready zone requirements. These points are only available for Base Code and not Stretch Code since Stretch Code requires following R402.7.	2
	Solar Hot Water	Solar hot water system designed to meet at least 50% of the annual hot water load	2
Renewables	On-Site Generation	Solar photovoltaic (PV) (or other on-site renewable energy system), 1 point per 1.5 kW per housing unit of renewable generation on site	1 per 1.5 kW, max. 4
Other Measures	Monitoring	Whole-building energy monitoring system installed, minimum 5 circuits and homeowner access to data	1
	Radon Mitigation System	Radon mitigation designed to https://www.epa.gov/radon/radon-standards-practice is installed and documented to homeowner	1
	Energy Model	Building energy model with projected annual energy use and costs developed, used in design and construction decisions, and provided to homeowner	1
	Battery	Minimum 6 kWh grid-connected dispatchable demand-response-enabled battery	1
	Advanced Lighting Controls	All lighting for at least 50% of floor area is controlled and/or continuously dimmed based by occupancy, daylight, load shedding, and/or schedule.	2
Insulation Embodied Carbon Emissions	Global Warming Potential (GWP)/square footage (kg CO2e/ ft^2)	Report the global warming potential (GWP) impact of project insulation materials as described in Section R408. Use calculation table R408.1.1 to summarize insulation GWP intensity (kg CO2e/ft^2) for the project. Default global warming potential (GWP) values for common insulation products are provided in table R408.1.2. The calculation may utilize Type III, product-specific environmental product declaration (EPD) in lieu of default values for insulation products. If EPD values are used for a given insulation product, include the sum of lifecycle stages A1-A3 from the sourced EPD instead of default GWP value when completing the calculation. Include A5 and B1 GWP values for SPF and XPS products, as noted in R408. **OR**[b]	1

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

For SI: 1 foot = 304.8 mm.

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

delete and replace **R402.1.3 *R*-value computation.**

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

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

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

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

1. Alterations.

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

delete and replace **TABLE R402.1.4**

TABLE R402.1.4
EQUIVALENT *U*-FACTORS[a,c]

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

For SI: 1 foot = 304.8 mm.
a. Nonfenestration *U*-factors shall be obtained from measurement, calculation or an approved source.
b. When more than half the insulation is on the interior, the mass wall *U*-factors shall be a maximum of 0.057.
c. Airtightness of less than or equal to 0.15 CFM50/Sq. Ft. of Building Shell (~2 ACH50) tested and balanced ventilation system compliant with R304, or the building must comply with Tables R402.1.2.2 and R402.1.2.3.

delete and replace **R402.1.5 Total UA alternative.**
Where the total *building thermal envelope* UA, the sum of *U*-factor times assembly area, is less than or equal to the total UA resulting from multiplying the U-factors in Table R402.1.4 by the same assembly area as in the proposed *building*, the *building* shall be considered to be in compliance provided that (a) airtightness is less than or equal to 0.15 CFM50/Sq. Ft. of Building Shell (~2 ACH50) tested, and (b) the ventilation system is: balanced, complying with R304. The UA calculation shall be performed using a method consistent with the ASHRAE *Handbook of Fundamentals* and shall include the thermal bridging effects of framing materials.

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

1. Alterations.

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

delete and replace **R402.1.6 Log homes.**
Log homes shall comply by doing all of the following steps:

1. Design log home in accordance with ICC 400—2022 or to the requirements of Table R402.1.6.

2. Determine the number of points needed to comply, using Table R402.1.2.2 based on building size.

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

delete and replace **TABLE R402.1.6**

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

FENESTRATION *U*-FACTOR[b]	**SKYLIGHT *U*-FACTOR**	**CEILING *R*-VALUE**	**LOG WALL[d]**	**FLOOR *R*-VALUE[e]**	**BASEMENT/ CRAWL SPACE WALL *U*-VALUE[f]**	**SLAB *R*-VALUE & DEPTH**	**HEATED SLAB *R*-VALUE[g]**	**AIR LEAKAGE i**	**HEATING SYSTEM AFUE[h]**
0.30	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;

For SI: 1 foot = 304.8 mm.

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

delete and replace **R402.2.1 Ceilings with attic spaces.**
Where Section R402.1.2 would require R-49 insulation in the ceiling, installing R-38 over the top of exterior walls where insulation is compressed in the eaves shall be deemed to satisfy the requirement for R-49 insulation provided that the balance of the ceiling is at R-49. Where Section R402.1 would require R-60 insulation in the ceiling, installing R-49 over the top of exterior walls where insulation is compressed in the eaves shall be deemed to satisfy the requirement for R-60 provided the balance of the ceiling is at R-60. This reduction shall not apply to the U-factor alternative approach in Section R402.1.4 and the total UA alternative in Section R402.1.5.

delete and replace **R402.2.2 Ceilings without attic spaces (slopes).**
Where Section R402.1.2 would require R-49 insulation in the ceiling, installing R-38 over the top of exterior walls where insulation is compressed in the eaves shall be deemed to satisfy the requirement for R-49 insulation provided that the balance of the ceiling is at R-49. Where Section R402**.**1 would require R-60 insulation in the ceiling, installing R-49 over the top of exterior walls where insulation is compressed in the eaves shall be deemed to satisfy the requirement for R-60 This reduction shall not apply to the *U*-factor alternative approach in Section R402.1.4 and the Total UA alternative in Section R402.1.5.

delete and replace **R402.2.3 Eave baffle.**
For air-permeable insulations in vented attics, a baffle shall be installed adjacent to soffit and eave vents. Baffles shall maintain a net free area opening equal to or greater than the net free area of the vent. The baffle shall extend over the top of the attic insulation. The baffle shall be permitted to be any solid material.

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

delete and replace **R402.2.4 Access hatches and doors.**
Access hatches and doors from conditioned spaces to unconditioned spaces such as attics and crawl spaces shall be weatherstripped and insulated to the same R-value required by Section R402 for the wall or ceiling in which they are installed. Access shall be provided to all equipment

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

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

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

delete and replace **R402.2.6 Steel-frame ceilings, walls and floors.**
Steel-frame ceilings, walls, and floors shall comply with the U-factor requirements of Table R402.1.2.1. The calculation of the U-factor for steel-framed ceilings and walls in an envelope assembly shall be determined in accordance with AISI S250 as modified herein.

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

delete **TABLE R402.2.6**

delete and replace **R402.2.8 Floors.**
Floor framing-*cavity insulation* shall be installed to maintain permanent contact with the underside of the subfloor decking.

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

delete and replace **R402.2.9 Basement walls.**
Walls associated with conditioned basements shall be insulated from the top of the *basement wall* down to 10 feet (3048 mm) below grade or to the basement floor, whichever is less. Walls associated with unconditioned basements shall meet this requirement unless the floor overhead is insulated in accordance with Sections R402.1.2.1 and R402.2.8.

delete and replace **R402.2.10 Slab-on-grade floors.**
Slab-on-grade floors with a floor surface less than 12 inches (305 mm) below grade shall be insulated in accordance with Table R402.1.2.1. The insulation shall extend downward from the top of the slab on the outside or inside of the foundation wall. Insulation located below grade shall be extended the distance provided in Table R402.1.2.1 by any combination of vertical insulation,

insulation extending under the slab or insulation extending out from the building. Insulation extending away from the building shall be protected by pavement or by not less than 10 inches (254 mm) of soil. The top edge of the insulation installed between the *exterior wall* and the edge of the interior slab shall be permitted to be cut at a 45-degree (0.79 rad) angle away from the *exterior wall.* Slab-edge insulation is not required in jurisdictions designated by the *code official or authority having jurisdiction*, where one exists, as having a very heavy termite infestation.

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

> **Exception:** For *sunrooms* and conditioned garages provided with *thermal isolation*, and enclosing *conditioned space*, the following exceptions to the insulation requirements of this code shall apply:
>
> 1. The minimum ceiling insulation *R*-value shall be R-38.
>
> 2. The minimum wall insulation *R*-value shall be R-20. Walls separating a *sunroom* or heated garage with a *thermal isolation* from *conditioned space* shall comply with the *building thermal envelope* requirements of this code.

add **R402.2.16 Building Science**
Consider building science principles in all design and construction. Buildings should be designed and constructed recognizing principles behind moisture vapor control approaches for cold climates. Maintain the envelope assembly's ability to adequately dry in at least one direction by not installing low-perm vapor retarder materials (e.g., vapor barrier) on both sides of an assembly, seek to optimize the assembly's ability to dry, and limit the potential for wetting. (From Applied Building Technologies Group, LLC).

delete and replace **R402.3 Fenestration.**
In addition to the requirements of Section R402.1.2.1, fenestration shall comply with Sections R402.3.1 through R402.3.5.

delete and replace **R402.3.2 Glazed fenestration SHGC.**
An area-weighted average of fenestration products more than 50-percent glazed shall be permitted to satisfy the SHGC requirements.

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

delete and replace **R402.3.3 Glazed fenestration exemption.**

Up to 15 square feet (1.4 m^2) of glazed fenestration per dwelling unit shall be permitted to be exempt from *U*-factor and SHGC requirements in Section R402.1.2.1. This exemption shall not apply to the *U*-factor alternative approach in Section R402.1.4 and the Total UA alternative in Section R402.1.5.

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

One side-hinged opaque door assembly up to 24 square feet (2.22 m^2) in area is exempted from the *U*-factor requirement in Section R402.1.2.1. This exemption shall not apply to the *U*-factor alternative approach in Section R402.1.4 and the total UA alternative in Section R402.1.5.

delete and replace **R402.3.5 Sunroom and conditioned garage fenestration.**
Sunrooms and conditioned garages enclosing *conditioned space* shall meet the fenestration requirements of this code.

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

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

delete and replace **R402.4 Air leakage.**
The *building thermal envelope* shall be constructed to limit air leakage in accordance with the requirements of this Section.

delete and replace **R402.4.1 Building thermal envelope.**
The *building thermal envelope* shall comply with Sections R402.4.1.1 through R402.4.1.3. The sealing methods between dissimilar materials shall allow for differential expansion and contraction.

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

delete and replace **TABLE R402.4.1.1**

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

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

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

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

(continued)

TABLE R402.4.1.1—continued
AIR BARRIER AND INSULATION INSTALLATION

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

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

Common wall	Whenever continuity of the building thermal envelope is broken at walls separating dwelling units in Group R-2 building, including common, party, and fire walls, such walls shall be insulated to a minimum of R-10 on each side of the break in insulation continuity.	Air barrier shall be installed in the common wall between dwelling units. Common walls shall be sealed at junctions with outside walls and at the top pressure plane of the house.
HVAC register boots	HVAC register boots that penetrate building thermal envelope shall be sealed to the subfloor or drywall.	—
Concealed sprinklers	When required to be sealed, concealed fire sprinklers shall only be sealed in a manner that is recommended by the manufacturer. Caulking or other adhesive sealants shall not be used to fill voids between fire sprinkler cover plates and walls or ceilings.	—
Fireplace	A durable air barrier shall be installed in contact with insulation. Fireplaces shall have compression closure doors and combustion air supplied from the outdoors.	—

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

delete and replace **R402.4.1.2 Air Leakage Testing.**
The *building* or dwelling unit shall be tested *and* verified as having an air leakage rate not exceeding two (2) air changes per hour or 0.15 CFM50/Sq. Ft. Building Shell area of all six sides of the building. Testing shall be conducted in accordance with **ANSI/RESNET/ICC 380**, **ASTM E779** or **ASTM E1827** and reported at a pressure of 0.2 inches w.g. (50 Pascals). Multifamily buildings shall comply with CBES C402.4.–Testing and verification shall be conducted by an applicable Building Performance Institutes (BPI) Professional, a Home Energy Rating System (HERS) Energy Rater, HERS Field Inspector, or a Vermont Department of Public Service approved air leakage tester. A written report of the results of the test shall be signed by the party conducting the test. Testing shall be performed at any time after creation of all penetrations of the *building thermal envelope*.

During testing:

1. Exterior windows and doors, fireplace and stove doors shall be closed, but not sealed, beyond the intended weatherstripping or other infiltration control measures.

2. Dampers including exhaust, intake, makeup air, backdraft and flue dampers shall be closed, but not sealed beyond intended infiltration control measures.

3. Interior doors, where installed at the time of the test, shall be open.

4. Exterior or interior terminations for continuous ventilation systems shall be sealed.

5. Heating and cooling systems, where installed at the time of the test, shall be turned off.

6. Supply and return registers, where installed at the time of the test, shall be fully open.

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

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

delete and replace **R402.4.1.3 Reporting.**
Air leakage testing shall be reported on the RBES Certificate in units of air changes per hour at 50 Pascals (ACH50) and CFM50/Sq. Ft. Building Shell area of all six sides of the building.

delete and replace **R402.4.2 Fireplaces.**
New wood-burning fireplaces shall have tight-fitting doors and outdoor combustion air. Where using tight-fitting doors on factory-built fireplaces *listed* and *labeled* in accordance with UL 127, the doors shall be tested and *listed* for the fireplace. Where using tight-fitting doors on masonry fireplaces, the doors shall be listed and labeled in accordance with UL 907 2019.

add **R402.4.6 Electrical and communication outlet boxes (air-sealed boxes**).
Electrical and communication outlet boxes installed in the building thermal envelope that are through or outside the building air barrier shall be sealed to limit air leakage between conditioned and unconditioned spaces. Electrical and communication outlet boxes shall be tested in accordance with **NEMA OS 4**, Requirements for Air-Sealed Boxes for Electrical and Communication Applications and shall have an air leakage rate of not greater than 2.0 cubic feet per minute (0.944 L/s) at a pressure differential of 1.57 psf (75 Pa). Electrical and communication outlet boxes shall be marked “NEMA OS 4” or “OS 4” in accordance with **NEMA OS 4**. Electrical and communication outlet boxes shall be installed per the manufacturer's instructions and with any supplied components required to achieve compliance with **NEMA OS 4**.

delete and replace **R402.5 Maximum fenestration *U*-factor and SHGC ().**
The area-weighted average maximum *fenestration U*-factor permitted using tradeoffs from Section R402.1.5 or R405 shall be 0.30 for *vertical fenestration*, and 0.41 for skylights.

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

add **R402.7.1 General.**
Solar-ready zone is required for Stretch Code but is optional for Base Code. Points are available for meeting the solar-ready zone requirements for Base Code.

For Stretch Code, new detached one- and two-family dwellings, and multiple single-family dwellings (townhouses) with not less than 600 square feet (55.74 m^2) of roof area oriented between 110 and 270 degrees of true north shall comply with this Section.

Exceptions:

1. New residential buildings with a permanently installed on-site renewable energy system.

2. A building where all areas of the roof that would otherwise meet the requirements of Section R407.5 are in full or partial shade for more than 70 percent of daylight hours annually.

3. Buildings and structures as designed and shown in construction documents that do not meet the conditions for a solar-ready zone area.

4. Buildings with possible location(s) for ground mounted systems identified in the submitted construction documents. Buildings claiming this exception must either install appropriate electrical conduit to the site of the proposed ground mounted solar array or include a solar site evaluation that supports the siting of the proposed ground mounting location.

Multifamily buildings shall comply with CBES C402.5.

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

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

add **R402.7.3 Solar-ready zone area.**

The total solar-ready zone area shall consist of an area not less than 300 square feet (27.87 m^2) per dwelling exclusive of mandatory access or setback areas. New multiple single-family dwellings (townhouses) three stories or less 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 11/4 inches (32 mm).

add **R402.7.7 Roof load documentation.**

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

add **R402.7.8 Interconnection pathway.**

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

add **R402.7.9 Electrical service reserved space.**

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

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

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

add **R402.7.11 Construction documentation certificate.**

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

add **R402.8 *Tiny house*s.**

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

Tiny houses require the following:

- ceiling flat attic U-0.033 (R-30);
- ceiling slope U-0.04 (R-24);
- above grade walls U-0.08 (R-13);
- frame floors U-0.05 (R-21);
- basement/crawl space walls R-20 continuous (ci) or R13+10ci;
- slab on grade R-20 for 4' on edge or under, OR R-15,4'(edge) + R-15 (under entire slab);
- heated slab on grade R-20,4' (edge) + R-15 (under entire slab);
- windows U-0.27;
- doors U-0.37;
- air leakage 0.15 CFM50/Sq. Ft. of Building 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 104ºF (40ºC).

delete and replace **R403.5.3 Hot water pipe insulation ().**
Insulation for service hot water pipe with a minimum thermal resistance (*R*-value) of R-4 shall be applied to the following:

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

R403.6 Mechanical ventilation.
Follow the mechanical ventilation requirements in R304.

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

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

delete **TABLE R403.6.1**

delete and replace **R403.8 Systems serving multiple dwelling units.**
Systems serving multiple dwelling units shall comply with Sections C403 and C404 of the 2023 *Vermont Commercial Building Energy Standards* (CBES) in lieu of Section R403 but will not be subject to the additional requirements outlined in Tables C406.1.1 and Table 406.1.2.

delete and replace **R403.10.1 Residential pools and permanent residential spas.**
Where installed, the energy consumption of residential swimming pools and permanent residential spas shall be controlled in accordance with the requirements of APSP 15.

delete and replace **R403.10.4 Covers.**
Outdoor heated pools and outdoor permanent spas shall be provided with an insulated vapor-retardant cover of at least R-12 or other *approved* vapor-retardant means.

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

SECTION R404
ELECTRICAL POWER AND LIGHTING SYSTEMS

delete and replace **R404.1 Lighting equipment.**
All permanently installed lighting fixtures, excluding kitchen appliance lighting fixtures, shall contain only high-efficacy lighting sources.

delete **R404.1.1 Lighting equipment**

add **R404.1.1 Exterior lighting.**
Exterior lighting for residential buildings shall comply with Sections C405.5 (Exterior Lighting Power Requirements) of the *Vermont Commercial Building Energy Standards* (CBES).

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

delete and replace **R404.1.2 Lighting equipment for multifamily spaces**
Multifamily buildings three-stories or less with common areas, stairwells, vestibules, lobbies, parking garages, and exterior parking areas and drives must meet the lighting power density (LPD) specifications of the *Vermont Commercial Building Energy Standards* (CBES). For parking garages, see Section C405.3.2; for uncovered parking areas and drives, see Section C405.5.2.

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

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

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

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

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

add **R404.2 Electric heating equipment.**
Heat pumps shall be certified *cold-climate heat pumps* only and shall have controls that, except during defrost, prevent supplementary electric heat operation where the heat pump compressor can meet the heating load.

Building heating with electric-resistance heating equipment is prohibited.

Exceptions:

1. Replacement of existing electrical resistance units.

2. Limited areas where other heating sources are cost prohibitive or impractical (for example, a small interior space such as a bathroom or stairwell, which is distant from the distribution system).

3. Buildings with cold-climate heat pump(s) as the primary heating system, provided that:

    a. The supplemental electric-resistance heat is controlled to prevent it from operating at an outside air temperature of 5°F or higher.

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

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

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

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

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

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

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

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

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

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

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

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

add **R404.4 200 Amp Electrical Service.**

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

add **R404.5 Dwelling electrical meter.**

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

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

add **R404.6 Electrical transformers.**

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

Exception: The following transformers are exempt:

1. Transformers that meet the *Energy Policy Act of 2005* exclusions based on the DOE 10 CFR 431 definition of special purpose applications.

2. Transformers that meet the *Energy Policy Act of 2005* exclusions that are not to be used in general purpose applications based on information provided in DOE 10 CFR 431.

3. Transformers that meet the *Energy Policy Act of 2005* exclusions with multiple voltage taps where the highest tap is not less than 20 percent more than the lowest tap.

4. Drive transformers.

5. Rectifier transformers.

6. Auto-transformers.

7. Uninterruptible power system transformers.

8. Impedance transformers.

9. Regulating transformers.

10. Sealed and nonventilating transformers.

11. Machine tool transformers.

12. Welding transformers.

13. Grounding transformers.

14. Testing transformers.

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

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

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

SECTION R405
ALTERNATIVE USING RES*check*™ SOFTWARE

delete and replace **R405.2 Mandatory requirements.**
Compliance with this section requires that the applicable provisions in Sections R401.3, R402, R403, R404, and Chapter 3 be met.

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

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

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

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

delete **R406.4 ERI-based compliance.**

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

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

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

BASE CODE	STRETCH CODE
60	59

delete **R406.6.3 Additional documentation.**

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

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

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

2. An executed contract that conveys to the homeowner the RECs associated with the on-site renewable energy, or conveys to the homeowner an equivalent quantity of RECs associated with other renewable energy

add **R406.6.4 Additional documentation.**

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

1. Documentation of the building component characteristics of the *ERI reference design*.

2. A certification signed by the builder providing the building component characteristics of the *rated design*.

3. Documentation of the actual values used in the software calculations for the *rated design*.

SECTION R407
VERMONT STRETCH CODE

delete and replace **R407.2 Compliance**
Compliance for *Stretch Code* shall be documented through either Section R402.1.2.1 “Package Plus Points Approach” or Section R406 "Energy Rating Index / Home Energy Rating System (HERS) Compliance Approach”.

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

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

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

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

delete **TABLE R407.2.1.2**

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

delete **TABLE R407.2.1.3**

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

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

delete **R407.4 Electric vehicle charging**

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

SECTION R408
INSULATION EMBODIED CARBON EMISSIONS

R408.1 Insulation Embodied Carbon
In order to earn Points from Table 402.1.2.3, complete calculation Table 408.1.1 to summarize estimated embodied carbon emissions from insulation materials used in the project. The output metric for this measure shall be global warming potential (GWP) intensity, capturing insulation GWP per conditioned square foot of project area. To complete the basic calculation, project teams shall provide the following information for foundation, wall, and roof insulation materials:

1. Insulation material type
2. Product R-value

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

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

TABLE R408.1.1

Table 1 – Insulation Global Warming Potential Calculation									Optional				
A	B		C		D		E	F	G			H	I
Assembly	Material *List insulation material type from Table 2*		Product R-Value		Surface Area (gross square feet)		Framing Factor ("1.0" for continuous, "0.8" for cavity)	Default Global Warming Potential (kg CO2e /sq.m. RSI-1) *Use Default GWP values from Table 2. Leave blank for products where product specific data will be*	Project has sourced Type III - Product-specific Environmental Product *Check box if project will be substituting default values with product specific data*	Product Specific Global Warming Potential (kg CO2e /sq.m. RSI-1) *Leave blank unless EPDs have been sourced. Use GWP values from product-specific EPDs.*		Conversion Factor	GWP Result (kg CO2e)
Below grade, slab/slab edge				X		X	1.0	X	☐		X	0.0164	=
Basement walls				X		X	1.0	X	☐		X	0.0164	=
Above grade walls, cavity				X		X	0.8	X	☐		X	0.0164	=
Above grade walls, continuous				X		X	1.0	X	☐		X	0.0164	=
Roof, flat				X		X	1.0	X	☐		X	0.0164	=
Roof, sloped, cavity				X		X	0.8	X	☐		X	0.0164	=
Roof, sloped, continuous				X		X	1.0	X	☐		X	0.0164	=
		Input for basic calculation							Summary Metrics	Total Insulation GWP (kg CO2e)			
		Inputs for product-specific data								Conditioned Floor Area (sf)			
		Calculation outputs								OUTPUT: Insulation GWP Intensity			

TABLE R408.1.2
DEFAULT INSULATION GLOBAL WARMING POTENTIAL VALUES

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

Material	Default Global Warming Potential (kg CO2e /sq.m. RSI-1)
Cellular glass - Aggregate	3.93[b]
Cellulose - Densepack	-2.10
Cellulose - Blown/loosefill	-1.10
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 throughR503.1.4.

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

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

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

SECTION R505
CHANGE OF OCCUPANCY OR USE

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

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

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

add **R505.2.1 Unconditioned space.**

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

CHAPTER 6
REFERENCED STANDARDS

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

ASHRAE

ASHRAE—2017 ASHRAE Handbook of Fundamentals
R402.1.5

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

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

APSP

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

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

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

ASTM

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

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

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

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

E1827—2011(2017) Standard Test Methods for Determining Airtightness of Building Using an Orifice Blower Door
R402.4.1.2

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

CSA

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

R402.4.3

R403.5.4

CSA B55.2—2020 Drain Water Heat Recovery Units

R403.5.4

DASMA

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

105 - 2017

R303.1.3

HVI

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

HVI Publication 916 - Air Flow Test Procedure

Table R403.6.1

HVI Publication 920 - Product Performance Certification Procedure

R304.1.1, R403.6.1

HVI Publication 911: Certified Home Ventilating Products Directory - Section III - HRV/ERV Directory Listing

R304.5.1, R304.6

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

ICC 400—17 Standard on the Design and Construction of Log Structures
Table R402.1.2.1, R402.1.6, Table R402.1.6, Table 402.4.1.1

IBC—18 International Building Code®
R202 – Occupancy Classifications, R303.2, R402.1.1, R402.2.11,

IECC—06 2006 International Energy Conservation Code®
R406.2, R406.3.1

IECC—09 2009 International Energy Conservation Code®
R406.2

IFC—21 International Fire Code®
R201.3, R402.7.3, R402.7.10, R501.5

IFGC—21 International Fuel Gas Code®
R201.3,

IMC—21 International Mechanical Code®
R201.3, R402.4.1.2, R403.3.2, R403.6,

IPC—21 International Plumbing Code®
R201.3,

IRC—21 International Residential Code®
R201.3, R303.2, R402.1.1, R402.2.11, Table R402.4.1.1, R402.4.1.2, R402.4.4, R403.3.2, R403.6, R501.5

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

515.1—2012 IEEE Standard for the Testing, Design, Installation, and Maintenance of Electrical Resistance Trace Heating for Commercial Applications
R403.5.1.2

NEMA National Electrical Manufacturers

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

OS 4—2016: Requirements for Air-Sealed Boxes for Electrical and Communication Applications
R402.4.6

NFPA

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

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

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

NFRC

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

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

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

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

RESNET

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

ANSI/RESNET/ICC 301—2019 Standard for the Calculation and Labeling of the Energy Performance of Dwelling and Sleeping Units using an Energy Rating Index Published December 18, 2018
R406.6.1, R406.7.3

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

907—2016 Standard for Fireplace Accessories
R402.4.2

~~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 "B*ase Code*" that applies statewide, and a "*Stretch Code*" that is more stringent. The *Stretch Code* applies to all Act 250 development projects and is also available for municipalities that choose to adopt a higher energy standard.

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

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

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

Italicized Terms

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

Marginal Markings

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

Abbreviations and Notations

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

AFUE	Annual fuel utilization efficiency
ATWHP	Air-to-water heat pump
bhp	Brake horsepower (fans)
Btu	British thermal unit
Btu/h-ft^2	Btu per hour per square foot
C-factor	See Chapter 2—Definitions
CDD	Cooling degree days
CFA	Conditioned floor area
cfm	Cubic feet per minute
cfm/ft^2	Cubic feet per minute per square foot
ci	Continuous insulation
COP	Coefficient of performance
CO_2e	Carbon dioxide equivalent
DCV	Demand control ventilation
°C	Degrees Celsius
°F	Degrees Fahrenheit
DWHR	Drain water heat recovery
DX	Direct expansion
E_c	Combustion efficiency
E_v	Ventilation efficiency
E_t	Thermal efficiency
ECM	Electronically commutated motor
EER	Energy efficiency ratio
EF	Energy factor
ERI	Energy rating index
EPD	Environmental product declaration

F-factor	See Chapter 2—Definitions
FDD	Fault detection and diagnostics
FEG	Fan efficiency grade
FL	Full load
ft^2	Square foot
GPF	Gallons per flush
GPM	Gallons per minute
GSHP	Ground-source heat pump
GWP	Global warming potential
HDD	Heating degree days
HERS	Home Energy Rating System
hp	Horsepower
H/ERV	Heat or energy recovery ventilation
HSPF	Heating seasonal performance factor
HVAC	Heating, ventilating and air conditioning
IEER	Integrated energy efficiency ratio
IPLV	Integrated Part Load Value
Kg/m^2	Kilograms per square meter
kW	Kilowatt
LPD	Light power density (lighting power allowance)
L/s	Liters per second
Ls	Liner system
m^2	Square meters
MERV	Minimum efficiency reporting value
NAECA	National Appliance Energy Conservation Act
NPLV	Nonstandard Part Load Value
Pa	Pascal
PF	Projection factor
pcf	Pounds per cubic foot
PSD	Department of Public Service (Vermont)
psf	Pounds per square foot
PTAC	Packaged terminal air conditioner
PTHP	Packaged terminal heat pump
R-value	See Chapter 2—Definitions
SCOP	Sensible coefficient of performance
SEER	Seasonal energy efficiency ratio
SHGC	Solar Heat Gain Coefficient
SPVAC	Single packaged vertical air conditioner
SPVHP	Single packaged vertical heat pump
SRE	System recovery efficiency
SRI	Solar reflectance index
SWHF	Service water heat recovery factor
U-factor	See Chapter 2—Definitions
VAV	Variable air volume
VRF	Variable refrigerant flow
VT	Visible transmittance
W	Watts
w.c.	Water column
w.g.	Water gauge

CHAPTER 1
ADMINISTRATION

PART 1—SCOPE AND APPLICATION

SECTION R101
SCOPE AND GENERAL REQUIREMENTS

delete and replace **R101.1 Title.**
This code shall be known as the ~~2020~~2023 *Vermont Residential Building Energy Standards* (RBES) and shall be cited as such. It is referred to herein as "this code."

delete and replace **R101.2 Scope.**
This code applies to *residential buildings* and the *building sites* and associated systems and equipment, including one family dwellings, two family dwellings, and ~~multi-family~~multifamily housing three stories or less in height.

For the purpose of determining the building type that must comply with the RBES under Vermont statute, a multifamily building is a *residential building* or *mixed-use* building with three or more *dwelling units* three stories or less in height. Multifamily buildings of four stories or more in height must comply with the CBES (from Vermont 30 V.S.A. § 51.)
While many sections of this code (e.g., inspections, review of construction documents, compliance, etc.) do not pertain to most of Vermont that lacks ~~*code officials*~~*a code official or authority having jurisdiction*, these sections are included to provide guidance for those jurisdictions that do have a *code official or* ~~*other*~~ *authority having jurisdiction*.

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

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

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

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

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

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

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

7. **Owner-built homes.** Residential construction by an owner, if all of the following apply:

7.1. The owner of the residential construction is the *builder*, as defined in 30 V.S.A § 51(a)(1), and;

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

7.3. The owner10 V.S.A. Chapter 151 (Act 250), and in any municipalities that have adopted the more stringent "Stretch Code."

All *Base Code* requirements shall be met in fact directs the details of construction with regardaddition to the installation of materials notrequirements in the *Stretch Code* section R407 in order to be in compliance with the RBES, and;

7.4. The owner discloses in writing to a prospective buyer, before entering into a binding purchase and sales agreement, with respect to the nature and extent of any noncompliance with the RBES.

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

delete and replace **R101.8 Compliance options.**
There are three thermal efficiency compliance options:

1. Package Plus Points: For the *Base Code* and *Strech Code*, Table R402.2.1.1 lists the options for insulation and fenestration packages. Table R402.1.2.2 lists the additional points required for compliance based on building square footage for both *Base Code* and *Stretch Code*, and Table R402.1.2.3 lists the components and respective point values to be used to meet the point requirement in Table R402.1.2.2. For the Stretch Code, Table R407.2.1.1 lists three options for insulation and fenestration packages, Table R407.2.1.2 lists the required additional points for compliance based on building square footage, and Table R407.2.1.3 lists the components and respective point values to be used to meet the point requirement in Table R407.2.1.2.

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

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

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

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

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

PART 2—ADMINISTRATION AND ENFORCEMENT

SECTION R103
CONSTRUCTION DOCUMENTS

delete and replace **R103.1 General.**
Where required, construction documents, technical reports and other supporting data shall be submitted in one or more sets, or in a digital format where allowed by the code *official or authority having jurisdiction*, where one exists, with each application for a permit. The construction documents and technical reports shall be prepared by a registered design professional where required by the statutes of the jurisdiction in which the project is to be constructed. Where special conditions exist, the *code official or authority having jurisdiction*, where one exists, is authorized to require necessary construction documents to be prepared by a registered design professional.

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

delete and replace **R103.2 Information on construction documents.**
Where required, construction documents shall be drawn to scale upon suitable material. Electronic media documents are permitted to be submitted where *approved* by the *code official or* ~~other~~ *authority having jurisdiction*, where one exists. Construction documents shall be of sufficient clarity to indicate the location, nature and extent of the work proposed, and show in

sufficient detail pertinent data and features of the *building*, systems and equipment as herein governed. Details shall include, but are not limited to, the following as applicable:

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

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

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

9. Energy code compliance path.

SECTION R104
INSPECTIONS

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

R104.1 General.
Where required, construction or work for which a permit is required shall be subject to inspection by the *code official or* ~~other~~ *authority having jurisdiction*, where one exists, or his or her designated agent, and such construction or work shall remain visible and able to be

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

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

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

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

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

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

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

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

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

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

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

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

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

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

CHAPTER 2
DEFINITIONS

SECTION R202
GENERAL DEFINITIONS

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

add **GLOBAL WARMING POTENTIAL (GWP).** GWP is an index for estimating the relative global warming contribution of atmospheric emissions of 1 kg of a particular greenhouse gas compared to emissions of 1 kg of CO_2. The following GWP values are used based on a 100-year time horizon: 1 for CO_2, < 10 for pentane (e.g., C_5H_{12}), and 1430 for R-134a (CH_2FCF_3).

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

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

add **HIGH-EFFICACY LIGHT SOURCES.** Non-linear ~~fluorescent lamps, or~~medium screw- and pin-base lamps with a minimum efficacy of not less ~~than 65~~than65 lumens per watt; or light fixtures of not less than ~~55~~65 lumens per watt. In determining the number or percent of lamps, each replaceable lamp (or light string) connected to a permanently installed lighting fixture shall count as one lamp.

~~*delete and replace* **HOME ENERGY RATING SYSTEM (HERS).** A home energy rating system approved by the Vermont Department of Public Service that provides a numerical rating in compliance with 30 V.S.A. § 52. The purpose of this procedure is to ensure that accurate and consistent home energy ratings are performed by accredited HERS providers in Vermont and to promote an objective, cost-effective, sustainable home energy rating process as a compliance method for residential building energy codes; as qualification for energy programs designed to reach specific energy-saving goals; and as a way to provide Vermont's housing market the ability to differentiate residences based on their energy efficiency.~~

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

delete **RENEWABLE ENERGY SOURCES.** ~~Means~~

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

(A) Methane gas and other flammable gases produced by the decay of sewage treatment plant wastes or landfill wastes and anaerobic digestion of agricultural products, byproducts, or wastes shall be considered renewable energy resources, but no form of solid waste, other than agricultural or silvicultural waste, shall be considered renewable.

(B) The only portion of electricity produced by a system of generating resources that shall be considered renewable is that portion generated by a technology that ~~qualifies as~~utilizes a renewable fuel or energy source.

(C) The following fuels shall not be considered renewable energy sources: coal, oil, propane, and fossil natural gas.

(D) *Biomass* is considered renewable.

(E) *Biodiesel* is considered renewable.

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

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

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

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

~~*delete "THERMAL CONDUCTANCE"*~~

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

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

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

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

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

delete **U-FACTOR THERMAL TRANSMITTANCE**

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

delete **VAPOR PERMEABLE MEMBRANE**

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

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

VAPOR RETARDER CLASSES AND EXAMPLES

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

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

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

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

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

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

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

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

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

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

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

CHAPTER 3
GENERAL REQUIREMENTS

SECTION R302
DESIGN CONDITIONS

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

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

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

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

~~For SI: °C = [(°F) - 32]/1.8.~~

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

Adjustments may be made only in the following cases:

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

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

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

   iii. ~~iii.~~ Adjustments shall be made as listed in the National Climate Data Center for the specific weather station: http://www.ncdc.noaa.gov/cdo-web/.

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

SECTION R303
MATERIALS, SYSTEMS AND EQUIPMENT

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

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

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

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

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

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

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

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

delete and replace **R303.2 Installation.**
Materials, systems and equipment shall be installed in accordance with the manufacturer's instructions and the *International Building Code* or the *International Residential Code*, as applicable.
delete and replace **R303.1.2 Insulation mark installation.**
Insulating materials shall be installed such that the manufacturer's *R*-value mark is readily

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

add **R303.1.5 Air-impermeable insulation.**
Insulation having an air permeability not greater than 0.004 cubic feet per minute per square foot [0.002 L/(s × m2)] under pressure differential of 0.3 inch water gauge (75 Pa) when tested in accordance with **ASTME2178** shall be determined air-impermeable insulation.

SECTION 304
DESIGN CRITERIA FOR RESIDENTIAL VENTILATION SYSTEMS

delete and replace ~~304~~**R304.1 Scope.**
This section shall govern ventilation of the dwelling unit(s) within Type R-1 *residential buildings*, Type R-2 *residential buildings* and multiple single-family attached dwellings (townhouses and *multifamily* buildings) not more than three stories in height.

delete and replace **R304.1.1 Compliance.**
Compliance with Section 304 shall be achieved by installing a *whole house balanced ventilation system* with minimum 75 *SRE* and 1.2 cfm/Watt, determined in accordance with HVI Publication 920 and listed in HVI Publication 911, while also meeting ~~Section~~compliance with Sections 304.2 through 304.11 or demonstrating compliance with one of the following alternatives:

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

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

2. Passive house ventilation requirements (PHI or PHIUS)

~~**Exception**~~

Exceptions:

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

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

delete and replace **304.2 Local ventilation.**
Ventilation fans in bathrooms containing a bathtub, shower, spa or similar bathing fixture and not included in the whole house ventilation system shall be sized to ~~meet the net~~provide 50 CFM intermittent or 20 CFM continuous exhaust capacity~~ rates as required in Table 304.2~~.
Whole house ventilation fans serving both localized and whole house ventilation functions shall be sized to meet the net capacity rates as required by Section ~~304~~R304.6 and must meet all

other requirements listed in Section ~~304~~R304.3, as applicable.

TABLE 304.2
MINIMUM REQUIRED LOCAL EXHAUST

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

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

delete and replace ~~**304.6.1.1 Minimum outdoor air.**~~
~~Automatic operation of~~ **R304.5 Fan motor requirements.**
Fans installed for the purpose of providing whole house ventilation must meet the minimum requirements as specified in this section.

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

delete **R304.5.34 Performance verification.**

delete and replace **R304.6 Net capacity requirements.**
Whole house ventilation system fans shall ~~not reduce~~be installed according to the manufacturer's installation instructions and shall have the manufacturer's fan flow ratings as listed in accordance with HVI 911. Unless the whole house system is tested according to procedures in Section R304.6.1, the minimum continuous ~~ventilation rate below 15 cfm of outdoor air~~flow rate that the ventilation system must be capable of supplying during its operation shall be based on the rate per bedroom ~~plus 15 cfm during occupancy~~as specified in Table R304.6.

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

~~*delete and replace* 304~~
TABLE R304.6
PRESCRIPTIVE FAN CAPACITY REQUIREMENTS FOR CENTRALLY DUCTED SYSTEMS

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

For SI: 1 cubic foot per minute = 0.0004719 m^3/s, 1 cubic foot per minute per square foot = 0.00508 $m^3/(s \cdot m^2)$.
a. Represents the total installed rated capacity of all fans designed for whole house ventilation.

delete and replace **R304.6.1 Testing option.**
Testing may be done for Points to verify that the whole house ventilation system satisfies the ventilation requirements of this section in accordance with Sections R304.6.1.1 and R304.6.1.2.

delete and replace **R304.8 Controls.**
Whole house ventilation systems (balanced ~~or exhaust only~~ ventilation) shall be capable of being set remotely for continuous operation or shall be provided with an automatic control for intermittent operation. All whole house ventilation controls shall be readily accessible.

Exception: Fans installed expressly for local ventilation purposes.

delete and replace ~~304~~R304.9.3 Ducts.
Smooth wall ducts (~~e.g.~~for example, metal or composite) must be used for all duct runs longer than 8 feet (2438 mm). Ducts shall be insulated when installed in an unheated location ~~or outside the building thermal envelope.~~

add **R304.9.9 Exhaust Dampers.**
Dampers with positive closures shall be installed to keep outside air from entering the exhaust duct when the system is not operating.

Exception: Mechanical ventilation systems designed for continuous operation.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

CHAPTER 4
RESIDENTIAL ENERGY EFFICIENCY

SECTION R401
GENERAL

delete and replace **R401.1 Scope.**
This chapter applies to *residential buildings* compliance with both the *Base Code* and S*tretch Code*. *Stretch Code* requires compliance with all Base Code requirements throughout RBES, plus achieving the additional points specified in Table R402.1.2.2, following all requirements of the following sections, and complying with Section R407 Vermont Stretch Code.

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

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

1. ~~"~~**Package Plus Points**~~":~~**:** Sections R402 through R404.

2. ~~"~~**RES*check*™ software**~~":~~**:** Section R405 and the provisions of Sections R401 through R404 indicated as "Mandatory."

3. ~~"~~**Home Energy Rating System (HERS**~~)":~~**):** An energy rating index (ERI) approach in Section R406.

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

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

SECTION R402
BUILDING THERMAL ENVELOPE

delete and replace **R402.1 General ~~(Prescriptive).~~**

:

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

~~Exceptions:~~

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

1. **Low energy use buildings.** Those with a peak design rate of energy usage less than 3.4 Btu/h per square foot of floor space for space conditioning purposes (10.7 W/m^2 or 1.0 watt/ft^2~~).~~ of floor area for space-conditioning purposes

2. **Unconditioned buildings.** Those that do not contain *conditioned space*.

3. ~~3.~~ **Mobile homes.** Homes subject to Title VI of the National Manufactured Housing Construction and Safety Standards Act of 1974 (42 U.S.C. §§ 5401~~–~~5426).

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

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

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

7. ~~7.~~ **Owner-built homes.** Residential construction by an owner, if all of the following apply:

    7.1. The owner of the residential construction is the *builder*, as defined in 30 V.S.A. § 51~~, and;~~.

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

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

    7.4. The owner discloses in writing to a prospective buyer, before entering into a binding purchase and sales agreement, with respect to the nature and extent of any noncompliance with the RBES.

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

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

delete and replace **R402.1.1 Vapor retarder.**
Wall assemblies ~~and roof or ceiling assemblies which are part of~~in the *building thermal envelope* shall comply with the vapor retarder requirements of Section R702.7 of the

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

delete and replace **R402.1.2 Insulation and fenestration criteria.**
The *building thermal envelope* shall **comply** with one of the following only:

1. Package Plus Points Approach: Tables R402.1.2.1, R402.1.2.2 and R402.1.2.3~~; or~~.

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

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

4. Log Home Approach: Section R402.1.6.

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

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

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

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

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

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

2. Determine the number of points needed to comply with Table R402.1.2.2 based on building size~~; and~~ and whether the building needs to comply with *Base Code* or *Stretch Code*.

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

~~*add*~~4. . Points can only be earned from measures that are not already required in the chosen standard package.

delete and replace **R402.1.2.1 Package Plus Points Approach.**
Projects shall comply with Items 1 through 4: for both *Base Code* and *Stretch Code*:

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

2. Determine the number of points needed to comply with Table R402.1.2.2 based on building size and whether the building needs to comply with *Base Code* or *Stretch Code*.

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

4. . Points can only be earned from measures that are not already required in the chosen standard package.

Delete and replace **TABLE R402.1.2.1**

TABLE R402.1.2.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT FOR ~~BASE~~STANDARD PACKAGES FOR BASE CODE AND STRETCH CODE [a]

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

Component	**Package 1**	**Package 2**
	"Standard Package"	"Log Homes"
Ceiling – flat attic[g]	**U-0.020:** R-49[g]	

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

For SI: 1 foot = 304.8 mm.

a. *R*-values are minimums. *U*-factors are maximums. Where insulation is installed in a cavity that is less than the label or design thickness of the insulation, the installed *R*-value of the insulation shall be not less than the *R*-value specified in the table. See Section R402.1.4 for alternative compliance methods.
~~a. The fenestration *U* factor row excludes skylights.~~

b. These are *example* wall assemblies. Any wall assembly would need to meet required U values and should consider building science to avoid moisture concerns. See RBES Handbook for building science guidance and more example wall assemblies.

c. The continuous portion of basement and crawlspace insulation can be met through interior, exterior or combination.

d. "4 ft" can be horizontal or vertical coverage including slab edge. "Edge and under" requires complete coverage. Up to 8 lineal feet of exposed slab edge may be insulated to R-10. "Heated slab" are those with embedded radiation.

e. The first value is cavity insulation, the second value is continuous insulation, or "ci", so "~~13+10~~20 + 5ci" means R-~~13~~20 cavity insulation plus R-~~10~~5 continuous insulation.~~When used, continuous insulation values shall~~

f. Consider building science principles in all design and construction. Buildings should be designed and constructed recognizing principles behind moisture vapor control approaches for cold climates. Maintain the envelope assembly's ability to adequately dry in at least ~~R-5.~~one direction by not installing low-perm vapor retarder materials (e.g., vapor barrier) on both sides of an assembly, seek to optimize the assembly's ability to dry, and limit the potential for wetting. (From Applied Building Technologies Group, LLC).

g. If there is insufficient space in the eaves, installing R-38 over ~~100 percent of the ceiling area requiring insulation~~the top of exterior walls shall be deemed to satisfy the requirement for R-49 insulation ~~wherever the full height of uncompressed R-38 insulation extends over the wall top plate at the eaves.~~provided the rest of the ceiling is R-49. (See Section R402.2.1). Multifamily buildings using continuous insulation with a maximum U-factor of 0.023 or tapered insulation with an average U-factor of 0.023 for the ceiling assembly satisfies this requirement. A minimum value of R-12 is required for tapered insulation.

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

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

~~d. "CFA" = conditioned floor area~~

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

~~Insulation systems complying.~~ CFM50/Sq. Ft. of Building Shell = amount of air leakage (in cubic feet per minute, or CFM) that leaks out of each square foot of the exterior surface all six sides of the building measured at 50 Pascals of pressure with ~~Table R402.1.4 shall be deemed to comply with the R-value requirements of Table 402.1.2.1~~a blower door.

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

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

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

Determine the number of points required by building or addition size from Table R402.1.2.2. Building size for this table is determined by the *finished conditioned floor* area per dwelling unit ~~within~~inside the *building thermal envelope*, including unfinished basements and storage/utility spaces. The Multifamily ~~< 2000~~less than 1,250 square feet (185.8 m^2) and 1,2500-2,500 square feet point requirement categories cannot be used for ~~semidetached~~semi-detached (semi-attached, side-by-side), row houses, and townhouses, as defined as *single-family dwellings* in Section R202, General Definitions ~~R202~~. *Multifamily dwelling* unit size is based on the average *finished conditioned floor* area dwelling size for the building~~.~~, excluding common areas, hallways, stairwells, etc..

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

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

BUILDING/DWELLING SIZE	BASE CODE REQUIRED POINTS	STRETCH CODE REQUIRED POINTS
Alterations	0	0
Additions < 250 square feet	0	0
Additions 250 to 500 square feet	1	2
Addition 501 to 1,000 square feet	2	3
Addition > 1,000 square feet	3	4
Multifamily < ~~2000~~650 square feet	~~4 points~~0	1
Multifamily 650 to 900 square feet	1	2
Multifamily 900 to 1,250 square feet	2	3
~~<2000~~Multifamily >1,250 to 2,500	4	5 ~~points~~

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

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

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

add
delete and replace **TABLE R402.1.2.3**

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

Component		Description	Points
Envelope	SlabSlab (on or below grade, heated or unheated)	R-1020 around perimeter and below entire slab **OR**[b]	12
		R-25 around perimeter and below entire slab	3
	Walls – Upgraded	Above grade walls R-20+12 (28 2x6 cavity insulation with continuous (R20+9ci or similar) (U-factor maximum 0.033036 wall assembly) (Not available for base package 3) **OR**[b]	21
		R-35 double stud or similar (cavity and continuous) (U-0.028 wall assembly) **OR**[b]	2
	Walls – High R	Above grade walls ≥ R-40 double stud or similar (cavity and continuous) (or U-factor maximum 0.025 wall assembly) **OR**[b]	3
		R-48 SIP 10 1/4" XPS or similar (cavity and continuous) (U-0.021 wall assembly)	4
	Ceiling	R-8060 attic flat / R-60 slopedflats (U-0.018) and R-49 slopes, vaulted and cathedral (U-.020)	1
		R-80 attic flats (U-0.013) and R-60 slopes, vaulted and cathedral (U-.018)	2
	Floors - Exposed	R-49 (U-0.021)	1
	Windows- Triple Pane	Average U-factor ≤ 0.27 **OR**[b]	1
		Average U-factor ≤ 0.2225 **OR**[b]	2
		Average U-factor ≤ 0.21 **OR**[b]	3
		Average U-factor ≤ 0.18	4
	Doors - Exterior	U-0.26	1

Air Leakage	Tight	Tested to ≤0.11 CFM50/Sq. Ft. of Building Shell (6-sided) (~1.5 ACH50) **OR**[b]	1
	Tighter	Tested to ≤0.07 CFM50/Sq. Ft. of Building Shell (6-sided) (~1.0 ACH50) **OR**[b]	2
	Tightest	Tested to ≤0.03 CFM50/Sq. Ft. of Building Shell (6-sided) (~0.5 ACH50)	3
~~**Air Leakage and**~~Mechanical Ventilation	~~Pre-Drywall~~Better Heat Recovery **OR**	~~ACH50 is tested with blower door after full insulation/primary air barrier completion but before insulation is fully enclosed/covered **OR**[b]~~Balanced ventilation with ECM fans and ≥80% SRE and ≥1.2 cfm/watt **OR**[b]	~~1~~3
	~~Tight~~Better Electrical Efficiency	~~ACH50 ≤ 2.0 and~~ Balanced ventilation with ~~ECM[e]~~ECM fans and ≥70% ~~SRE[d] for HRV[e], ≥65% SRE[d] for ERV[e] **OR**[b]~~SRE, and ≥2.0 cfm/watt	~~3~~
	~~Very Tight~~Mechanical Ventilation Testing	~~ACH50 ≤ 1.0 and balanced ventilation with ECM[e] fans and ≥ 80% SRE[d] for HRV[e], ≥75% SRE[d] for ERV[e]~~ Mechanical ventilation systems shall be tested and verified to provide the minimum ventilation flow rates required by Section R403.6. Testing shall be performed according to the ventilation equipment manufacturer's instructions, or by using a flow hood or box, flow grid, or other airflow measuring device at the mechanical ventilation fan's inlet terminals or grilles, outlet terminals or grilles, or in the connected ventilation ducts.	~~4~~1
Heating and Cooling[a]	Basic Equipment	ENERGY STAR basic: (1) Gas/propane furnace ≥ 95 AFUE, Oil furnace ≥ 85 AFUE~~,~~; (2) Gas/propane boiler ≥ 90 AFUE, Oil boiler ≥ 87 AFUE~~, (3) Heat pump HSPF ≥9.0; PLUS any AC is SEER ≥14.5~~; **OR**[b]	1
	Cold Climate Air Source Heat Pump	Whole building heating /cooling is ENERGY STAR v.6 labeled[d]	5
	Ground Source Heat Pump	Whole building heating /cooling is Ground Source Heat Pump (GSHP) and ENERGY STAR labeled[d]	10
	Air-to-Water Heat Pump	Whole building heating/cooling is Air-to-Water Heat Pump (ATWHP) COP ≥ 2.5	5

	Advanced Wood Heating System	Whole building ~~heat/cool~~heating/cooling is ~~(1) NEEP-listed air source heat pump combination[j], (2) GSHP[i], closed loop and COP ≥ 3.3, (3) ATWHP[f] COP ≥2.5 and 120F design temp, (4)~~ Advanced wood heating system from http://www.rerc-vt.org/advanced-wood-heating-system/eligible-equipment-inventory-eei	~~3~~5
	Low-Temperature Hydronic Distribution System	Hydronic distribution system designed to meet building peak heating demand with 120-degree water	1
	Demand Responsive Thermostats	All electric heating thermostats provided with *demand responsive controls*	1
Water	Heat Pump Basic	~~ENERGY STAR basic: Fossil fuel [EF 0.67 for ≤ 55 gal; EF 0.77 for > 55 gal] OR~~[b] Electric Heat Pump Water Heater UEF ≥ 2.20 **OR**[b]	~~1~~3
	Heat Pump Advanced	~~ENERGY STAR advanced:~~ Electric ~~[EF or~~Heat Pump Water Heater UEF ≥ ~~2.00 for ≤ 55 gal; EF ≥2.20 for > 55 gal]~~3.30	~~2~~5
	Low flow	All showerheads ≤ 1.75 ~~gpm~~[g]gpm, all ~~lav.~~lavatory faucets ≤ 1.0 ~~gpm~~[g]gpm, and all toilets ≤ 1.28 ~~gpf~~[h]gpf[c] **OR**[b]	1
	~~Certified~~[k]Certified[e]	Certified water efficient design per WERS, WaterSense, or ~~RESNETH2O~~ RESNET $HERS_{H2O}$	2
	Drain heat recovery	Drain water heat recovery system on *primary showers* and tubs	1
	Recirculation User-demand	Controlled hot water recirculation system with user-demand via push-button for furthest fixtures	1
	Pipe Insulation	All service hot water piping is insulated to at least R-4 from the hot water source to the fixture shutoff.	1
	Demand Responsive Controls	Electric storage water heater(s) provided with *demand responsive controls*	1
	Point of Use Electric Water Heater	Remote fixtures requiring hot water supplied from a localized source of hot water with no recirculating system.	1
~~**Renewables**~~	Solar Ready Zone	~~Home is Solar Ready per R407.5, OR~~[b]Follow R402.7 Solar –ready zone requirements. These points are only available for Base Code and not Stretch Code since Stretch Code requires following R402.7.	~~1~~2
	Solar Hot Water	Solar hot water system designed to meet at least 50% of the annual hot water load	2

Renewables	On-Site Generation	Solar photovoltaic (PV) (or other on-site renewable energy system), 1 point per 1.5 kW per housing unit of renewable generation on site	1 per 1.5 kW, max. 4
	~~Solar Hot Water~~	~~Solar hot water system designed to meet at least 50% of annual hot water load~~	~~2~~
Other Measures	Monitoring	~~Install~~ Whole-building energy monitoring system~~, min.~~ installed, minimum 5 circuits and homeowner access to data	1
	~~EV Ready~~Radon Mitigation System	Radon mitigation designed to https://www.epa.gov/radon/radon-standards-practice~~Level 2 electric vehicle charger ready per R407.4~~ [i] is installed and documented to homeowner	1
	Energy Model	Building energy model with projected annual energy use and costs developed, used in design and construction decisions, and provided to homeowner	1
	Battery	~~Min.~~Minimum 6 kWh grid-connected dispatchable demand-response-enabled battery ~~backup~~	1
	Advanced Lighting Controls	All lighting for at least 50% of floor area is controlled and/or continuously dimmed based by occupancy, daylight, load shedding, and/or schedule.	2
Insulation Embodied Carbon Emissions	Global Warming Potential (GWP)/square footage (kg CO2e/ ft^2)	Report the global warming potential (GWP) impact of project insulation materials as described in Section R408. Use calculation table R408.1.1 to summarize insulation GWP intensity (kg CO2e/ft^2) for the project. Default global warming potential (GWP) values for common insulation products are provided in table R408.1.2. The calculation may utilize Type III, product-specific environmental product declaration (EPD) in lieu of default values for insulation products. If EPD values are used for a given insulation product, include the sum of lifecycle stages A1-A3 from the sourced EPD instead of default GWP value when completing the calculation. Include A5 and B1 GWP values for SPF and XPS products, as noted in R408. **OR**[b]	1
	Global Warming Potential (GWP)/square footage (kg CO2e/ft^2)	Demonstrate a calculated insulation GWP intensity (kg CO2e/ft^2) less than 0.5. Product-specific EPDs may be used in place of default values, subject to requirements in R408. **OR**[b]	2
		Demonstrate a calculated insulation GWP	3

		intensity (kg CO_2e/ft^2) less than 0. Product-specific EPDs may be used in place of default values, subject to requirements in R408.	
Multifamily Buildings	Efficient Elevator Equipment	Elevators in the building qualify with Energy Efficiency Class A per ISO 25745-2, Table 7.	1
	Residential Kitchen Equipment	All dishwashers, refrigerators, and freezers comply with the most recent ENERGY STAR Most Efficient label.	2
	Water Heating System Submeters	Each individual dwelling unit served by a central service water-heating system is provided with a service hot water meter connected to a reporting system that provides individual dwelling unit reporting of actual domestic hot water use.	1

For SI: 1 foot = 304.8 mm.

a. Heating and cooling system points are only available if all components of primary systems comply.

b. "OR" indicates that points are not additive; one component OR the following one can be selected, but not both.

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

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

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

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

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

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

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

d. https://~~neep.org/initiatives/high-efficiency-~~www.energystar.gov/products/~~emergingtechnologies/ashp/cold-climate-~~spec/central_air-_conditioner_and_air_source-_heat-_pump_specification_version_6_0_pd

e. Certification standard as of 1/1/2019 or later. "WERS" = Water Efficiency Rating Score http://www.wers.us/. ~~EPA WaterSense compliance for all water products, https://www.epa.gov/watersense. RESNET Water Energy Rating Index compliant, http://www.resnet.us/professional/about/resnet_to_develop_water_efficiency_rating_system.~~

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

EPA WaterSense compliance for all water products: https://www.epa.gov/watersense.
RESNET Water Energy Rating Index compliant:
http://www.resnet.us/professional/about/resnet_to_develop_water_efficiency_rating_system.

delete and replace **R402.1.3 *R*-value computation.**

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

and R402.1.3. Computed *R*-values shall not include an *R*-value for other building materials or air films. Where insulated siding is used for the purpose of complying with the continuous insulation requirements of Tables R402.1.1 and R402.1.3, the manufacturer's labeled *R*-value for insulated siding shall be reduced by R-0.6. Average continuous insulation R-values across flat roofs meet the requirements of **Tables R402.1.2.1 and R402.1.2.3**,

delete and replace **R402.1.4 *U*-factor alternative.**
An assembly with a *U*-factor equal to or less than that specified in Table R402.1.4 shall be permitted as an alternative to the *R*-values in ~~Table~~Tables R402.1.2.1~~.~~ and R402.1.2.3. The building must still comply with ~~Table~~Tables R402.1.~~2.~~2.1, R402.1.2.2, and Table R402.1.2.3.

An assembly with a *U*-~~-~~factor equal to or less than that specified in Table R402.1.4 shall be permitted as an alternative compliance method with no Table R402.1.2.3 points required, provided that (a) airtightness is ~~≤ 2.~~less than or equal to 0.15 CFM50/Sq. Ft. of Building Shell (~2 ACH50) tested, and (b) the ventilation system ~~is: Balanced;~~complies with ~~ECM fan(s) plus ≥ 70% SRE for HRV, or ≥ 65% SRE for ERV~~section R304.

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

1. Alterations.

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

delete and replace **TABLE R402.1.4**

TABLE R402.1.4
EQUIVALENT *U*-FACTORS[a,c]

FENESTRATION *U*-FACTOR	~~SKY-LIGHT~~ SKYLIGHT *U*-FACTOR	CEILING *U*-FACTOR	FRAME WALL *U*-FACTOR	MASS WALL *U*-FACTOR[b]	FLOOR *U*-FACTOR	BASEMENT WALL *U*-FACTOR	CRAWL SPACE WALL *U*-FACTOR	SLAB ~~&~~ ON GRADE & UNHEATED SLAB *U*-FACTOR & DEPTH
0.~~27~~30	0.~~55~~41	0.~~022~~020	0.044	0.060	0.~~030~~027	0.~~035~~39	0.~~035~~39	0.~~066~~05, 4 ft

For SI: 1 foot = 304.8 mm.
a. Nonfenestration *U*-factors shall be obtained from measurement, calculation or an approved source.
b. When more than half the insulation is on the interior, the mass wall *U*-factors shall be a maximum of 0.057.
c. Airtightness of ~~≤ 2.~~less than or equal to 0.15 CFM50/Sq. Ft. of Building Shell (~2 ACH50) tested and balanced ventilation system compliant with ~~ECM fan(s) plus ≥ 70% SRE for HRV, or ≥ 65% SRE for ERV are required~~R304, or the building must comply with ~~Table~~Tables R402.1.2.2 and ~~Table~~ R402.1.2.3.

delete and replace **R402.1.5 Total UA alternative.**

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

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

1. Alterations.

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

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

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

1. Design log home in accordance with ICC 400~~-2017~~—2022 or to the requirements of Table R402.1.6.

2. Determine the number of points needed to comply, using Table R402.1.2.2 based on building size~~; AND~~.

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

~~*add*~~ *delete and replace* **TABLE R402.1.6**

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

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

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

For SI: 1 foot = 304.8 mm.

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

delete and replace **R402.2 ~~Specific insulation requirements (Prescriptive).~~**
~~In addition to the requirements of Section R402~~**.1**~~, insulation shall meet the specific requirements of Sections R402.2.1 through R402.2.15.~~

~~*delete and replace* **R402.2.2**~~ **Ceilings ~~without~~with attic spaces.**
Where Section R402.1.2 would require R-49 insulation ~~levels above R-30 and~~in the ~~design of the roof/~~ceiling ~~assembly does not allow sufficient space for the required insulation, the minimum required insulation for such roof/ceiling assemblies shall be~~ , installing R-~~30. Insulation shall extend~~38 over the top of ~~the wall plate to the outer edge of such plate and shall not be~~ exterior walls where insulation is compressed~~. This reduction of insulation from the requirements of~~ in the eaves shall be deemed to satisfy the requirement for R-49 insulation provided that the balance of the ceiling is at R-49. Where Section R402.1~~.2 shall be limited to 500 square feet (46 m^2) or 20 percent of the total insulated~~ would require R-60 insulation in the

ceiling ~~area, whichever is less~~, installing R-49 over the top of exterior walls where insulation is compressed in the eaves shall be deemed to satisfy the requirement for R-60 provided the balance of the ceiling is at R-60. This reduction shall not apply to the U-factor alternative approach in Section R402.1.4 and the total UA alternative in Section R402.1.5.

delete and replace **R402.2.2 Ceilings without attic spaces (slopes).**
Where Section R402.1.2 would require R-49 insulation in the ceiling, installing R-38 over the top of exterior walls where insulation is compressed in the eaves shall be deemed to satisfy the requirement for R-49 insulation provided that the balance of the ceiling is at R-49. Where Section R402.1 would require R-60 insulation in the ceiling, installing R-49 over the top of exterior walls where insulation is compressed in the eaves shall be deemed to satisfy the requirement for R-60 This reduction shall not apply to the *U*-factor alternative approach in Section R402.1.4 and the Total UA alternative in Section R402.1.5.

delete and replace **R402.2.3 Eave baffle.**
For air-permeable insulations in vented attics, a baffle shall be installed adjacent to soffit and eave vents. Baffles shall maintain ~~an~~a net free area opening equal to or greater than the net free area of the vent. The baffle shall extend over the top of the attic insulation. The baffle shall be permitted to be any solid material.

~~*delete and replace* **TABLE R402.2.6** *footnotes as follows:*~~
~~a. The first value is~~ The baffle shall be installed to the outer edge of the exterior wall top plate so as to provide maximum space for attic insulation coverage over the top plate. Where soffit venting is not continuous, baffles shall be installed continuously to prevent ventilation air in the eave soffit from bypassing the baffle.

delete and replace **R402.2.4 Access hatches and doors.**
Access hatches and doors from conditioned spaces to unconditioned spaces such as attics and crawl spaces shall be weatherstripped and insulated to the same R-value required by Section R402 for the wall or ceiling in which they are installed. Access shall be provided to all equipment that prevents damaging or compressing the insulation. A wood-framed or equivalent baffle or retainer is required to be provided when loose-fill insulation is installed, the purpose of which is to prevent the loose-fill insulation from spilling into the living space when the attic access is opened, and to provide a permanent means of maintaining the installed *R*-value of the loose-fill insulation.

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

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

delete and replace **R402.2.6 Steel-frame ceilings, walls and floors.**
Steel-frame ceilings, walls, and floors shall comply with the U-factor requirements of Table R402.1.2.1. The calculation of the U-factor for steel-framed ceilings and walls in an envelope assembly shall be determined in accordance with AISI S250 as modified herein.

1. Where the steel-framed wall contains no cavity insulation ~~*R*-value,~~ and ~~the second value is~~ uses continuous insulation ~~*R*-value. For example, "R-30+3" means R-30~~ to satisfy the U-factor maximum, the steel-framed wall member spacing is permitted to be installed at any on center spacing.

2. Where the steel-framed wall contains framing spaced at 24 inches (610 mm) on center with a 23% framing factor or framing spaced at 16 inches (400 mm) on center with a 25% framing factor, the net lower framing member spacing input values shall be used when calculating using AISI S250.
3. Where the steel-framed wall contains less than 23% froaming factors the AISI S250 shall be used without any modifications.
4. Where the steel-framed wall contains other than standard C-shape framing members the AISI S250 calculation option for other than standard C-shape framing is permitted to be used.

delete **TABLE R402.2.6**

delete and replace **R402.2.8 Floors.**
Floor framing-*cavity insulation* ~~plus R-3 continuous insulation~~shall be installed to maintain permanent contact with the underside of the subfloor decking.
~~b. Insulation exceeding the height of the framing shall cover the framing.~~

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

delete and replace **R402.2.9 Basement walls.**
Walls associated with conditioned basements shall be insulated from the top of the *basement wall* down to 10 feet (3048 mm) below grade or to the basement floor, whichever is less. Walls associated with unconditioned basements shall meet this requirement unless the floor overhead is insulated in accordance with Sections R402.1.2.1 and R402.2.8.

delete and replace **R402.2.10 Slab-on-grade floors.**
Slab-on-grade floors with a floor surface less than 12 inches (305 mm) below grade shall be insulated in accordance with Table R402.1.2.1. The insulation shall extend downward from the top of the slab on the outside or inside of the foundation wall. Insulation located below grade shall be extended the distance provided in Table R402.1.2.1 by any combination of vertical insulation, insulation extending under the slab or insulation extending out from the building. Insulation extending away from the building shall be protected by pavement or by not less than 10 inches (254 mm) of soil. The top edge of the insulation installed between the *exterior wall* and the edge of the interior slab shall be permitted to be cut at a 45-degree (0.79 rad) angle away from the *exterior wall.* Slab-edge insulation is not required in jurisdictions designated by the *code official or authority having jurisdiction*, where one exists, as having a very heavy termite infestation.

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

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

1. The minimum ceiling insulation *R*-value shall be R-~~30.~~ 38.

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

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

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

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

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

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

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

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

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

add **R402.2.16 Building Science**
Consider building science principles in all design and construction. Buildings should be designed and constructed recognizing principles behind moisture vapor control approaches for cold climates. Maintain the envelope assembly's ability to adequately dry in at least one direction by not installing low-perm vapor retarder materials (e.g., vapor barrier) on both sides of an assembly, seek to optimize the assembly's ability to dry, and limit the potential for wetting. (From Applied Building Technologies Group, LLC).

delete and replace **R402.3 Fenestration ~~(Prescriptive).~~.**
In addition to the requirements of Section R402.1.2.1, fenestration shall comply with Sections R402.3.1 through R402.3.5.

delete and replace **R402.3.2 Glazed fenestration SHGC.**
An area-weighted average of fenestration products more than 50-percent glazed shall be permitted to satisfy the SHGC requirements.

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

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

delete and replace **R402.3.3 Glazed fenestration exemption.**
Up to 15 square feet (1.4 m^2) of glazed fenestration per dwelling unit shall be permitted to be exempt from *U*-factor and SHGC requirements in Section R402.1.2.1. This exemption shall not apply to the *U*-factor alternative approach in Section R402.1.4 and the Total UA alternative in Section R402.1.5.

delete and replace **R402.3.4 Opaque door exemption.**
One side-hinged opaque door assembly up to 24 square feet (2.22 m^2) in area is exempted from the *U*-factor requirement in Section R402.1.2.1. This exemption shall not apply to the *U*-factor alternative approach in Section R402.1.4 and the total UA alternative in Section R402.1.5.

delete and replace **R402.3.5 Sunroom and conditioned garage fenestration.**
Sunrooms and conditioned garages enclosing *conditioned space* shall meet the fenestration requirements of this code.

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

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

delete and replace **R402.4 Air leakage ~~(Mandatory).~~**
The *building thermal envelope* shall be constructed to limit air leakage in accordance with the requirements of this Section.

delete and replace **R402.4.1 Building thermal envelope.**
The *building thermal envelope* shall comply with Sections R402.4.1.1 through R402.4.~~4.5~~1.3. The sealing methods between dissimilar materials shall allow for differential expansion and contraction.

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

delete and replace **TABLE R402.4.1.1**

TABLE R402.4.1.1
AIR BARRIER, AIR SEALING AND INSULATION ~~INSTALLATION~~[a]INSTALLATION

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
General conditions and appropriate materials for air barriers	A continuous, durable air barrier shall be installed in the building envelope. ~~The exterior thermal envelope contains a continuous, durable air barrier.~~ Breaks or joints in the air barrier shall be sealed. ~~An air barrier is defined as any durable solid (non-porous) material that completely blocks air flow between *conditioned space* and *unconditioned space*, including necessary accessories to provide adequate support to resist positive and negative pressures without displacement or damage.~~ The air barrier should be continuous and be durably connected to all penetrations, windows and other (structural) interruptions. Open-cell or closed-cell foam shall have a finished thickness ~~≥~~greater than or equal to 5.5 in. or 1.5 in., respectively, to qualify as an air barrier unless the manufacturer indicates otherwise. If flexible air barriers are used, they shall be fully sealed at all seams and edges and supported ~~per~~in accordance with manufacturer's installation instructions. Flexible air barriers shall not be made of kraft paper, or other materials that are easily torn. If polyethylene is used, its thickness shall be ~~≥~~greater than or equal to 6 mil. Materials meeting ASTM E2357 Standard Test Method for Determining Air Leakage of Air Barrier Assemblies are acceptable.	Air-permeable insulation shall not be used as a sealing material; when installed in vertical walls, sloped ceilings, and floors within the thermal envelope, it shall be enclosed on all six sides and in contact with a durable, air barrier.
Dropped ceilings/soffits	The air barrier in any dropped ceiling/soffit shall be aligned with (in contact with) the insulation and any gaps in the air barrier shall be sealed. Access openings, drop ~~down stairs~~downstairs or knee wall doors to unconditioned attic spaces shall be sealed, insulated and gasketed.	The insulation in any dropped ceiling/soffit shall be aligned with (in contact with) the air barrier and shall be enclosed on five sides and in contact with a durable, interior air barrier. A top-side air barrier is not required in a flat attic.
Framing junctions and cavities	The junction of the foundation and sill plate shall be sealed. The junction of the top plate and the top of exterior wall sheathing shall be sealed. Knee walls shall be air sealed. When part of the thermal envelope, knee wall insulation shall be enclosed on all six	Cavities within corners and headers of frame walls shall be insulated by completely filling the cavity with a material having a minimum thermal resistance of R-3

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

	Doors or hatches in knee walls opening to exterior or unconditioned space shall be insulated and gasketed.	
~~Narrow cavities~~		~~Batts in narrow cavities shall be cut to fit, or narrow cavities shall be filled by insulation that on installation readily conforms to the available cavity space.~~
~~Garage separation~~	~~Air sealing shall be provided between the garage and *conditioned spaces*.~~	
~~Recessed lighting and appliances~~	~~Recessed light fixtures and other appliances (speakers, exhaust fans, light shafts, etc.) installed in the building thermal envelope shall be ICAT (Insulation Contact and Air Tight) rated, airtight labeled (or "Washington State Approved") and sealed with a gasket or caulk between the housing and the interior wall or ceiling cover. Fixtures and appliances shall maintain required clearances of not less than ½" from combustible material and not less than 3" from insulation material, or as required by manufacturer's installation requirements.~~	~~Recessed light fixtures installed in the building thermal envelope shall be air tight and ICAT rated (ICAT rated indicates Insulation Contact and Air Tight and meets IC and air tightness requirement).~~
~~Plumbing and wiring~~	~~All plumbing and wiring penetrations shall be sealed to the air barrier.~~	~~Insulation shall be placed between the exterior of the wall assembly and pipes. Insulation should not be installed on the interior of the piping. Batt insulation shall be cut neatly to fit around wiring and plumbing in exterior walls, or insulation that on installation readily conforms to available space shall extend behind piping and wiring and shall be in full contact with all air barriers.~~
~~Shower/tub on exterior wall~~	~~Exterior walls adjacent to showers and tubs shall have insulation filling any gaps or voids between tub or shower walls and unconditioned space.~~	~~Exterior walls adjacent to showers and tubs shall have a rigid durable, air barrier separating the exterior wall from the shower and tubs and be insulated.~~
~~Electrical/phone box on exterior walls~~	~~The air barrier shall be installed behind electrical or communication boxes or air sealed boxes shall be installed.~~	~~Insulation completely fills voids between the box and exterior sheathing.~~
~~Common wall~~	~~Whenever continuity of the building thermal envelope is broken at walls separating dwelling units in Group R-2 building, including common, party, and fire walls, such walls shall be insulated to a minimum of R-10 on each side of the break in insulation continuity.~~	~~Air barrier shall be installed in common wall between dwelling units. Common walls shall be sealed at junctions with outside walls and at the top pressure plane of the house.~~
~~HVAC register boots~~	~~HVAC register boots that penetrate building thermal envelope shall be sealed to the subfloor or drywall.~~	
~~Concealed sprinklers~~	~~When required to be sealed, concealed fire sprinklers shall only be sealed in a manner that is recommended by the manufacturer. Caulking or other adhesive sealants shall not be used to fill voids between fire sprinkler cover plates and walls or ceilings.~~	

~~Fireplace~~	~~A durable air barrier shall be installed in contact with insulation. Fireplace shall have compression closure doors and combustion air supplied from the outdoors.~~	

(continued)

TABLE R402.4.1.1—continued
AIR BARRIER AND INSULATION INSTALLATION

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
Narrow cavities	Narrow cavities of 1 inch or less that are not able to be insulated shall be air sealed.	Batts in narrow cavities shall be cut to fit, or narrow cavities shall be filled by insulation that on installation readily conforms to the available cavity space.
Garage separation	Air sealing shall be provided between the garage and *conditioned spaces*.	Insulated portions of the garage separation assembly shall be installed in accordance with Sections R303 and R402.2.7.and R402.2.7.
Recessed lighting and appliances	Recessed light fixtures installed in the building thermal envelope shall be air sealed in accordance with Section R402.4.5. Recessed light fixtures and other appliances (speakers, exhaust fans, light shafts, etc.) installed in the building thermal envelope shall be ICAT (Insulation Contact and Air Tight) rated, airtight labeled (or "Washington State Approved") and sealed with a gasket or caulk between the housing and the interior wall or ceiling cover. Fixtures and appliances shall maintain required clearances of not less than 1/2 inch from combustible material and not less than 3 inches from insulation material, or as required by manufacturer's installation requirements.	Recessed light fixtures installed in the building thermal envelope shall be airtight and ICAT rated (ICAT-rated indicates Insulation Contact and Airtight and meets the IC and air tightness requirement), and shall be buried or surrounded with insulation.
Plumbing and wiring	All holes created by wiring, plumbing or other penetrations in the air barrier assembly shall be air sealed.	Insulation shall be installed to fill the available space and surround wiring, plumbing, or other obstructions, unless the required *R*-value can be met by installing insulation and air barrier systems completely to the exterior side of the obstructions. Insulation shall be placed between the exterior of the wall assembly and

		pipes. Insulation should not be installed on the interior of the piping. Batt insulation shall be cut neatly to fit around wiring and plumbing in exterior walls, or insulation that on installation readily conforms to available space shall extend behind piping and wiring and shall be in full contact with all air barriers.
Shower/tub on exterior wall	Exterior walls adjacent to showers and tubs shall have insulation filling any gaps or voids between tub or shower walls and unconditioned space.	Exterior walls adjacent to showers and tubs shall have a rigid, durable air barrier separating the exterior wall from the shower and tubs and be insulated.
Electrical/phone box on exterior walls	The air barrier shall be installed behind electrical, or communication boxes or air-sealed boxes shall be installed.	Insulation completely fills voids between the box and exterior sheathing.
Common wall	Whenever continuity of the building thermal envelope is broken at walls separating dwelling units in Group R-2 building, including common, party, and fire walls, such walls shall be insulated to a minimum of R-10 on each side of the break in insulation continuity.	Air barrier shall be installed in the common wall between dwelling units. Common walls shall be sealed at junctions with outside walls and at the top pressure plane of the house.
HVAC register boots	HVAC register boots that penetrate building thermal envelope shall be sealed to the subfloor or drywall.	—
Concealed sprinklers	When required to be sealed, concealed fire sprinklers shall only be sealed in a manner that is recommended by the manufacturer. Caulking or other adhesive sealants shall not be used to fill voids between fire sprinkler cover plates and walls or ceilings.	—
Fireplace	A durable air barrier shall be installed in contact with insulation. Fireplaces shall have compression closure doors and combustion air supplied from the outdoors.	—

a. In addition, inspection of log walls shall be in accordance with the provisions of ICC 400 ~~2017.~~ 2022

~~add~~b. Air barrier and insulation full enclosure is not required in unconditioned/ventilated attic spaces and at rim joints.

delete and replace **R402.4.1.2 Air Leakage Testing.**
The *building* or dwelling unit shall be tested *and* verified as having an air leakage rate not exceeding ~~three (3~~two (2) air changes per hour~~.~~ or 0.15 CFM50/Sq. Ft. Building Shell area of all six sides of the building. Testing shall be conducted in accordance with **ANSI/RESNET/ICC 380**, **ASTM E779** or **ASTM E1827** and reported at a pressure of 0.2 ~~inch~~inches w.g. (50 Pascals). Multifamily buildings shall comply with CBES C402.4.~~-~~Testing and verification shall be conducted by an applicable Building Performance Institutes (BPI) Professional, a Home Energy Rating

System (HERS) Energy Rater, HERS Field Inspector, or a Vermont Department of Public Service approved air leakage tester. A written report of the results of the test shall be signed by the party conducting the test. Testing shall be performed at any time after creation of all penetrations of the *building thermal envelope*.

During testing:

1. Exterior windows and doors, fireplace and stove doors shall be closed, but not sealed, beyond the intended weatherstripping or other infiltration control measures.

2. Dampers including exhaust, intake, makeup air, backdraft and flue dampers shall be closed, but not sealed beyond intended infiltration control measures.

3. Interior doors, where installed at the time of the test, shall be open.

4. Exterior or interior terminations for continuous ventilation systems shall be sealed.

5. Heating and cooling systems, where installed at the time of the test, shall be turned off.

6. Supply and return registers, where installed at the time of the test, shall be fully open.

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

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

delete and replace **R402.4.1.3 Reporting.**
Air leakage testing shall be reported on the RBES Certificate in units of air changes per hour at 50 Pascals (ACH50~~).~~

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

delete and replace **R402.4.2 Fireplaces.**
New wood-burning fireplaces shall have tight-fitting doors and outdoor combustion air. Where using tight-fitting doors on factory-built fireplaces *listed* and *labeled* in accordance with UL 127, the doors shall be tested and *listed* for the fireplace. Where using tight-fitting doors on masonry fireplaces, the doors shall be listed and labeled in accordance with UL 907~~.~~ 2019.

~~*delete and replace*~~*add* **R402.4.~~5 Recessed lighting.~~**
~~Recessed luminaires~~**6 Electrical and communication outlet boxes (air-sealed boxes)**.
Electrical and communication outlet boxes installed in the building thermal envelope that are

through or outside the building air barrier shall be sealed to limit air leakage between conditioned and unconditioned spaces. ~~All recessed luminaires~~Electrical and communication outlet boxes shall be ~~ICAT-rated (Insulation Contact and~~tested in accordance with **NEMA OS 4**, Requirements for Air~~-Tight) or IC-rated and *labeled* as having~~-Sealed Boxes for Electrical and Communication Applications and shall have an air leakage rate of not ~~more~~greater than 2.0 ~~cfm~~cubic feet per minute (0.944 L/s) ~~when tested in accordance with ASTM E283~~ at a ~~1.57 psf (75 Pa)~~ pressure differential~~. All recessed luminaires~~ of 1.57 psf (75 Pa). Electrical and communication outlet boxes shall be ~~sealed~~marked "NEMA OS 4" or "OS 4" in accordance with ~~a gasket or caulk between the housing and~~ **NEMA OS 4**. Electrical and communication outlet boxes shall be installed per the ~~interior wall or ceiling covering~~manufacturer's instructions and with any supplied components required to achieve compliance with **NEMA OS 4**.

delete and replace **R402.5 Maximum fenestration *U*-factor and SHGC ~~(Mandatory).~~().**
The area-weighted average maximum *fenestration U*-factor permitted using tradeoffs from Section R402.1.5 or R405 shall be 0.30 for *vertical fenestration*, and 0.~~55~~41 for skylights.

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

add **R402.~~6 Vestibules~~7 Solar-ready zone.**

add **R402.7.1 General.**
Solar-ready zone is required for Stretch Code but is optional for Base Code. Points are available for meeting the solar-ready zone requirements for Base Code.

For Stretch Code, new detached one- and two-family dwellings, and multiple single-family dwellings (townhouses) with not less than 600 square feet (55.74 m^2) of roof area oriented between 110 and 270 degrees of true north shall comply with this Section.

Exceptions:

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

Multifamily buildings ~~3~~ shall comply with CBES C402.5.

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

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

add **R402.7.3 Solar-ready zone area.**

The total solar-ready zone area shall consist of an area not less than 300 square feet (27.87 m^2) per dwelling exclusive of mandatory access or setback areas. New multiple single-family dwellings (townhouses) three stories or less ~~built~~in height above ~~a parking garage require a vestibule~~grade plane and with a total floor area less than or equal to 2,000 square feet (185.8 m^2) per dwelling shall have a solar-ready zone area of not less than 150 square feet (13.94 m^2) per dwelling. The solar-ready zone area shall be not less than 40 percent of the roof area calculated as the horizontally projected gross roof area less the area covered by skylights, occupied roof decks, vegetative roof areas and mandatory access or set back areas as required by the *International Fire Code*. The solar-ready zone shall be composed of areas not less than 5 feet (1524 mm) in width and not less than 80 square feet (7.44 m^2) exclusive of access or required set back areas.

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

add **R402.7.4 Obstructions.**

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

add **R402.7.5 Shading.**

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

add **R402.7.6 Capped roof penetration sleeve.**

A capped roof penetration sleeve shall be provided adjacent to a solar-ready zone located on a roof slope of not greater than 1 unit vertical in 12 units horizontal (8-percent slope). The capped roof penetration sleeve shall be sized to accommodate the future photovoltaic system conduit, but shall have an inside diameter of not less than 11/4 inches (32 mm).

add **R402.7.7 Roof load documentation.**

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

add **R402.7.8 Interconnection pathway.**

Construction documents shall indicate pathways for routing of conduit (or plumbing for solar thermal systems) from the solar-ready zone to the electrical service panel or service hot water system. Alternatively, install two 1-inch minimum diameter EMT conduits from the main

electrical panel location to the attic or other area easily accessible to the solar array's proposed location. Conduits for future solar installations are to be capped, airtight and labeled at both ends.

add **R402.7.9 Electrical service reserved space.**

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

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

The floor area of the electrical energy storage system-ready area shall be not less than 2 feet (610 mm) in one dimension and 4 feet (1219 mm) in another dimension and located in accordance with ~~C402.4.7 from the Vermont Commercial~~Section 1207 of the *International Fire Code*. The location and layout diagram of the electrical energy storage system-ready area shall be indicated on the construction documents.

add **R402.7.11 Construction documentation certificate.**

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

add **R402.8 *Tiny house*s.**

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

Tiny houses require the following:

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

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

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

- ducts inside thermal boundary.

Compliance with all other provisions of this code is required.

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

SECTION R403
SYSTEMS

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

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

Exception: The following exceptions are allowed as long asonly where a 5-wire connection to thermostat location is provided:

1. Radiant floor, wall, ceiling and/or beam system on dedicated zone.

2. *Cold-climate heat pump* not designed for setbacks.

Wifi

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

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

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

Ductless heat pumps shall not have integrated supplementary electric-resistance heat other than that provided for frost control. See Section R404.24 for guidance on electric-resistance heating equipment other than heat pumps.

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

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

delete and replace **R403.3.3 Duct testing**
1 Ducts shall be pressure tested to determine air leakage by one of the following methods:**located outside conditioned space.**

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

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

Exceptions:

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

delete and replace **R403.4 Mechanical system piping insulation (Mandatory).**
Mechanical system piping designed to carry fluids above 105°F (41°C) or below 55°F (13°C) shall be located within the building thermal envelope and insulated to a minimum of R-~~3~~4.

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

~~*delete and replace*~~ *delete and replace* **R403.5.1.1 Circulation systems.**
Where installed, heated water circulation systems shall be provided with a circulation pump. The system return pipe shall be a dedicated return pipe or a cold-water supply pipe. Gravity and thermosyphon circulation systems shall be prohibited. Controls for circulating hot water system pumps shall automatically turn off the pump when the water in the circulation loop is at the desired temperature and when there is no demand for hot water. The controls shall limit the temperature of the water entering the cold-water piping to not greater than 104ºF (40ºC).

delete and replace **R403.5.3 Hot water pipe insulation ().**
Insulation for service hot water pipe with a minimum thermal resistance (*R*-value) of R-4 shall be applied to the following:

1. Piping $^3/_4$ inch (19.1 mm) and larger in nominal diameter located inside the *conditioned space*

2. Piping serving more than one dwelling unit.

3. Piping located outside the conditioned space.

4. Piping from the water heater to a distribution manifold.

5. Piping located under a floor slab.

6. Buried piping.

7. Supply and return piping in circulation and recirculation systems other than cold water pipe return demand recirculation systems.

R403.6 Mechanical ventilation.
Follow the mechanical ventilation requirements in R304.

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

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

delete **TABLE R403.6.1**

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

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

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

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

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

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

~~*delete and replace* **R403.9 Snow melt and ice system controls (Mandatory).**~~
~~Snow- and ice-melting systems, supplied through energy service to the building, shall include automatic controls capable of shutting off the system when the pavement temperature is above 45°F (10°C) and precipitation is falling, and an automatic or manual control that~~ but will ~~allow shutoff when the outdoor temperature is above 40°F (4.8°C).~~not be subject to the additional requirements outlined in Tables C406.1.1 and Table 406.1.2.

delete and replace **R403.10.1 Residential pools and permanent residential spas.**
Where installed, the energy consumption of residential swimming pools and ~~residential~~ permanent residential spas ~~that are accessory to detached one- and two-family dwellings and townhouses three stories or less in height above grade plane and that are available only to the household and its guests~~ shall be controlled in accordance with the requirements of APSP ~~-~~15.

delete and replace **R403.10.4 Covers.**
Outdoor heated pools and outdoor permanent spas shall be provided with an insulated vapor-retardant cover of at least R-12 or other *approved* vapor-retardant means.

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

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

SECTION R404
ELECTRICAL POWER AND LIGHTING SYSTEMS

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

delete **R404.1.1 Lighting equipment**

add **R404.1.1 Exterior lighting.**
Exterior lighting for residential buildings shall comply with Sections C405.5 (Exterior Lighting Power Requirements) of the *Vermont Commercial Building Energy Standards* (CBES).

Exceptions:

1. Detached one- and two- family dwellings.
2. Townhouses.
3. Solar-powered lamps not connected to any electrical service.
4. Luminaires controlled by a ~~permanently installed lighting fixture, the number of lamps is to be used in calculating the percentage~~motion sensor.

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

delete and replace **R404.1.2 Lighting equipment for multifamily spaces ~~(Mandatory).~~**
Multifamily buildings three-stories or less with common areas, stairwells, vestibules, lobbies, parking garages, and exterior parking areas and drives~~,~~ must meet the lighting power density (LPD) specifications of the *Vermont Commercial Building Energy Standards* (CBES). For

parking garages, see Section C405.3.2; for uncovered parking areas and drives, see Section C405.45.2.

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

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

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

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

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

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

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

Building heating with electric-resistance heating equipment is prohibited.

Exceptions~~*:~~ **:**

1. Replacement of existing electrical resistance units.

2. Limited areas where other heating sources are cost prohibitive or impractical (~~e.g.,~~for example, a small interior space such as a bathroom or stairwell, which is distant from the distribution system).

3. Buildings with cold-~~-~~climate heat pump(s) as the primary heating system, provided that:

   a. The supplemental electric-resistance heat is controlled to prevent it from operating at an outside air temperature of 5°F or higher~~; and~~ .

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

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

~~*~~

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

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

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

Exception: Electric vehicle parking spaces are not ~~counted in Table R404.3~~ required if one of the following conditions apply:

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

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

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

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

~~Level 2 Electric Vehicle Charging Parking requires one 208/240V 40 amp grounded connection for electric vehicle charging through dedicated EVSE with J1772 connector or AC receptacle, NEMA 14-50, or equivalent, within 5 feet of the centerline for each EV Charging Parking Space.~~

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

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

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

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

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

~~*modify* "~~For *multifamily building* garage or covered parking, provide on electrical drawings the appropriate sized pathway to the building electrical room to accommodate a future electrical upgrade for Level 2 EVSE electric vehicle charging; provide adequate wall and floor space in the building electrical room for future EV charging related electrical equipment; provide the appropriate sized pathways to exterior on-grade surface parking spaces for future Level 2 EVSE electric vehicle charging; provide a line diagram on the electrical drawings demonstrating a pathway for future Level 2 EVSE electric vehicle charging. Quantity of future Level 2 EVSE electric vehicle charging stations shall be as required by Table R404.3.

add **R404.4 200 Amp Electrical Service.**

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

add **R404.5 Dwelling electrical meter.**

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

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

add **R404.6 Electrical transformers.**

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

Exception: The following transformers are exempt:

1. Transformers that meet the *Energy Policy Act of 2005* exclusions based on the DOE 10 CFR 431 definition of special purpose applications.

2. Transformers that meet the *Energy Policy Act of 2005* exclusions that are not to be used in general purpose applications based on information provided in DOE 10 CFR 431.

3. Transformers that meet the *Energy Policy Act of 2005* exclusions with multiple voltage taps where the highest tap is not less than 20 percent more than the lowest tap.

4. Drive transformers.

5. Rectifier transformers.

6. Auto-transformers.

7. Uninterruptible power system transformers.

8. Impedance transformers.

9. Regulating transformers.

10. Sealed and nonventilating transformers.

11. Machine tool transformers.

12. Welding transformers.

13. Grounding transformers.

14. Testing transformers.

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

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

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

SECTION R405

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

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

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

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

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

delete and replace **R406.2 Mandatory requirements.**
Compliance with this section requires that the applicable provisions in Sections ~~R402.1.1, R403.3.1, R403.5.3 and the mandatory provisions identified in Sections~~ R401.3, R402, R403 and R404 be met. The *building thermal envelope* shall be greater than or equal to levels of efficiency and *solar heat gain coefficients* in Table 402.1.2 of the 2009 *International Energy Conservation Code* for *Climate Zone* 6.

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

delete ~~*and replace*~~ **R406.4 ERI-based compliance.**

add **R406.4 ERI/HERS-Based Compliance for *Base Code* and *Stretch Code*.**
Compliance based on an ERI analysis requires that the *rated design* be shown to have an ERI/HERS Index less than or equal to 54 for *Base Code* and less than or equal to ~~61~~47 for *Stretch Code* when compared to the *ERI reference design*. Up to 5 ERI points can be earned with renewables. This includes all residential structures, including log homes. The ERI to be used to verify compliance is ~~"HERS Index with IAF" using~~ REM/~~Rate~~ v16.3.3 or later or Ekotrope version 4.0 or later that is accredited by RESNET at https://www.resnet.us/providers/accredited-providers/hers-software-tools/~~15.7. Up to 5 ERI points can be earned with renewables.~~ .If the HERS Index scale is revised, the Department of Public Service may update these Index points.

delete **TABLE 406.4**

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

SECTION R407
VERMONT STRETCH CODE

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

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

delete **TABLE R407.1**

delete **R407.2 Testing.**

delete **TABLE R407.2**

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

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

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

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

add **TABLE R407.2.1.1**

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

~~PACKAGES~~

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

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

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

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

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

~~c. The continuous portion of basement and crawlspace insulation can be met through interior, exterior or a combination.~~

~~d. "4 ft" can be horizontal or vertical coverage including slab edge. "Edge and under" requires complete coverage. Up to 8 lineal feet of exposed slab edge may be insulated to R-10. "Heated slab" are those with embedded radiation.~~

~~e. The first value is cavity insulation, the second value is continuous insulation, so "13 + 10" means R-13 cavity insulation plus R-10 continuous insulation. These insulation requirements can be met through any combination of insulation R-values that yields an equivalent effective R-value using a series-parallel path calculation method.~~

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

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

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

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

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

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

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

~~"ECM" = Electronically Commutated Motor~~

~~*add*~~

delete **R406.6.3 Additional documentation.**

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

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

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

2. An executed contract that conveys to the homeowner the RECs associated with the on-site renewable energy, or conveys to the homeowner an equivalent quantity of RECs associated with other renewable energy

add **R406.6.4 Additional documentation.**

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

1. Documentation of the building component characteristics of the *ERI reference design*.

2. A certification signed by the builder providing the building component characteristics of the *rated design*.

3. Documentation of the actual values used in the software calculations for the *rated design*.

SECTION R407
VERMONT STRETCH CODE

delete and replace **R407.2 Compliance**

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

For both Base Code and Stretch Code compliance, in Section R402.1.2.1 "Package Plus Points Approach", the same standard package is used. Stretch Code then requires more Points than

the Base Code. For ERI/HERS compliance, a lower HERS Index is required for Stretch Code than for Base Code.

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

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

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

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

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

delete **TABLE R407.2.1.2**

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

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

delete **TABLE R407.2.1.3**

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

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

delete **R407.4 Electric vehicle charging**

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

SECTION R408
INSULATION EMBODIED CARBON EMISSIONS

R408.1 Insulation Embodied Carbon

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

1. Insulation material type
2. Product R-value
3. Total surface area (ft^2)

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

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

TABLE R408.1.1

Table 1 – Insulation Global Warming Potential Calculation

									Optional					
A	B		C		D		E		F	G			H	I
Assembly	Material *List insulation material type from Table 2*		Product R-Value		Surface Area (gross square feet)		Framing Factor ("1.0" for continuous, "0.8" for cavity)		Default Global Warming Potential (kg CO2e /sq.m. RSI-1) *Use Default GWP values from Table 2. Leave blank for products where product specific data will be*	Project has sourced Type III - Product-specific Environmental Product *Check box if project will be substituting default values with product specific data*	Product Specific Global Warming Potential (kg CO2e /sq.m. RSI-1) *Leave blank unless EPDs have been sourced. Use GWP values from product-specific EPDs.*		Conversion Factor	GWP Result (kg CO2e)
Below grade, slab/slab edge				x		x	1.0	x		☐		x	0.0164	=
Basement walls				x		x	1.0	x		☐		x	0.0164	=
Above grade walls, cavity				x		x	0.8	x		☐		x	0.0164	=
Above grade walls, continuous				x		x	1.0	x		☐		x	0.0164	=
Roof, flat				x		x	1.0	x		☐		x	0.0164	=
Roof, sloped, cavity				x		x	0.8	x		☐		x	0.0164	=
Roof, sloped, continuous				x		x	1.0	x		☐		x	0.0164	=

	Input for basic calculation	Summary Metrics	Total Insulation GWP (kg CO2e)
	Inputs for product-specific data		Conditioned Floor Area (sf)
	Calculation outputs		OUTPUT: Insulation GWP Intensity

TABLE R408.1.2
DEFAULT INSULATION GLOBAL WARMING POTENTIAL VALUES

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

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

graphite	
EPS - Board, unfaced, Type I - 10psi	2.80
EPS - Board, unfaced, Type II- 15psi	3.80
EPS - Board, unfaced, Type IX- 25psi	4.80
Fiberglass - Batt, unfaced	0.70
Fiberglass - Blown/loosefill	1.00
Fiberglass - Blown/spray	1.93[c]
Hemp - Batt	-0.50
HempCrete	-3.00
Mineral wool - Batt, unfaced	1.70
Mineral wool - Blown	1.60
Mineral wool - Board, unfaced, "light" density	3.30
Mineral wool - Board, unfaced, "heavy" density	8.10
Phenolic foam - Board	1.54[d]
Polyiso - Wall Board	4.10
Polyiso - Roof Board	2.90
SPF – Spray, open cell	1.40
SPF – Spray, closed cell HFO	4.20
SPF – Spray, high density HFO	4.90
SPF – Spray, closed cell HFC	13.10
SPF – Spray, high density HFC	17.00
Straw – Panel	-6.50
~~<2000 square feet~~Vacuum Insulated Panel	7 ~~points~~.40
~~2000 to 4000 square feet~~Wood fiber – Board, unfaced, European	~~9 points~~-6.50
~~>4000 square feet~~Wood fiber – Board, unfaced, North America	~~12 points~~-10.30
Wood fiber – Batt, unfaced	-2.40
Wool (Sheep) – Batt	1.00
Wool (Sheep) – Loosefill	0.80
XPS – Board, 25psi HFC	55.50
XPS – Board, 25psi “Low GWP” (HFO/HFC)	4.90

[a] https://www.buildersforclimateaction.org/beam-estimator.html~~*add* **R407.2.1.3 Points by Component.**~~

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

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

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

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

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

	Monitoring	Install whole-building energy monitoring system, min. 5 circuits and homeowner access to data	1
Other Measures	EV Ready	Level 2 electric vehicle charger-ready per 407.4 [k]	1
	Battery	Min. 6 kWh grid-connected dispatchable demand-response-enabled battery backup	1

For SI: 1 foot = 304.8 mm.

a. Heating and cooling system points are only available if all components of primary systems comply
b. "**OR**" indicates that points are not additive; one component OR the following one can be selected, but not both.
c. "H/ERV" = Heat or Energy Recovery Ventilation
d. "SRE" = System Recovery Efficiency
e. "ECM" = Electronically Commutated Motor
f. "ATWHP" = Air to Water Heat Pump
g. "gpm" = gallons per minute
h. "gpf" = gallons per flush. Applies to new construction only.
i. "GSHP" = ground source heat pump
j.
k. Points are limited to one per dwelling. Additional Level 2 charging equipment receives no more points.

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

delete **R407.3 Electric vehicle charging**

delete **TABLE R407.3**

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

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

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

Exception: Parking spaces are not counted in Table R404.3 if one of the following conditions apply:

1. Parking spaces intended exclusively for storage of vehicles for retail sale or vehicle service.
2. Parking spaces are separated from the meter by a public right-of-way.
3. Parking spaces which are limited to parking durations of less than an hour.

Parking spaces with *Electric Vehicle Supply Equipment* ("EVSE") shall be marked for EV use only.

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

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

Level 2 Electric Vehicle Charging Parking requires one 208/240V 40 amp grounded connection for electric vehicle charging through dedicated EVSE with J1772 connector or AC receptacle, NEMA 14-50, or equivalent, within 5 feet of the centerline for each EV Charging Parking Space. Level 2 "ready" includes space in the panel for at least one minimum 40-ampere branch circuit to be provided to garages and/or the exterior of the building to accommodate a future dedicated Society of Automotive Engineers (SAE) standard J1772-approved Level 2 EVSE. The circuits shall have no other outlets. The service panel shall provide sufficient capacity and space to accommodate the circuit and over-current protective device. A permanent and visible label stating "EV READY" shall be posted in a conspicuous place at both the service panel and the circuit termination point.

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

add **R407.5.1 General.**

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

EXCEPTIONS:

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

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

Construction documents shall indicate the solar ready zone where applicable.

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

The total solar-ready zone area shall consist of an area not less than 300 ft2 (27.87 m2) exclusive of mandatory access or set back areas. New multiple single-family dwellings (townhouses) three stories or less in height above grade plane and with a total floor area less than or equal to 2,000 ft2 (185.8 m2) per dwelling shall have a solar-ready zone area of

not less than 150 ft2 (13.94 m2). Multifamily buildings should maximize the solar-ready zone by consolidating mechanicals, access, set back areas and other roof obstructions with a goal of 40% of the roof area available for the solar-ready zone. The solar-ready zone shall be composed of areas not less than five feet (1,524 mm) in width and not less than 80 ft2 (7.44 m2) exclusive of access or required set back areas.

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

add **R407.5.4 Obstructions.**

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

add **R407.5.5 Roof Load Documentation.**

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

add **R407.5.6 Interconnection Pathway.**

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

add **R407.5.7 Electrical Service Reserved Space.**

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

[b] EPD Declaration Number NEPD-2012-889-EN
[c] EPD Declaration Number 4788647002.102.1
[d] EPD Declaration Number EPD-KSI-20190072-IBC1-EN

CHAPTER 5
EXISTING BUILDINGS

SECTION R501
GENERAL

delete **R501.2 Existing buildings.**

add **R501.2 General**

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

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

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

SECTION R502
ADDITIONS

~~*delete and replace* R502.1 General.~~

~~***Additions* to an existing *building*, *building* system or portion thereof shall conform to the provisions of this code as those provisions relate to new construction without requiring the unaltered portion of the existing *building* or *building* system to comply with this code. *Additions* shall not create an unsafe or hazardous condition or overload existing *building* systems. An *addition* shall be deemed to comply with this code where the *addition* alone complies, where the existing *building* and**~~*delete and replace* **R502.1.1.1 Building envelope.**

New *building* envelope assemblies that are part of the *addition* shall comply with Sections R402.1, R402.2, R402.3.1 through R402.3.5, and R402.4. Air leakage testing in accordance with Section R402.4.1.2 is not required for *additions* complying with this code based on the attributes of the *addition* alone. Where the existing *building* and the *addition* comply with this code as a single building, or where the *building* with the *addition* does not use more energy than the existing *building*~~. *Additions* shall~~, testing must be performed in accordance with Section ~~R502.1.1 or R502~~R402.4.1.2 and an air leakage rate not exceeding three (3) air changes per hour at 50 Pascals (or 0.23 CFM50/Sq. Ft. building shell area, six sided) must be verified.

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

~~New *building* envelope assemblies that are part of the *addition* shall comply with Sections R402.1, R402.2, R402.3.1 through R402.3.5, and R402.4.~~

Exception: Where *unconditioned* space is changed to *conditioned* space, the building envelope of the addition shall comply where the UA, as determined in Section ~~402~~R402.1.~~4~~5, of the existing building and the addition, and any alterations that are part of the project, is less than or equal to UA generated for the existing *building*.

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

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

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

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

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

SECTION R503
ALTERATIONS

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

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

1. Storm windows installed over existing fenestration.

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

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

4. Roof recover.

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

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

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

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

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

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

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

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

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

Alterations shall not create an unsafe or hazardous condition or overload existing *building* systems. *Alterations* shall be such that the existing *building* or structure uses no more energy than the existing *building* or structure prior to the *alteration*. *Alterations* to existing *buildings* shall comply with Sections R503.1.1 throughR503.1.4.

delete and replace **R503.1.4 Lighting.**
New lighting systems that are part of the *alteration* shall comply with Section R404.1.

> **Exception:** *Alterations* that replace less than ~~50~~10 percent of the luminaires in a space, provided that such *alterations* do not increase the installed interior lighting power.

SECTION R505
CHANGE OF OCCUPANCY OR USE

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

> **Exception:** Where the simulated performance ~~(REScheck)~~ option in Section R405 is used to comply with this section, the annual energy cost of the proposed design is permitted to be 110 percent of the annual energy cost otherwise allowed by Section R405.~~3.~~

~~SECTION R504~~
~~REPAIRS~~

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

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

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

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

CHAPTER 6
REFERENCED STANDARDS

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

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

~~AAMA~~**ASHRAE**

~~A m e r i c a n A r c h i~~

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

	ite 550 Schaumburg, IL 60173-4268
ASHRAE—2017 ASHRAE Handbook of Fundamentals	R402.1.5

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

		Determining the Airtightness of HVAC Equipment R403.3.2.1

~~ACCA~~

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

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

APSP

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

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

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

ASTM

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

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

E283—2004(2012) Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors Under Specified Pressure Differences Across the Specimen

R202 “Air-Impermeable Insulation,” R402.4.4

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

R402.4.1.2

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

R402.4.1.2

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

R202 “Air-Impermeable Insulation”

~~ASHRAE~~CSA

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

CSA Group 8501 Eastpoint Parkway, Cleveland, OH 44130

Standard reference number	Title	Referenced in code section number
ASHRAE—2017	ASHRAE Handbook of Fundamentals	R402.1.54.3

OH441315575

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

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

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

~~CSA~~

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

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

DASMA

Door and Access Systems Manufacturers Associatio__

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

			~~section number~~
~~105—2016~~	~~Test Method for Thermal Transmittance and Air Infiltration of Garage Doors~~	R303.1.3	

HVI	~~Home Ventilating Institute~~ ~~1000 North Rand Road, Suite 214~~ ~~Wauconda, IL 60084~~	Home Ventilating Institute 1000 North Rand Road, Suite 214 Wauconda, IL 60084
~~Standard reference number~~	~~Title~~	~~Referenced in code section number~~
~~916—09~~	~~Airflow~~**HVI Publication 916 - Air Flow Test Procedure**	Table R403.6.1
HVI Publication 920 - Product Performance Certification Procedure		R304.1.1, R403.6.1
HVI Publication 911: Certified Home Ventilating Products Directory - Section III - HRV/ERV Directory Listing		R304.5.1, R304.6

ICC

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

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

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

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

IEEE

The Institute of Electrical and Electronic

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

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

R403.5.1.2

NEMA

National Electrical Manufa

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

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

R402.4.6

~~IEEE~~ **FPA**

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

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

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

NFPA

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

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

NFRC

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

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

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

~~Standard reference number~~	~~Title~~	~~Referenced in code section number~~
~~ANSI/RESNET/ICC 301-2014~~	**ANSI/RESNET/ICC 301—2019 Standard for the Calculation and Labeling of the Energy Performance of ~~Low-rise Residential Buildings~~Dwelling and Sleeping Units using an Energy Rating Index ~~First~~ Published ~~March 7, 2014 — Republished January 2016~~ December 18, 2018** R406.6.1, R406.7.3	~~R406.3, R406.6.1~~ ~~R402.4.1.2~~
~~ANSI/RESNET/ICC 380-2016~~	**ANSI/RESNET/ICC 380—2016 Standard for Testing Airtightness ~~for~~of Building Dwelling Unit and Sleeping Unit Enclosures, Airtightness of Heating and Cooling Air Distribution Systems, and Airflow of Mechanical Ventilation Systems ~~—~~ Republished January 2016** R402.4.1.2	

UL	~~UL LLC~~ ~~333 Pfingsten Road~~ ~~Northbrook, IL 60062~~	UL LLC 333 Pfingsten Road Northbrook, IL 60062

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

US-FTC

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

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

WDMA

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

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

INDEX

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add **ELECTRIC RESISTANCE HEATING EQUIPMENT**.....R404.2

add **ELECTRIC VEHICLE CHARGING**

delete and replace **ENERGY ANALYSIS, ANNUAL**

delete and replace **ENERGY COST**

delete and replace **ENERGY RECOVERY VENTILATION SYSTEMS**

delete and replace **EQUIPMENT ROOM**

delete and replace **EXTERIOR WALL**

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Sunroom R402.3.5
Requirements. . . . . TABLE R402.1.2.1

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Defined. R202

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Eave baffle R402.2.3

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Agency of Administration
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Kristin L. Clouser, Secretary

INTERAGENCY COMMITTEE ON ADMINISTRATIVE RULES (ICAR) MINUTES

Meeting Date/Location: October 10, 2022, virtually via Microsoft Teams
Members Present: Chair Douglas Farnham, Brendan Atwood, Diane Bothfeld, Jared Adler, Jennifer Mojo, John Kessler, Diane Sherman, Michael Obuchowski and Donna Russo-Savage
Minutes By: Melissa Mazza-Paquette

- 2:01 p.m. meeting called to order, welcome and introductions.
- Review and approval of minutes from the September 12, 2022 meeting.
- No additions/deletions to agenda. Agenda approved as drafted.
- No public comments made.
- The following emergency rules were supported by ICAR Chair Farnham *(note the summaries may be found on the agenda)*:
    - Transitional Housing Program Emergency Rules, Agency of Human Services, Department for Children and Families, on 09/22/22
    - The Board of Medical Practice Emergency Rule, Agency of Human Services, Department of Health, on 09/30/22
    - PUC Emergency Rule 2.500 COVID-19 Emergency Procedures, Public Utility Commission, on 09/30/22
- Presentation of Proposed Rules on pages 3-9 to follow.
    1. Licensing Regulations for Foster Homes in Vermont, Agency of Human Services, Department for Children and Family Services, page 3
    2. Telehealth, Agency of Human Services, page 4
    3. Prosthetic and Orthotic Devices, Agency of Human Services, page 5
    4. Podiatry Services, Agency of Human Services, page 6
    5. Transplantation Services, Agency of Human Services, page 7
    6. Vermont Commercial Building Energy Standards, Department of Public Service, page 8
    7. Vermont Residential Building Energy Standards Amendments, Department of Public Service, page 9
- No other business.
- Next scheduled meeting is November 14, 2022 at 2:00 p.m.
- 3:47 p.m. meeting adjourned.

Proposed Rule: Vermont Residential Building Energy Standards Amendments, Department of Public Service

Presented By: Ben Civiletti, Barry Murphy and Kelly Launder

Motion made to accept the rule by Diane Bothfeld, seconded by Mike Obuchowski, and passed unanimously with the following recommendations:

1. Incorporate relevant feedback from the Vermont Commercial Building Energy Standards – stated below for reference:
   a. Provide the year when referring to the ICC standards.
   b. Proposed Filing Coversheet, #8: Include the date when the update occurred, what was updated, what is being done beyond the ICC, and explain the importance. Clearly identify that this is the Commercial rule – as it's written now, it's the same as the Residential rule.
   c. Proposed Filing Coversheet, #12: Provide an overview of the cost and benefit. Define 'modest'.
   d. Economic Impact Analysis, #3: Clarify units and title in the chart, and include references and footnotes.
   e. Define acronyms early and often.
   f. Economic Impact Analysis: Include parallel data to ICC.
   g. Economic Impact Analysis: Clearly identify who benefits from the economic impacts. Perhaps include a narrative separating the affecting parties.
   h. Environmental Impact Analysis, #9: Identify the sources of information used and the analysis done.
   i. Public Input Maximization Plan, #4: Remove duplicates.

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VERMONT
DEPARTMENT OF PUBLIC SERVICE

Louise Corliss
Office of the Secretary of State
1078 Route 2, Middlesex
Montpelier, Vt. 05633-7701

April 25, 2023

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

RE: Vermont Residential Building Energy Standards Rule Responsiveness Summary

Attached please find the responses of the Public Service Department ("Department") to comments and suggested changes (summarized in the document) received during the public comment period for the Residential Building Energy Standards ("RBES") rule. Each comment received by the Department (in full) is also included in its filing.

As discussed in the Economic Impact Analysis section of the rule documents, modifications to the 2023 RBES since the initial filing with the Secretary of State on 10/27/2022 ("Proposed Rule Filing") were made to ensure a cost-effective set of improvements compared to RBES 2020. These changes were necessary after the 2020 code reference home used in the model for comparison to the proposed 2023 code was changed to better reflect a 2020 RBES-compliant home and cost estimates were updated based on feedback from stakeholders. Specifically, the baseline reference home used in the Proposed Rule Filing was the 2020 RBES Package 1 only, without the added components that provide the required points for 2020 RBES compliance. Using this improved 2020 RBES reference home in the cost effectiveness model results in a more efficient baseline, which in turn means less energy savings when a 2023 RBES-compliant home is compared to this more efficient baseline. Additionally, new cost estimates were received for the proposed wall insulation measure, which made both the measure and the RBES package of recommendations as a whole not cost-effective. Accordingly, the Department found it necessary to make changes to certain components of the proposed 2023 RBES to arrive at a cost-effective package of improvements. These changes were: 1) window U-factor requirements changing from 0.27 back to the former 2020 RBES value of 0.30 (see Chapter 4, Table R402.1.2.1); 2) wall U-factor requirements changing from the value of 0.033 back to the former 2020 RBES value of 0.044 (See Chapter 4, Table R402.1.2.1); and 3) requiring "solar ready" for Stretch Code only and not for the base code. As compared to the initial proposal, these changes also significantly reduce the overall cost of complying with the 2023 RBES.

The Department also made other changes based on specific public comments, as noted in the attached summary of public comments and PSD responses.

The issue of code compliance and enforcement was a reoccurring topic during the lengthy stakeholder engagement process that the Department undertook to update this rule. It is not within the Departments purview to make the changes proposed by stakeholders, as compliance and enforcement requirements are embedded in statute. The core reason stated for wanting some level of enforcement and compliance was to 'level the playing field' by ensuring that all those involved in construction follow the law as described in this rule. Another related recommendation was to have code officials who can review technical plans and drawings prior to construction to ensure that the proposed structure meets the rule's requirements.

Please contact me if you need any additional information or clarification on this item.

Regards,

Keith Levenson
Energy Program Specialist,
Energy and Efficiency Resources Division
Public Service Department
Keith.Levinson@vermont.gov

Date	Commenter	Affiliation	Chapter Ref.	Comment Summary	PSD response	Decision and Resulting Changes Made
9/9/2022	Bryn Oakleaf	Efficiency Vermont	R102.1	why is there a reference to code official? Is there a code official that could determine a design meets the intent of the code?	These references to the "code official or authority having jurisdiction" are left in the code in the case that the state or any municipality is empowered to enforce the code.	
9/9/2022	Bryn Oakleaf	Efficiency Vermont	R304.1.1	Nomenclature alignment - "balanced whole house ventilation" in subsequent paragraphs "whole house balanced ventilation"	Changed all to "whole house balanced ventilation" to align with the definition in Section R202	Changed all to "whole house balanced ventilation" to align with the definition in Section R202
9/9/2022	Bryn Oakleaf	Efficiency Vermont	R304.1.1	why is the exception allowing demand-control removed?	This exception was kept. Demand controlled ventilation systems do not need to meet minimum runtimes or ventilation rates in the referenced alternative standards or in Section 304.6.1.1.	This exception was reinstated.
9/9/2022	Bryn Oakleaf	Efficiency Vermont	R304.5.2	Remove reference to single port ventilation equipment. Given section R304.5 exception and fan efficiency requirement in section R304.1.1, is this paragraph is necessary?	Agreed.	Section R304.5.2 deleted
9/9/2022	Bryn Oakleaf	Efficiency Vermont	R304.5.3	remove this requirement	Agreed.	Section R304.5.3 deleted
9/9/2022	Bryn Oakleaf	Efficiency Vermont	R304.5.4	Remove flow verification requirement (points option)	Agreed. This is now eligible for points in the prescriptive compliance pathway.	Section R304.5. deleted
9/9/2022	Bryn Oakleaf	Efficiency Vermont	R304.6	Need to clarify the fan flow listed in HVI and it if shall be used to show compliance with table R304.6, and flow at WHICH PRESSURE specified	Agreed.	Table R304.6 now lists rated capacity at 0.1 inches w.g.
9/9/2022	Bryn Oakleaf	Efficiency Vermont	R304.6	Remove third column in table R304.6	Agreed.	Third column in Table R304.6 removed
9/9/2022	Bryn Oakleaf	Efficiency Vermont	R304.6	Add delivered ventilation requirement	Not added since this would require testing and verification	
9/9/2022	Bryn Oakleaf	Efficiency Vermont	R304.7	Add reference to 304.6.1.1; require that the rate be met EACH SIX HOUR PERIOD	Not added since this refers to occupied periods vs. unoccupied periods rather than flow rates	
9/9/2022	Bryn Oakleaf	Efficiency Vermont	R304.9.5	Replace "securely" with "mechanically"	Agreed.	"securely" replaced with "mechanically" in Section R304.9.5
9/9/2022	Bryn Oakleaf	Efficiency Vermont	R305.4.3.4	Change minimum mesh size to 1/2"	Agreed.	Section R305.4.3.4 now reads, "The air inlet shall be screened with 1/2 inch (13 mm) mesh."
9/9/2022	Bryn Oakleaf	Efficiency Vermont	Table R402.1.2.1	Footnote g: The footnote maintains IECC language allowing for R-38 uncompressed. The shift back to R-49 (from R-60) already assumed uncompressed insulation. Either remove footnote, or maintain footnote and reset ceiling insulation requirement to R-60. update langauge in corresponding section of R402.2	The footnote allows for insulation levels below those required at the eaves if there is not sufficient space, but maintains a minimum requirement. The Department believes we need to maintain this exception so that rafter or truss systems do not need to be redesigned, however the exception now only applies to the eaves rather than the whole attic flat, and insulation must cover the top plates of exterior walls.	Footnote g changed to, "If there is insufficient space in the eaves, installing R-38 over the top of exterior walls shall be deemed to satisfy the requirement for R-49 insulation provided the rest of the ceiling is R-49. (See Section R402.2.1). Multifamily buildings using continuous insulation with a maximum U-factor of 0.023 or tapered insulation with an average U-factor of 0.023 for the ceiling assembly satisfies this requirement."
9/9/2022	Bryn Oakleaf	Efficiency Vermont	Table R402.1.2.1	Footnote e: remove R13+10 example, not a compliance option	These are now labeled "examples" in the table, including R13 + 10 ci. R20 + 5ci is used as the	
9/9/2022	Bryn Oakleaf	Efficiency Vermont	Table R402.1.2.1	2 ACH50 is threshold. Modeling and CBA for 'low cost' assumed 1 ACH50	Agreed.	
9/9/2022	Bryn Oakleaf	Efficiency Vermont	Table R402.1.2.1	Don't see a footnote h in table	Footnote h defines air leakage terminology.	Added language to footnote h: "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."
9/9/2022	Bryn Oakleaf	Efficiency Vermont	Table R402.1.2.1	There is no footnote i in the Table text. But same comment as for flat ceilings. Modeling assumed R-49 uncompressed so there should not be an R38 allowance.	footnote i allows R-38 over the top of exterior walls where there is insufficient space for R-44.	footnote i allowing R-38 over the top of exterior walls where there is insufficient space for R-44 added to Table R402.1.2.1
9/9/2022	Bryn Oakleaf	Efficiency Vermont	R402.1.2.2	1,2500-2,500 square feet (should be 1,250)	Corrected	Correction made.

Date	Commenter	Affiliation	Chapter Ref.	Comment Summary	PSD response	Decision and Resulting Changes Made
9/9/2022	Bryn Oakleaf	Efficiency Vermont	TABLE R402.1.2.3	Should there be a points option for R60 ceiling since the requirement was taken back to R49?	Agreed.	Added an R-60 option for 1 point and changed R-80 to 2 points.
9/9/2022	Bryn Oakleaf	Efficiency Vermont	TABLE R402.1.2.3	2 ACH50 is threshold. Modeling and CBA for 'low cost' assumed 1 ACH50 - may need adjustment if base requirement changes per modeling and CBA	Agreed.	One point now available for ~1.5 ACH50, 2 points for 1.0 ACH50 and 3 points for 0.5 ACH50.
9/9/2022	Bryn Oakleaf	Efficiency Vermont	TABLE R402.1.2.3	GSHP: No ENERGY STAR requirement. Coefficient of Performance (COP) is referenced for both water to air and water to water. Should EnergyStar be preferred over a COP threshold?	Agreed.	requirement is now for ENERGY STAR and "closed loop" has been deleted to allow open loop GSHP.
9/9/2022	Bryn Oakleaf	Efficiency Vermont	TABLE R402.1.4	How were these slab U-factors calculated? Slabs described in F-factor. Had long conversations with PNNL (Rob Salcido) and EVT last round trying to track down source of this value in 2020 RBES to no	F-factors are not easy for builders to interpret or implement. Left the Table as is.	
9/9/2022	Bryn Oakleaf	Efficiency Vermont	TABLE R402.1.4	"How were these basement wall U-factors calculated? REM does not report. Had long conversations with PNNL (Rob Salcido) and EVT last round trying to track down source of this value in 2020 RBES to no resolution. The IECC U-factor equiv for R15ci is 0.05. This was my recommendation when looking into the 0.035 value for 2020 RBES: Current Uo: 0.035 derived from a fully insulated 8' R20 wall that is 100% below grade. Uo accounts for soils and air film in addition to insulation and concrete. This is not realistic.	U-values are a metric that builders understand as they can be converted to R-values easily.	
9/9/2022	Bryn Oakleaf	Efficiency Vermont	R402.2.1	Section R402.2.1 maintains IECC language allowing for R-38 uncompressed. The shift back to R-49 (from R-60) already assumed uncompressed insulation. Either remove, or maintain and reset ceiling insulation requirement to R-60.	This section allows for insulation levels below the minimum required at the eaves if there is not sufficient space, but maintains a lower minimum requirement "over the top of exterior walls." The Department believes we need to maintain this exception so that rafter or truss systems do not need to be redesigned. However the exception now only applies to the eaves rather than the whole attic flat, and insulation must cover the top plates of exterior walls.	Language changed to: "Where Section R402.1.2 would require R-49 insulation in the ceiling, installing R-38 over ~~100 percent of the ceiling area requiring insulation~~ the top of exterior walls where insulation is compressed in the eaves shall be deemed to satisfy the requirement for R-49 insulation ~~wherever the full height of uncompressed R-38 insulation extends over the wall top plate at the eaves~~ provided that the balance of the ceiling is at R-49.
9/9/2022	Bryn Oakleaf	Efficiency Vermont	Table R402.1.2.1	Footnote f: Add specific type and amount of spray foam. This footnote is allowing to be considered R-23. Assume its meant to allow 5.5" of open cell spray foam to be R-23 but that is not clear, note just says "or spray foam". The whole footnote seems biased and unnecceary.	Agree that this footnote is confusing.	Deleted former version of footnote f. Replaced with a general caution about using building science principles.
9/9/2022	Bryn Oakleaf	Efficiency Vermont	Table R402.1.2.1	depending on resolution to keeping footnote i at all (previous comment) the full text of this section R402.2.2 limits this to 500 sq.ft. or 20% of total ceiling area	Reduced insulation levels now limited to "over the exterior walls" at the eaves.	Section R402.2.2 now reads, "Where Section R402.1.2 would require R-49 insulation in the ceiling, installing R-38 over the top of exterior walls where insulation is compressed in the eaves shall be deemed to satisfy the requirement for R-49 insulation provided that the balance of the ceiling is at R-49.
11/1/2022	Walt Adams			Include a definition of "net zero ready" in RBES and CBES.	Agreed.	Definition of net zero ready added to Section R202: NET ZERO ENERGY READY. A highly efficient and cost-effective building designed and constructed so that renewable energy could offset all or most of its annual energy consumption
11/3/2022	Alex Weinhagen	Town of Hinesburg	R402.7.1	Section R402.7.1 (page 92 of the redline document), first sentence. Update the section reference at the end of the sentence. Change from R407.5 (which has been deleted) to R402.7.	Done.	The last sentence of Section R402.7.1 has been updated to ".... shall comply with this Section."
11/7/2022	Kevin Dennis			Self-certified compliance effectively equates to the honor system. I am aware of no towns which actually enforce submission of the form, and even then they are unqualified to evaluate the accuracy, and unable because there is no actual means of inspection. This results in an "architect tax" where architects are bound by professional and ethical standards to adhere to the codes, and contractors are not. Similar when Eff VT is involved.	Changes in the enforcement mechanism would require a statutory change or a municipal ordinance and are beyond the scope of the code update.	

Date	Commenter	Affiliation	Chapter Ref.	Comment Summary	PSD response	Decision and Resulting Changes Made
11/8/2022	Paul Conner, AICP	City of South Burlington		The Commission appreciates the diligence and work that went into this update, and offers the following recommendation, approved at its October 25, 2022 meeting: That the Residential and Commercial codes require that buildings and roofs be oriented to maximize solar potential and to require that solar ready zones on new commercial buildings be required to have solar PV systems that reasonable maximize those solar ready zones.	This suggestion has major implications for the residential construction industry and there is not sufficient time at this point in the process for this proposal to be thoroughly vetted. The idea will be presented to the the Advisory Committee and stakeholders during the next update cycle.	
11/17/2022	Rob Pickett			...these two attachments reflect the work done in the ICC Energy Standards Committees. These two public comment drafts present a different minimum specification for the building thermal envelope that had been published in the 2021 IECC/IRC Ch. 11. Based on my participation on the VT Stakeholders calls, I believe that what has happened in the ICC residential energy standard reflects the comments of builders in VT. For example, the minimum requirement for Climate Zone 6 roof insulation has been reduced from R60 to R49. I propose to the Energy Code Update Team that the RBES that has been developed works great as a Stretch Code, but the base energy code needs to be a realistic minimum level similar to that in the attached draft.	The Department is required to propose code improvements that are "cost-effective and affordable from the consumer's perspective." The Department has provided a cost effectiveness estimate that uses the best available estimates of incremental construction costs and energy savings from a variety of stakeholders including builders and design professionals and we have made changes to the proposed code based on that analysis. We believe the proposed changes reflect an appropriate balance between energy efficiency and affordability in challenging economic conditions.	
11/28/2022	Chris Snyder	Snyder Homes		I am writing to express my concern about the proposed energy code changes developed by the Department of Public Service. Our State's policy goals of providing affordable, energy efficient homes for all will be impacted by this proposed change. I believe that the changes should be delayed for two years. ... All of our projects are permitted through municipal processes, and comes under Act 250 regulations including the requirements to exceed code by at least 10%. We have a lot of experience in building science and energy efficiency because of the oversight and involvement of Efficiency Vermont on all projects.	The statute governing RBES states 'the Commissioner shall ensure that appropriate revisions are made promptly after the issuance of updated standards for residential construction under the IECC.	
11/28/2022	Chris Snyder (cont.)	Snyder Homes		We have reviewed the cost impact of the code changes to our homeowners and tenants. Unfortunately, the proposed changes will increase the costs of the homes dramatically, and the homeowners will not be able to realize a benefit. The review completed by the Dept. does not account properly for the cost of the improvements. We have estimated that the increased cost to meet the code and stretch code for Act 250 projects is over $17,500 per home. The benefits for these future homeowners will not be realized for many, many years. In the past, we have utilized Efficiency Vermont to offset some of the costs associated with the construction of the home. We have recently learned that Efficiency VT will not be participating in providing rebates to homes that would be created to meet the "Missing Middle". They will only be participating with government funded affordable housing projects, and high-end custom homes. Further, Act 250 projects are required to meet stretch code. This creates a dis-incentive to construct dense residential neighborhoods. From a policy perspective, the State wants and needs to develop higher density, land efficient housing options. The negative impact of requiring a higher code for Act 250 projects is in direct conflict with this goal.	The Department has provided a cost effectiveness estimate that uses the best available estimates of incremental construction costs and energy savings from a variety of stakeholders including builders such as yourself. We acknowledge that under the current economic conditions, the costs and benefits are difficult to estimate now, let alone project for the 2023 to 2026 period that the updated code will be in effect.	Changes to the cost-effectiveness analysis were made based estimates of incremental costs from a variety of stakeholders including builders. This updated analysis resulted in the reduction in proposed insulation values for wall systems and increase in windows u-values (back to 2020 levels) in order to provide a cost-effective package of improvements.
11/28/2022	Chris Snyder (cont.)	Snyder Homes		I recommend that LCAR direct the Dept of Public Service to maintain the 2020 RBES, delay the implementation of the proposed code changes for a minimum of two years to allow for a comprehensive program that would include increased funding by Efficiency VT to cover the cost of the improvements for homes within Act 250 designated projects.	The statute governing RBES states 'the Commissioner shall ensure that appropriate revisions are made promptly after the issuance of updated standards for residential construction under the IECC.	

Date	Commenter	Affiliation	Chapter Ref.	Comment Summary	PSD response	Decision and Resulting Changes Made
11/29/2022	Nick Sennett	Sustain Builders, LLC		Commenting mostly on insulation values for walls and other area. But the overall updates are doing everything but making it possible to provide more affordable housing and remodels. Which is all we hear about from the state and the people that live here. That working class families can not afford the work. When will it be enough insulation and at what point does the carbon foot print we put into the house out weigh the energy usage. The additional costs when you require these increased values of insulation and the continues insulation increasing the cost substantially. Not just with the additional labor and material to add this foam or other CI but the additional labor and material that is required to trim out windows, doors the challenges this adds to securing the sheathing and siding.... The list goes on. I understand why we would like this but this should be an option not requiring people to do this. This state is just continuing to make building in this state more expensive at the cost of being "Green" which is causing the cost of living to just increase and push more young people like myself to other states. Rents are already high in this state but now we are going to require new buildings to have more costs which lead to bigger rents and again the same problem we have now with not enough rentals or affordable rentals (relaying on government subsidies). I understand that we want to make homes more efficient but this is going to continue to price working families out of new homes or large remodels. We are getting to a point where a code house could almost be considered a passive house. I know this is your goal but this is not affordable for most working class families. When is enough..... Enough	The updates to the RBES must be "cost-effective and affordable from the consumer's perspective." The Department has provided a cost effectiveness estimate that uses the best available estimates of incremental construction costs and energy savings. We acknowledge that under the current economic conditions, the costs and benefits are difficult to estimate now, let alone project for the 2023 to 2026 period that the updated code will be in effect, but our estimates show that the updates to RBES result in a positive cash flow from day one.	Changes to the cost-effectiveness analysis were made based estimates of incremental costs from a variety of stakeholders including builders. This updated analysis resulted in the reduction in proposed insulation values for wall systems and increase in windows u-values (back to 2020 levels) in order to provide a cost-effective package of improvements.
11/29/2022	Jason Webster	Huntington Homes		I strongly oppose the current amendments as-written. The enabling legislation of RBES requires that any proposed amendment to the RBES pass a three prong test. And I believe the proposed amendments fail all three tests. Each is outlined below. The enabling legislation (30 VSA Section 51) for the Vermont Building Energy Standards directs the Commissioner of Public Service to amend the RBES from time to time using the IECC model codes as a guideline. The enabling legislation includes a mandatory three prong test for any amendment. Applicable provision of the legislation quoted below. (1) Any amendments to the RBES shall be: a. Consistent with the duly adopted State energy policy, as specified in section 202a of this title, and consistent with duly adopted State housing policy; b. Evaluated relative to their technical applicability and reliability; and c. Cost-effective and affordable from the consumer's perspective. I'll take each in order.		
11/29/2022	Jason Webster (cont.)	Huntington Homes		Consistent with the duly adopted energy and housing policy. Energy Policy: The 2022 Vermont Comprehensive Energy Plan sets a goal of all new construction to be net-zero ready by 2030. The Energy Plan then spends two pages detailing the historic problems of compliance, oversight, and licensure. The Energy Plan goes further and notes "Lack of compliance undermines the objective of the building energy standards, particularly in the residential sector". The proposed 2023 RBES amendments does nothing to address the compliance problem. Housing Policy. The 2022 Housing Annual Action Plan lays out four goals. It then spends 92 pages outlining how they'll measure and achieve their goals. There is one mention of energy efficiency in this Action plan, and it states "ensure a robust analysis of costs is considered in the development of State energy-efficiency standards and building codes.". I say that the DPS has failed to adequately assess the costs of the proposed amendments. See further discussion below.	Issues of enforcement and compliance are beyond the purview of the PSD and beyond the scope of the RBES update. Changes in the enforcement mechanism would require a statutory change or a municipal ordinance. The PSD has done a robust analysis of costs and has taken costs provided by builders such as yourself into consideration and made changes based on that information.	
11/29/2022	Jason Webster (cont.)	Huntington Homes		Technical applicability and reliability: Technical Applicability. The proposed amendments to the 2023 RBES are related to Energy, but they are effectuated by Building. And Vermont has no active program for building codes for single family residential construction. Vermont is alone in this regard. All neighboring states review and enact their Energy Code within the bounds of Building, Electrical, and Plumbing Codes. Because of this all neighboring states are still working off the 2015 and 2018 IECC as they also update their Building Codes to work in tandem. Historically Vermont adopting the latest version of the IECC hasn't been a problem because the energy requirements of the IECC followed "standard" or general building practices. But the 2021 IECC goes well beyond standard practices. It requires complicated wall assemblies that some builders understand, but many do not. Building them wrong can be disastrous (google "interstitial condensation"). These advanced wall assemblies MUST be built within the guidelines of the Building Code and good building science. Building them without the guidance and oversight of a Building Code will very likely increase premature failure of our homes. This isn't durable or safe for Vermonters. For this reason I say that the proposed amendments can't be technically applied.	The Department believes that the code update as proposed can be implemented while maintaining acceptable health, safety, durability and structural integrity standards. We acknowledge that there is potential for builders to construct both RBES compliant or non-compliant buildings that could produce problems with moisture management, building durability or indoor air quality. We will address those issues to the extent possible by incorporating more general building science in the RBES Handbook. It is beyond the capabilities of the RBES to dictate construction practices and methods to avoid all problematic scenarios.	Adding building science section to RBES Handbook.

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11/29/2022	Jason Webster (cont.)	Huntington Homes		Reliability. The current RBES effectively has no enforcement, applications, permits, inspections, or certifications. It is a self-certified, after-the-fact-type code. There is a general consensus among everyone else involved in construction that a very high percentage of new builds aren't built with RBES in mind. The last study done by the DPS on technical code compliance (regardless of self-certification status) was done in 2015 and that study found only 66% of homes built then met the standards of the time. The technical requirements of the code in 2015 were pretty basic and generally a codification of good building practices (ie what builders were building anyway). The census of those involved with this code amendment is that as the code gets tougher the technical compliance gets lower. I dare guess that maybe 30% of homes built today meet the technical requirements of the 2020 RBES. With the significant jump in the technical standards of the proposed 2023 RBES I'd guess that the compliance rate drop near 10% under the proposed code. For this reason I say these proposed amendments fail the test of reliability. With no building codes, and with no enforcement there's very little chance the proposed amendment will be applied, reliable, and/or effectuate change.	Changes in the enforcement mechanism would require a statutory change or a municipal ordinance and are beyond the scope of the code update.	
11/29/2022	Jason Webster (cont.)	Huntington Homes		Cost-Effective and Affordable from a consumers prospective: The DPS Filing states a $12k cost and $900 annual savings under the proposed regulations. But I believe the DPS has erred in their analysis. I was part of the working group that ran these calculations and I think you are using a proposed wall assembly that wouldn't meet the Building Code (for structural shear reasons) therefore it shouldn't be compared. The more applicable cost calculation used a double stud assembly and that package added $18,300 to the cost of a new home and netted a $480/year savings. That's a 38 year simple payback. It's not an investment a business would make. It shouldn't be something the DPS forces Vermonters to buy. There is also a strong argument that we shouldn't only be looking at the cost jump from the current 2020 RBES to the proposed 2023 RBES. We all agree that most builders aren't building to the current Energy Code, they're still building what they've always built. That historic home is most inline with the 2015 RBES. And the cost jump from the 2015 RBES to the proposed 2023 RBES is $30,300 on a typical 1800sf home. Or an 8.4% price increase on that home. The DPS goes further and makes an argument that the energy savings is cash flow positive against the increased mortgage payments. But this is not how banks see it. They don't give credit for forward / future costs. Bottom Line is that a mortgage payment on a more expensive home is more expensive. If banks don't use future cash flow for determining a loan neither should the DPS in a proposed regulation.	The Department has developed a cost effectiveness estimate that uses the best available estimates of incremental construction costs and energy savings from a variety of stakeholders including builders such as yourself. This analysis resulted in a number of changes to the proposed code in order to provide a cost-effective package of improvements. The statue requires that the RBES amendments are cost-effective, which therefore requires the comparison of the proposed RBES 2023 to RBES 2020. If we were to revert to an earlier code as the basis for costs, we would also need to credit the additional energy savings. We also examine return on investment and payback along with customer cash flow as metrics for cost-effectiveness.	Changes to the cost-effectiveness analysis were made based estimates of incremental costs from a variety of stakeholders including builders. This updated analysis resulted in the reduction in proposed insulation values for wall systems and increase in windows u-values (back to 2020 levels) in order to provide a cost-effective package of improvements.
11/29/2022	Jason Webster (cont.)	Huntington Homes		A Marketwatch study in March 2021 found Vermont to be the least affordable new home market in the country. Only 16% of Vermont households could afford the mortgage payment on a median priced new home, and that was when mortgage rates were 4% and before housing prices really took off. State policy should be figuring out how to get more Vermonters into more new homes (which everyone agrees we desperately need). Not how to make them more complicated and more expensive. For these reasons I say the proposed amendments fail the test of cost-effective and affordable from a consumers prospective. In Summary. The proposed amendments do not address the compliance problems noted in the state Energy Policy and present in these rules since 1997. The proposed amendments haven't demonstrated cost effectiveness. The proposed amendments contain no oversight or certifications to make sure new homes are consistently built safe and durable. The proposed amendments do not satisfy the three tests outlined in the enabling legislation. The DPS should not advance these amendments at this time. The DPS should acknowledge the fundamental flaws I and others have outlined above and propose a new set of rules that contain real oversight, certifications, inspections, and compliance measures. If not there's almost zero chance we'll actually get to net-zero ready by 2030.	The Department's cost-effectiveness analysis uses a VHFA projected 2024 mortgage interest rate of 6% and a 12-month average for construction costs. We acknowledge that the cost-effectiveness analysis is very sensitive to interest rates and construction costs, but we believe that we have used reasonable estimates of where mortgage rates and construction costs will be in the 2024 - 2026 period. We believe our analysis is also conservative as we don't assume any future increase in fossil fuel prices and instead used a 12 month average of fuel prices.	See above comments on measures that were scaled back due to cost-effectiveness.

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11/30/2022	John Linn, AIA	Hillview Design Collaborative and Hillview Building Company		I'm a licensed architect and have been working in the building profession since 1997. I am one of the owners of Hillview Design Collaborative and Hillview Building Company. Together we make up a design-build firm in Richmond, Vermont. Since our inception we've pushed clients to build high efficiency and net-zero ready homes. The homes we build exceed current codes and would be compliant with the proposed RBES rules. We have been very fortunate to find clients that share our values regarding energy efficiency. Personally I feel that while the goal is admirable, the amendments as proposed are going to further unbalance the market between builders that are following the rules and those that are not. The new rules create much more stringent rules while the support builders currently receive is being effectively reduced. The current approach to enforcement of code compliance is through litigation. This requires a homeowner to know enough about building to understand that their beautiful new home has flaws below the surface. Are they supposed to know that their home has continuous insulation or is properly air sealed? Are they responsible for confirming that the R value listed on the RBES certificate is what was actually installed? Even if the homeowner had their suspicions or a problem presented itself they would have to have someone do fairly expansive forensic investigation to determine that the building didn't meet code. Then they'd need to pay to have a fellow builder or architect take the stand to prove that the original builder created a sub-standard structure. I have heard of less than a handful of projects being called out for lack of code compliance which is pretty incredible considering the energy code has been around for over 20 years. Does the board really feel that all of the buildings created in that timeframe have met the applicable code? What's the point of creating more stringent codes if there's no effective way of requiring builders to meet them? It feels very contradictory for me as a builder and architect to be arguing for more oversight and/or enforcement but that's the best way I can see to ensure that the RBES actually does what it's intended to do. Adding more oversight or enforcement with a lack of support will further drive up the cost of already expensive construction.	Changes in the enforcement mechanism would require a statutory change or a municipal ordinance and are beyond the scope of the code update.	
11/30/2022	John Linn (cont.)	Hillview Design Collaborative and Hillview Building Company		Until the end of 2022 all of our company's new home construction has been supported by Efficiency Vermont either through their base or high efficiency home programs. They've provided HERS ratings, blower door tests, site visits and design advice throughout the process. Currently a project enrolled in an Efficiency Vermont program has third party oversight from beginning to end including job site inspections. Efficiency Vermont provided rebates if a project met their program requirements. As I understand it in 2023 this support will be reduced to just the advice. Builders will now be responsible for trying to find HERS raters and subcontractors capable of doing accurate blower door tests. This reduction in support at a time when the code is becoming much more stringent is very unfortunate timing. Having seen the lack of code compliance and resistance to change that some builders are currently showing, I feel that the state should be offering more incentives to meet code while maintaining (or even increasing) oversight to confirm that new construction is meeting code. I feel that the Efficiency Vermont programs were the closest thing we had to that. Either reinstating their system for builder support or creating a similar one seems the most effective way to provide the help that most builders will need. Allow all new construction to be enrolled in a similar program even if it's just meeting base RBES requirements and provide incentives for doing so. These incentives should be directed toward the permanent portions of the house. The point of purchase rebates for light bulbs and heat pumps that are currently offered don't address the insulation, air sealing, windows and thermal envelope of a home. Those are more or less permanent portions of a home that can't be changed out or added as technology changes like solar panels or more efficient heating sources. More energy efficiency incentives could help reduce the cost of building similar to the subsidies and tax free fuel that the state is offering to electric vehicles. I think creating appropriate incentives and finding a way to distribute those while enforcing code compliance is where we should be headed. Not simply making more strict rules that have no effective means of enforcement.	It has been the policy of the Department that giving incentives builders to meet code which is required under law is not appropriate. However, the Department is exploring ideas on how to provide continuing support to builders in meeting code.	

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11/30/2022	Dixie F. O'Connor	President, Vermont Builders & Remodelers Association, Inc.		The Vermont Builders and Remodelers Association (VBRA) requests that the RBES update to the 2021 International Energy Conservation Code (IECC) be delayed. The focus of our opposition to adoption of the 2021 code: 1. Vermont has no building code (beyond energy code) that addresses comprehensive modern building science. With RBES being the only code and energy use the sole focus, builders may be able to hit the R-value, but at great risk of an improperly built home. Some builders will have the knowledge to understand the interaction between energy code and proper ventilation, but many will not. The new codes require complicated wall assemblies and ventilation systems that – without the oversight of a comprehensive building code and inspection - will push the level of necessary whole-house expertise beyond the skill of many builders. Building incorrectly has serious consequences for the health and safety of Vermonters.	Statute requires the PSD to update the RBES "promptly after the issuance of updated standards for residential construction under the IECC." The creation of a statewide residential building code to complement the RBES would require an act of the Legislature. The Builder Registry, created under Act 182 of 2022, is a step in the right direction in raising awareness of the RBES and construction best practices.	PSD will add a general building science section to the RBES handbook.
11/30/2022	Dixie F. O'Connor (cont.)	President, Vermont Builders & Remodelers Association, Inc.		2. There is no inspection, enforcement or certification of the code we do have. RBES are self-certified. As requirements become tougher the level of compliance will decrease. It's been over a decade since the DPS conducted a code compliance study, and at that time found that only 72% met the standards. If a similar study were performed today, we would expect a sizable decrease from that margin. Without enforcement an increasingly high percentage of homes are built without RBES in mind. Without comprehensive building code too many will be built with only RBES in mind.	Changes in the enforcement mechanism would require a statutory change or a municipal ordinance and are beyond the scope of the code update.	
11/30/2022	Dixie F. O'Connor (cont.)	President, Vermont Builders & Remodelers Association, Inc.		3. VBRA is concerned that the cost increases associated with the 2021 code will not be merely "incremental," and will instead add significant and unnecessary costs to residential construction. VBRA members report cost increases of $17,500 – $18,300 per home, locking more and more potential homeowners out of buying their first home or for current homeowners to move up to a new home. As Vermont grapples with a housing crisis, we question the advisability of a drive for increasing R-values that do as much harm as good to housing affordability. In summary, we ask the DPS to consider delaying the adoption of the 2021 IECC code until the above issues have been discussed and solutions created for the stated issues.	Statute requires the PSD to update the RBES "promptly after the issuance of updated standards for residential construction under the IECC."	PSD made measure changes to decrease upfront costs.
12/2/2022	Kevin duPont	Dupont Construction?		I think that it is out of line to try to enact this proposed update without addressing inspection first. The added cost associated with these changes are bore out with real savings the the homeowner can realize. Housing in VT is expensive enough with out this new code. If these measures are put into place without inspection, there is a real concern about doing more harm than good. It may be setting up situations of trapped moisture and premature building failure.	Changes in the enforcement mechanism such as adding inspection rules would require a statutory change or a municipal ordinance and are beyond the scope of the code update. The RBES Handbook will be expanded this code cycle to provide detailed guidance on building science, moisture management and indoor air quality principles to help builders meet the code while maintaining health, safety and building durability.	
12/2/2022	Silvio	Modern Mill		I have been reading throught the changes and aside from the R-value requirements which I feel would be one of the changes that would affect us the most. I would like to know your opinion in how these changes could affect our product in the area or Vermont. In case you are not familiar with our company, we produce 100% wood-free composite boards mainly used for exterior cladding with products used mainly as siding and decking. We have had some people concerned about how these changes could affect the usage of our product and we would just like to know how concern we should be if we should be concerned at all with these changes.	From the description of your products, the Department does not believe the RBES updates will materially affect your business. R-value requirements for walls are not related to the type of siding or cladding used, as long as your product can be used along with continuous exterior wall insulation.	

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12/5/2022	Jeff Stetter	Pella Windows	Table R402.1.2.1	Based upon reviewing the slide deck from the RBES 12/2/2022 presentation, I offer the following for consideration: Table R402.1.2.1- Insulation and fenestration requirements by component for standard packages for base code and stretch code. •Ramifications of a .27 U-Value Requirement for Fenestration. oWith the current U-Value requirements of .28 to .30, Aluminum Clad Wood windows include options to typically meet the requirement with standard Cardinal Low-E270 Glass with Argon. With the proposed .27 requirement across the board most, if not all, Aluminum Clad Wood Windows (double hungs, casements, awnings, etc) will require switching to a glazing package which includes an additional interior coat of Low-E. Depending on the line of windows, this can increase the overall window cost between 9-16%. These are real numbers. To change to triple pane windows would increase the base cost between 38-46%. oThe glazing package that requires an additional interior coat of Low-E lowers the interior surface temperature of the glass, and thus decreases the window's resistance to condensation. oVinyl windows can typically meet the standard without any increase in cost. oFiberglass windows have fewer options to meet the new standard without triple pane and typically will have increased cost.	This analysis is appreciated. The fenestration requirements were proposed based on energy dynamics and modified based on the availability and incremental cost of qualifying window models. The increased condensation potential of double pane windows with low-e coating on the inside pane as well as the incremental cost of qualifying windows were both considerations in our decision to revert the proposed U-0.27 requirement to U-0.30. We will include guidance in the RBES Handbook that cautions builders about potential condensation issues and suggests options to reduce the condensation potential of windows with low-e coating on the inside pane. Additionally, the required balanced ventilation system will help control relative humidity that can help with the window condensation issue.	Window U-value requirements reverted to U-0.30. The RBES Handbook will provide cautions about potential condensation issues and suggest options to reduce the condensation potential of windows.
12/5/2022	Jeff Stetter	Pella Windows	Table R402.1.2.2, Table R402.1.2.3, Sect. R402.4.3	Table R402.1.2.2 •Multifamily housing is so inherently more efficient than single family. Most of the large multifamily projects being constructed these days have most units under 600sf. Seems like small units of this scale should be rewarded. •Seems like a 1500sf house should have less points required than a 2500sf house?? Table R402.1.2.3 •I like the Insulation Embodied Carbon Emissions points requirements. Seems to me that's likely the most valuable part of this code in terms of saving the planet. R402.4.3 Fenestration Air Leakage Seems like reducing air leakage to "no more than 0.2 cfm per square foot" would be a viable reduction. This would be a good base level for window air leakage rates.	Agree that multi-family is inherently more efficient. Made changes to the point system to reflect that. Further air leakage reductions will be analyzed in the next code update.	The subcategories of Multifamily average unit size have been changed in Table 402.1.2.2 Points Requirements. There are now four size categories: Multifamily < 650 SF (0 points) Multifamily 650 to 900 SF (1 point), Multifamily 900 to 1,250 SF (2 points) and Multifamily 1,250 to 2,500 SF (4 points).
12/6/2022	William Nash	ICC		We respectfully recommend that Vermont adopt the most updated version of the IECC model code (2021 version.) However, we recognize Vermont's unique characteristics and significant efforts that Vermont leaders have made, including their commitment to a safe built environment via up-to-date codes for their visitors and citizens. In addition, the I-Codes correlate without conflicts to eliminate confusion in building design, inconsistent code enforcement, or interpretation among different jurisdictions.	The proposed RBES meets or exceeds the 2021 IECC, with VT specific amendments, including some required by statue such as the owner/builder exemption	No change.
12/6/2022	William Nash (cont.)	ICC		The Code Council would like to commend the State of Vermont for its consistently outstanding work inreviewing and proposing to update the Vermont RBES based on the 2018 & 2021 IECC. The proposed amendments and update of this code, while incorporating amendments that reflect the unique character and needs of Vermont, will ensure that the Vermont RBES remains technically viable, allow for consistency in code application and enforcement, allow for economic investment in building construction, and provide for the most significant safety of the public and emergency responders while embracing modern technology, energy efficiency and building practices.		
12/7/2022	Diane Sherman	Chair, Montpelier Housing Committee	Sect. R404.3	We write as the Montpelier Housing Committee, a committee tasked with addressing the critical shortage of housing units to accommodate the needs of current residents and residents looking to move to Montpelier for work. We write to ask you to reconsider a portion of the new electrical requirements in the proposed changes to the Vermont Residential Building Energy Standards (RBES) that would have the unintended consequence of deterring the improvement and development of housing units in Montpelier and around the state. The proposed changes to the RBES appear to require, via R404.3, owners of multi-family buildings subject to these rules (e.g., triplexes, duplexes, and presumably single-family homes with accessory dwelling units (or, ADUs)), should they alter the building's electrical system, to ensure that each unit has a parking spot capable of supporting a level 2 charger. This requirement also appears to apply to owners of single-family homes who seek to add an ADU or otherwise divide their house into more units, as these changes are likely to necessitate altering the electrical system in the process.	The code language does appear to require one Level-2 Capable space per dwelling unit, but this is intended for new construction. This was not inteded to require Level-2 capable spaces for each dwelling unit in the case of an existing home alteration. We interpret the Existing Buildings section to say that in this situation, only the portion of the electrical system that serves the ADU needs to meet RBES requirements, so the project need not meet Section R404.3.	added to 404.3 (EV Charging)..."for new construction" to make it clear that this does not pertain to renovations or additions.

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12/7/2022	Diane Sherman (cont.)	Chair, Montpelier Housing Committee	Sect. R404.3	... in most situations this will mean that each unit must have 150 or 200 amp service despite the exemption in R404.4 specifying that multi-family buildings do not need to supply 200 amp service per unit. While there are exemptions to R404.3 in the RBES when there is no parking space for a dwelling unit or when the parking space is distant, Montpelier, and presumably many other municipalities, require at least one parking space per dwelling unit. Thus, in most situations, compliance by multi-family dwellings with R404.3 will be unavoidable. It is unclear from the text of Chapter 5 of the RBES what changes to a building's electrical system would meet the threshold of "alterations." However, a comparable technical code, the Vermont Electrical Safety Rules, is construed broadly by Vermont state electrical inspectors to require owners of multi-family buildings to ensure any portion of the electrical system they modify is brought fully up to the current code requirements. If this same interpretation applies to the RBES, actions such as adding or doing any work on an outside electrical outlet, increasing the number of outlets in one's garage or basement to meet the current Vermont Electrical Safety Rules, replacing one's electrical panel, and other changes to address problems or safety hazards in, or to bring up to modern standards, the electrical system of a multi-family building, would trigger the imposition of R404.3.	The code language does appear to require one Level-2 Capable space per dwelling unit, but this is intended for new construction. This was not inteded to require Level-2 capable spaces for each dwelling unit in the case of an existing home alteration. We interpret the Existing Buildings section to say that in this situation, only the portion of the electrical system that serves the ADU needs to meet RBES requirements, so the project need not meet Section R404.3.	
12/7/2022	Diane Sherman (cont.)	Chair, Montpelier Housing Committee		Much of the housing stock in Montpelier and elsewhere in Vermont is older and presumably is neither currently served by 200 amp service nor meets every requirement in the recently revised Vermont Electrical Safety Rules. For a homeowner who wants or needs to improve the electrical system in an already existing multi-family building, or in a single-family home that is being turned into a multi-family building, the additional cost to upgrade to 200 amp service for each unit may be prohibitive.	The incremental cost of 200-Amp service has been included in the cost-effectiveness analysis filed along with the proposed code updates.	
12/7/2022	Diane Sherman (cont.)	Chair, Montpelier Housing Committee		For instance, according to my utility company, Green Mountain Power, switching the current 100-amp service to 200-amp service for my dwelling unit and the ADU in my home would be just shy of $4000 based on an estimate for their work outside the building plus what they generally see required by an electrician for updates to the meter sockets inside the building. This total does not include the cost of level 2 charging equipment for each unit. $4000 is a significant amount of money that far eclipses the negligible value that would be served by increasing the amps available to a building that already has adequate electrical service under the Vermont Electrical Safety Rules and by making the parking space for each unit available for a level 2 charger that may remain unused or under used for years.		
12/7/2022	Diane Sherman (cont.)	Chair, Montpelier Housing Committee		The outsized cost of the electrical changes required by R404.3 will foreseeably deter or prevent improvements to the condition of electrical system in multi-family building and deter the modification of an existing single-family home to add one or more housing units. For homeowners who chose to proceed nonetheless, the costs spent on the service upgrade will be unavailable for improvements that would have significant impacts for homeowners and future tenants, such as increasing insulation to reduce energy costs and to make the living space more comfortable. The individual and societal return on investment from R404.3 for multi-family dwellings that fall within the RBES and are not fully new construction appears negative. In conclusion, we ask that you exempt all but fully new construction single- and multi-family dwellings that fall within the RBES from needing to supply level 2 capable parking spots. This revision to the proposed language would make R404.3 more consistent with the decision to exempt multi-family buildings that fall within the RBES from needing to supply 200 amp service for each unit and prevent the unintended consequences to the housing supply identified in this letter.		
12/7/2022	Diane Sherman (cont.)	Chair, Montpelier Housing Committee		Additionally, the following clarifications to the rules would aid homeowners' understanding of the rules and improve compliance. Single-family buildings with attached ADUs are not treated as multi-family buildings in some codes and laws; we ask that you clarify that the term multifamily building, as used in the RBES, includes single-family homes with ADUs. It is also not clear what sections of the rules an owner must comply with when altering an existing building. The addition of plain language in the rules clarifying this, or the development of a guidance document on this question and the question of what the threshold for "alteration" is, would help address the noncompliance problem that is identified around minute 24 of the Department's training video "Part 1 Code Background" on YouTube.	Multifamily Buildings are defined in RBES and CBES as buildings containing three or more dwelling units. We will provide further guidance in the RBES Handbook on what provisions of the code must be complied with for alterations.	The RBES Handbook will be expanded to include guidance on code compliance for additions and alterations

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12/8/2022	Erin DeSantis & Amy Schmidt	American Chemistry Council		... Our members produce products for the whole of the U.S. market and in some cases have a global presence as well. This includes but is not limited to plastic building materials like foam plastic board insulation, spray foam insulation and air sealants, house and building wraps, liquid applied water resistive barriers, plastic pipe, plastic glazing, and roof membranes. These products provide a wide range of benefits including thermal, air, and moisture management. ACC has concerns with the proposed amendments to Vermont CBES and RBES that give preference to low embodied carbon insulation materials. If adopted, this would be a significant expansion of the energy code; no other state has adopted any mandated or optional points for low embodied carbon insulation materials. We encourage the consideration of the following information:		
12/8/2022	Erin DeSantis & Amy Schmidt (cont.)	American Chemistry Council		All materials require an investment of carbon to produce them including those with high embodied carbon like concrete, steel, and glass. However, only some materials provide carbon savings benefits during the operational life of the building like insulation and air barriers. The building and construction sector accounts for 37 percent of global carbon emissions. Embodied carbon accounts for 10 percent while building operations account for 27 percent of emissions of those emissions.[1] Building materials like concrete, steel, and glass account for the largest portion of the embodied carbon. Cement, steel and glass are the next highest contributors, which means insulation makes up an extremely small portion of a building's embodied carbon. Despite its relatively small percentage in overall building embodied carbon impact, insulation does however have a significant contribution to operational energy and greenhouse gas emissions savings. Energy Star estimates that you can save an average of 15% on heating and cooling costs by air sealing and adding insulation to the typical existing U.S. home.[2]		
12/8/2022	Erin DeSantis & Amy Schmidt (cont.)	American Chemistry Council		Insulation products offer significant savings with a minor impact on the building's embodied carbon profile. The preference for low embodied carbon insulation could lead to improper product selection and negatively impact the operation carbon use of the building. Insulation materials provide important benefits beyond thermal protection like air sealing and vapor management which are beneficial to a building's overall performance. Insulation manufacturers have been optimizing their products to lower their carbon footprints for many decades. They have also been very transparent, and Environmental Product Declarations (EPDs) are available for most products. • We support a whole building approach that includes operation carbon benefits and product transparency. • We believe that manufacturers that have been optimizing the carbon intensity of their products should be rewarded rather than disincentivized from doing the right thing. • We believe Vermont should recognize product contributions to operational carbon savings. • We believe insulation choice should not be limited by this policy as insulation products save more carbon and energy than it takes to produce them.[3]	The proposed RBES does not contain any prohibitions of particular insulation or building materials. The embodied carbon provisions in the proposed code are limited to providing optional points toward compliance in the Prescriptive compliance pathway. Should a builder choose to complete a carbon inventory of insulation products used in a particular home, that inventory can and should contain the default GWP value or values from Type III Product-specific Environmental Product Declaration (EPD), which should accurately reflect the degree to which a particular product has been optimized for carbon intensity.	
12/8/2022	Erin DeSantis & Amy Schmidt (cont.)	American Chemistry Council		ACC members have been making great progress in lowering their embodied carbon emissions. Their innovative and durable building materials enable greater carbon savings over their service life than it takes to produce them. Their progress has also minimized the difference in CO_2 emissions between different insulation products.[4] A recent report by McKinsey & Company also demonstrates the carbon benefits of plastic building materials in comparison to alternative products. In fact, this report shows that in most cases plastic materials provide lower total GHG emissions over their life. This climate-related benefit commonly associated with the use plastics, including plastic construction materials, is further detailed in McKinsey's report.[5]		

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12/8/2022	Erin DeSantis & Amy Schmidt (cont.)	American Chemistry Council		Insulation manufacturers have been providing transparency information for the industry in the form of Environmental Product Declarations (EPDs) that provide CO2 embodied carbon emissions data for over a decade. This data was not intended for comparison purposes. If it is used in this manner, it is important for users to be educated regarding the limitations of comparisons as well as the tools and data sources they are using. Unfortunately, many tools do not accurately account for industry improvements in a timely manner or follow standard guidance for comparing products. They often allow products with different baseline assumptions and utilize different Product Category Rules. They also often include comparisons between industry and product specific EPDs, etc. Due to the above concerns, we recommend that total carbon accounting be used to understand the full impact different products have over the life of the building. We do not recommend providing incentives for embodied carbon as a single attribute that could lead to regrettable substitutions.	EPDs are the best available source of information regarding the embodied carbon GWP of particular products. RBES and CBES pertain only to the energy use in buildings, so we have limited the scope of embodied carbon to just those materials that are measurable (through EPDs) and impact the energy perforance of buildings; insulation. Enbodied carbon in building materials can rival or even be significantly larger than operational energy. In order to educate designer and builders about the potentially large carbon impacts of insulation choices, we felt it was important to include an optional means of gaining points through measuring and reducing the amount of embodied carbon in insulation materials.	No change.
12/8/2022	Erin DeSantis & Amy Schmidt (cont.)	American Chemistry Council		Embodied carbon decisions should not be made prior to considering the other primary and necessary functions of building materials like their ability to eliminate other products, mitigate air leakage, manage moisture, etc. Operational offsets must be considered. Decoupling the embodied carbon of products like insulation can have negative effects on building performance and the performance characteristics of the insulation regarding thermal protection, moisture management and air leakage should not be sacrificed for relatively small differences in embodied carbon. ACC along with several other insulation industry associations published a Building Decarbonization Statement of Policy Principles that supports this total carbon or whole building view of the carbon impacts.[6] This is important so that decisions are not made that would affect the building performance (thermal, air, moisture management, etc.). Please see more regarding the Insulation Industry Decarbonization Policy Principles here: Building Decarbonization Statement of Policy Principles (americanchemistry.com)	The other functions and benefits of insulation materials, including operational carbon emissions reductions are taken into account in developing the RBES updates. In particular, the operational energy savings of rigid foam continuous insulation was critical factor in developing a the final package of cost-effective improvements.	The properties of rigid foam insulation as they relate to moisture dynamics and building durability will be described in the building science section in the expanded RBES handbook.
12/8/2022	Kathy Beyer, Charlie Wilner	Evernorth		Evernorth has very much appreciated being included in the RBES/CBES Advisory Group during these past few months. Evernorth and our local nonprofit partners have worked with Efficiency Vermont and our architects and engineers to build among the most energy efficient multifamily buildings in the state. And as long-term owners of these buildings, we also have feedback data on where energy efficiency measures are working, and in some cases, where they are not working. We are submitting our comments in a time of unprecedented increases in construction costs. We are closing on construction that is 30% more costly than it was a year ago. With this construction cost environment, it is imperative that our choices in the 2023 energy code update includes a thorough assessment of the energy efficiency gains in comparison to a payback analysis. With each building, each decision made, we balance both the climate crisis and the housing crisis. The authorizing statute for the revision of the energy standards embodies this balance: any amendments to RBES will be consistent with State energy policy, State housing policy, evaluated relative to technical reliability, and cost-effective and affordable from the consumer's perspective.		
12/9/2022	Kathy Beyer, Charlie Wilner (cont.)	Evernorth		Diving more into the details of the code update, we have appreciated the Department's efforts to start to differentiate between single family and multifamily buildings. Multifamily buildings are inherently more energy efficient than single family homes, and also have much more complex building systems. The state energy plan's goal of net zero for all new construction by 2030 should be interpreted in a different approach for multifamily buildings. It is imperative that this distinction starts to be made in the energy code update for 2023, and in the discussions around net zero by 2030. Lastly, the Department is keenly aware of the lack of enforcement for the energy code. Each cycle of the code update, where enforcement is not addressed, creates an ever-growing gap between buildings that are constructed by conscientious owners, and those built by owners who are ignorant, or do not care about the energy code. The march towards net zero by 2030 is a fallacy, without code enforcement.	Changes in the enforcement mechanism would require a statutory change or a municipal ordinance and are beyond the scope of the code update.	

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12/8/2022	Kathy Beyer, Charlie Wilner (cont.)	Evernorth		We appreciate the move to using an energy use target (EUI) target to guide code recommendations. Will there be any monitoring done on buildings built to the new code to see where the actual EUI's land compared to the predicted EUI's? This data would shed some light on how we are actually doing vs how we think we should be doing, and could guide future code revisions. Without this data we're placing a lot of faith in energy models which in our experience are often a poor predictor of actual performance. Have the cost of insulation and mechanical system upgrades been compared to the cost effectiveness of installing additional solar capacity? A detailed costing may show that solar panels are a more cost-effective way of driving down project EUI.	The Department agrees that energy modeling is not perfect. However, we do not have actual energy usage data for the proposed code for comparison with the current code so we are limited to modeling comparisons. The Department does periodic market assessments that estimate actual energy use and that is incorporated into the models.	No change.
12/8/2022	Kathy Beyer, Charlie Wilner (cont.)	Evernorth	RBES 404.5	We suggest that the Exception read: "Buildings where a majority of the living units serve tenants at or below %80 percent of area median income."	Agreed.	The proposed language has been incorporated into section R404.5
12/8/2022	Kathy Beyer, Charlie Wilner (cont.)	Evernorth	RBES R101.6	RE: R101.6 "Authority Having Jurisdiction." We feel it is worth noting that the majority of municipalities in Vermont lack an "authority having jurisdiction".	Our understanding is that municipalities have the authority to appoint an AHJ, however for smaller towns, this may not be financially feasible unless they collaborate with neighboring town or their RPC.	
12/8/2022	Kathy Beyer, Charlie Wilner (cont.)	Evernorth	Table R402.1.2.2	We request two additional categories "Multifamily < 900 sqft" with Base Code points of 1 and stretch code 2, and "Multifamily < 650 sqft" with no additional points requirements. This recognizes the inherent energy efficiency of building small energy efficient apartments.	Agreed with additional modifications based on other stakeholder feedback.	The subcategories of Multifamily average unit size have been changed in Table 402.1.2.2 Points Requirements. There are now four size categories: Multifamily < 650 SF (0 points) Multifamily 650 to 900 SF (1 point), Multifamily 900 to 1,250 SF (2 points) and Multifamily 1,250 to 2,500 SF (4 points).
12/8/2022	Kathy Beyer, Charlie Wilner (cont.)	Evernorth	Table R402.4.1.1	RE: Table R402.4.1.1 Air Barrier, Air Sealing and Insulation Installation. At windows, skylights and doors, caulk with backer rod and sealant as well as flexible membranes should also be acceptable air barriers. This is common practice in the building industry and may be required by some manufacturers.	The proposed language says, "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."	"Flexible membrates" (tapes) are acceptable.
12/8/2022	Kathy Beyer, Charlie Wilner (cont.)	Evernorth	Sect. R402.4.1.2	Air Leakage Testing. Should this be read to mandate air leakage testing of individual dwelling units within a multifamily building as well as whole building testing, or just one or the other? It may be simpler for section R4402.4.1.2 to only apply to single family homes, and then point multifamily dwellings to section CBES C402.4. If this section does not point to C402.4 than the following sentence should be ammended as [follows]: ….. and reported at a pressure of .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~~. Buildings six (6) stories and taller shall have an air leakage rate not exceeding .25cfm/ft2 of the building thermal envelope area of all six sides of the building at a pressure differential of 75 Pascals.	Agreed.	Proposed language added.
12/8/2022	Kathy Beyer, Charlie Wilner (cont.)	Evernorth	Sect. R402.7	Solar Ready Zone. Multifamily buildings appear to be exempt from the solar ready zone. Was that the intention?	Solar Ready requirements in RBES have been removed based on cost-effectiveness.	Language updated.

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12/8/2022	Kathy Beyer, Charlie Wilner (cont.)	Evernorth	Sect. R403.1.1	Programmable Thermostat. Programmable thermostats are the cause of much confusion in multifamily buildings, the functionality is typically not understood by tenants. We request an exception to the programmability requirements be included for multifamily buildings. In our experience, thermostat manufacturer's do not typically custom program residential thermostats. Perhaps the thermostat should be configured by the mechanical or controls contractor. Also, our thermostats typically allow tenants to adjust the thermostat within a certain range. Is the intent of 403.1.1 that the maximum of the adjustable range for heating is 70F (meaning the tenant cannot adjust the heating setpoint above 70F)? Or is the intent simply that the setpoint start at 70F and the tenant may change the setpoint when they move into a space?	The point about programmable thermostats being confusing is valid. We also understand that the cost of programmable thermostats is higher than conventional ones, however we will continue the requirement that thermostats have the *capapbility* of being programmed as described in the code. Programmable thermostats can always be overridden and operated manually. Section R403,1.1 explicitly says the thermostat should be capable of maintaining zone temperatures anywhere from 55 deg. To 85 deg. "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)."	
12/8/2022	Kathy Beyer, Charlie Wilner (cont.)	Evernorth	Sect. R403.5	To better align requirements for multifamily buildings we request an exception to R403.5 that reads: Exception: Systems serving multiple dwelling units shall comply with Section C404 of the 2023 edition of the Vermont Commercial Building Energy Standards (CBES), but will not be subject to the additional requirements outlined in Tables C406.1.1 and Table 406.1.2.	Agreed.	Added to R403.5: "Exception: Systems serving multiple dwelling units shall comply with CBES C404, but will not be subject to the additional requirements outlined in Tables C406.1.1 and Table C406.1.2. "
12/8/2022	Kathy Beyer, Charlie Wilner (cont.)	Evernorth	Sect. R403.8	CBES section C403.1 notes that "projects must achieve the required number of credits based on building occupancy group as outlined in Table C406.1.1 and Table C406.1.2." Buildings that fall under RBES already have additional points requirements placed on them, and should not have another set of requirements mandated by the CBES provisions. We request the following language be added to the end of the section R403.8: ", but will not be subject to the additional requirements outlined in Tables C406.1.1 and Table 406.1.2."	Agreed. See above.	
12/8/2022	Kathy Beyer, Charlie Wilner (cont.)	Evernorth	Sect. R404.3	This code section represents a large cost impact to multifamily projects. We recommend the addition of a definition for "*ELECTRIC VEHICLE CHARGING - LEVEL 2 CAPABLE (MULTI-FAMILY): provide appropriate sized pathway to the building electrical room to accommodate a future electrical upgrade for Level 2 EVSE electric vehicle charging; provide adequate wall and floor space in the building electrical room for future EV charging related electrical equipment; provide the appropriate sized pathways to exterior ongrade surface parking spaces for future Level 2 EVSE electric vehicle charging; if the building includes garage or covered parking, provide a line diagram on the electrical drawings demonstrating a pathway for future Level 2 EVSE electric vehicle charging. Quantity of future Level 2 EVSE electric vehicle charging stations shall be as required by Table R404.3* ."	Agree to add this language for parking spaces inside the building. Outside spaces must adhere to the existing language in R404.3.	The following language added below Table R404.3: For multifamily building garage or covered parking, provide on electrical drawings the appropriate sized pathway to the building electrical room to accommodate a future electrical upgrade for Level 2 EVSE electric vehicle charging; provide adequate wall and floor space in the building electrical room for future EV charging related electrical equipment; provide the appropriate sized pathways to exterior on-grade surface parking spaces for future Level 2 EVSE electric vehicle charging; provide a line diagram on the electrical drawings demonstrating a pathway for future Level 2 EVSE electric vehicle charging. Quantity of future Level 2 EVSE electric vehicle charging stations shall be as required by Table R404.3.
12/8/2022	Kathy Beyer, Charlie Wilner (cont.)	Evernorth	Table R404.3	Exterior parking is "struck-through" - does that mean there are no requirements for exterior parking? What does the "4" in the line below to the right refer to? Recommended changes: i. Strike "or Multifamily Building" from first line under BUILDING/PARKING TYPE column. ii. Add new line below first line for "Multifamily Building". Add the following language to this new line under "MINIMUM REQUIRED NUMBER…": 25% of provided parking spaces (refer to DEFINITIONS for differing requirements for covered/garage spaces versus exterior on-grade surface parking spaces. iii. Delete remaining lines in the Table. The single digit 4 under "MINIMUM REQUIRED NUMBER…" doesn't seem to apply to anything.	The fact that Exterior Parking is deleted was intended to mean that all parking spaces are treated equally. However, in response to the previous comment, we have agreed to treat interior parking spaces differently.	Exception provided for multifamily garage or covered parking. See previous comment.

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12/9/2022	Bob Duncan	Duncan-Wisniewski Architecture		1. An energy code without enforcement is problematic at best. And the lack of any such enforcement places builders and architects trying to follow the code at a distinct disadvantage to those who don't. Lack of enforcement can lead to poor construction methods, whether through best intentions or not, that may lead to serious health and safety issues and building materials failures. It is imperative that we have an enforcement process that includes education (construction methods and energy code), and it's also imperative that the inspectors charged with enforcement are trained in the very complexity of building codes and building science. The Department of Public Service should lobby and encourage the Legislature to address this very important issue. The Inflation Reduction Act has $250M over five years to assist state and local governments and partnerships in efforts to upgrade energy codes, training, enforcement, etc. Some entity in state government should lead the way in applying for these funds to guide the way forward in education and enforcement. These funds are available through a competitive grants program, announcement of which is expected soon. I can provide more information on this topic, and have shared it also with the Division of Fire Safety. 2. A very minor point: why do Certificates of Compliance need to be notarized? It's just one more hassle in the process.	1. Changes in the enforcement mechanism would require a statutory change or a municipal ordinance and are beyond the scope of the code update. 2. We are not aware of any requirement to notarize RBES Certificates and there is no explicit requirement for notarizing RBES Certificates in statute.	
12/9/2022	Bob Duncan (cont.)	Duncan-Wisniewski Architecture		3. Important issues to be considered regarding EV Level 2 Capable charging stations: a. If a multi-family building includes garage parking, as many of them do, we do not yet know what the additional DFS requirements will be regarding EV stations, but we do know that DFS has serious concerns about them. b. If building electrical equipment is sized for the immediate building needs (not including future EV), then the utility will most likely size the transformer for the immediate building needs; when the time comes to upgrade for EV, the electrical gear will need to be replaced, and the transformer will also likely need to be replaced (both at considerable cost). If the building electrical equipment is sized for building and future EV needs, then the upfront costs for the additional gear size will be higher, as will the utility costs for the increased transformer size (if the utility is even willing to provide a transformer bigger than what the initial demand for power is), and perhaps even increased vault size (which on tight sites in downtown locations may be challenging).	The DFS concerns about EVSE relate to parking spaces inside the building only. As agreed to in response to the Evernorth comments above, we will only require Level-2 ready spaces for exterior parking.	Level-2 ready spaces now required for exterior parking only. added 403.4 language that should adddress interior parking.
12/9/2022	Bob Duncan (cont.)	Duncan-Wisniewski Architecture		c. Quantity of spaces to be 'EV capable': except for the range limitations of EVs, won't EV owners' charging patterns be similar to FF owners' patterns? In other words, not everyone fills the tank/charges the battery every day? And if parking spaces are unassigned (the case in most rental units, maybe even some ownership units), then people who need a charge will park where the available chargers are. Even though we may hope/expect all cars to be EVs at some future point, it still seems to me that having 25% of spaces EV capable is more than sufficient. After all, charging times may vary substantially in the future, even today's battery systems may become obsolete in favor of some currently unknown technology. d. There is a difference between earlier RBES and CBES editions and the current ones which changes the nomenclature from 'EV ready' to 'EV capable' and the limit on the number of 'EV capable' locations does not exceed the number of parking spaces provided. However, further limiting the number of charging stations based upon a percentage of provided spaces makes sense, as more and more projects are providing <1 parking space/dwelling unit, and more and more zoning ordinances are being revised to not require parking spaces (leaving the decision to the project developer). The current language in CBES appears to require one charging station/dwelling unit plus a percentage of other spaces, and the CBES language for EV capable seems to require that all the infrastructure but for the actual charger itself must be in place. This requires increased service size, increased electrical equipment, increased electrical room size, conduit runs to all charging station locations, etc. This has very large upfront construction costs that will be a burden and impediment for many developers of multi-family housing. While the explosion in EV registrations in VT is a surprise to many people, it's also clear that battery technology and charging capability is going to be rapidly changing as well. Given the uncertainty of how the EV revolution will unfold, I think considerably more thought needs to be invested in the best way to prepare ourselves and our buildings for the electrification of transportation. Please see proposed changes described below in definitions as well as quantity of EV capable space requirements.	As agreed to in response to the Evernorth comments above, we will only require Level-2 ready spaces for exterior parking. In most cases where there will be one parking space per dwelling unit in the parking garage, this would mean 25% of the remaining (outdoor) spaces would need to be Level 2 Capable.	Level-2 ready spaces now required for exterior parking only.

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12/9/2022	Bob Duncan (cont.)	Duncan-Wisniewski Architecture		4. The summary sheets for both RBES and CBES point out that the "base energy standards for for multifamily buildings remain consistent between RBES and CBES". For example: a. Requirements for R-2 occupancy roof and wall envelopes are not aligned in Table C402.1(2) and Table R402.1.2.1. There are differences between them for both wall and roof assemblies (see comments below about CBES roof assemblies; while flat roofs are far less common in SF homes, there are some, and there are certainly MF budings that fall under RBES that have flat roofs). For instance, CBES lists three options for wood-framed walls: 1) R-13 cavity + R18 ci, 2) R19 cavity + R14ci, or R27ci; but RBES has 4 options: 1) R21 cavity + R12ci, 2) R23 cavity + R10ci, 3) R15 cavity + R15ci or 4) R28 - 8.25" SIPS panel. Currently, the most cost effective (and safe from a building science perspective) wood-framed wall is R19 cavity + R12ci. Should be able to do the RBES R21 cavity + R12ci without too much difficulty, but the CBES R19 + R14ci is a much more costly wall, unless we can find a ci that's rated to R7/inch. Once we get above 2" ci thickness, the fasteners to secure strapping over the ci get heavier-duty and longer or we need to switch to a different and more costly anchoring system for the siding. It's unclear to me why the differences between the two, if the intent was to make them consistent. b. EV charging station requirements are also not consistent for multi-family buildings between RBES and CBES. The proposed changes outlined below will align the two.	Agreed.	Minimum requirements are now expressed in U-values and are aligned between RBES and CBES for multifamily buildings to the extent possible.
12/9/2022	Bob Duncan (cont.)	Duncan-Wisniewski Architecture		RBES 2023 Comments: 1. I recommend the addition of a definition for "ELECTRIC VEHICLE CHARGING - LEVEL 2 CAPABLE (MULTI-FAMILY): provide appropriate sized pathway to the building electrical room to accommodate a future electrical upgrade for Level 2 EVSE electric vehicle charging; provide adequate wall and floor space in the building electrical room for future EV charging related electrical equipment; provide the appropriate sized pathways to exterior on-grade surface parking spaces for future Level 2 EVSE electric vehicle charging; if the building includes garage or covered parking, provide a line diagram on the electrical drawings demonstrating a pathway for future Level 2 EVSE electric vehicle charging. Quantity of future Level 2 EVSE electric vehicle charging stations shall be as required by Table R404.3." Refer to Item 4 below for changes to Table R404.3. 2. Table R402.1.2.1: ceiling insulation: neither ceiling option addresses continuous insulation on top of roof sheathing for a flat roof. Note 'g' covers this, but does not address whether the U-factor of 0.023 can be an average, i.e., some min thickness at roof drains sloping upward at 1/4"/LF by means of tapered insulation. Section C402.1.2.1.1 allows tapered insulation to be averaged. Does RBES have a similar section?	1. Agreed for interior parking areas. The requirement for 25% Level 2 Capable outside parking spaces will be retained. 2. RBES does not have language similar to C402.1.2.1.1 allowing flat roof insulation to taper.	Level-2 ready spaces now required for exterior parking only. Footnote g., Table R402.1.2.1 added: "Multifamily buildings using continuous insulation with a maximum U-factor of 0.023 or tapered insulation with an average U-factor of 0.023 for the ceiling assembly satisfies this requirement.
12/9/2022	Bob Duncan (cont.)	Duncan-Wisniewski Architecture	Table R402.1.2.3, Table R404.3	3. Table R402.1.2.3: can average r values for flat roofs get points if the average R meets the table requirements? 4. Table R404.3: Exterior parking is "struck-through" - does that mean there are no requirements for exterior parking? What does the "4" in the line below to the right refer to? a. Recommended changes: i. Strike "or Multifamily Building" from first line under BUILDING/PARKING TYPE column. ii. Add new line below first line for "Multifamily Building". Add the following language to this new line under "MINIMUM REQUIRED NUMBER…: 25% of provided parking spaces (refer to DEFINITIONS for differing requirements for covered/garage spaces versus exterior on-grade surface parking spaces." NOTE: the 25% number (which is coincidental to the proposed language requiring 25% of additional parking spaces) is intentional to reduce the proposed requirement from one/DU (or one/parking space if total parking is less than total dwelling units) to a number that seems much more consistent with how the demand will unfold over time (for reasons stated above). iii. Delete remaining lines in the Table. The single digit 4 under "MINIMUM REQUIRED NUMBER…" doesn'tseem to apply to anything.	3. Agreed. 4. The fact that Exterior Parking is deleted was intended to mean that all parking spaces are treated equally. However, we have agreed to treat interior parking spaces differently as noted above.	Added language to R402.1.3 allowing averaging R values. Parking language updated per Evernorth comments above.
12/9/2022	Bob Duncan (cont.)	Duncan-Wisniewski Architecture	R404.5, R402.4.6, R402.7.9	5. R404.5, Exception: should low-income occupants should be identified in some way? <50% of median? 60%? 80%? 6. R402.4.6: does this requirement for air sealed outlet boxes apply when the boxes are inboard of the air barrier? 7. R402.7.9: does this requirement for reserved dual pole circuit breaker apply to each dwelling unit panel in a multifamily building?	5. Agree - below 80% AMI 6. Air sealed electric boxes are not required if they are inboard of the air barrier so long as the air barrier is designed to not become a condensing surface under expected ambient conditions. 7. No. This is intended to provide capacity for future solar installations, which would tie in to the building master panel in the case of multifamily buildings.	5. Exception now reads, "Buildings where a majority of the living units serve tenants at or below 80 percent of area median income." 6. R402.4.6 - Clarified that air-sealed electrical boxes only pertain to boxes that are "through or outside the building air barrier". R402.7.9 - Clarified that "This requirement is only for the building master panel and not individual dwelling unit panels in the case of multifamily buildings."

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12/9/2022	Jonathan Dowds	REV		As a state, our capacity to meet our climate goals rests heavily on the rapid electrification of our transportation and thermal sectors. REV applauds the Department's proactive efforts to prepare Vermont's building stock for this transition. Incorporating strong EV Ready parking requirements and standards in both the CBES and RBES is a vital step to supporting widespread electrification. Access to convenient and reliable charging opportunities is essential for consumer adoption of EVs. Currently, most charging occurs at home, and ensuring that new single and, especially, multi-family properties have access to home charging will be a key factor for promoting equitable EV adoption opportunities. Ensuring that charging opportunities are readily available at commercial buildings will further facilitate EV adoption and provide for greater flexibility in when and where vehicles charge. As we electrify an increasing share of the economy, utilizing EVs as flexible sources of the load has potentially significant system advantages. These advantages stand to benefit vehicle owners, distribution utilities, and Vermont ratepayers alike. Standards that prepare new residential and commercial buildings for EV charging will have significant benefits for advancing our climate goals, promoting equitable access to the benefits of electrification, and building a robust and resilient grid.	N/A no changes suggested.	
12/9/2022	Jonathan Dowds (cont.)	REV		The cost of installing charging infrastructure during a building retrofit is substantially higher than during new construction, as much as four times higher according to a report prepared for the California Electric Transportation Coalition, ChargePoint, and Tesla.i EV Ready codes such as those currently proposed, that result in expanded breaker panels, conduit, and wire access at parking spots will reduce the cost and complexity of making EV infrastructure widely available. REV strongly supports the EV readiness standards that have been proposed and encourages the Department to adopt them as drafted.		
12/9/2022	Collin H Frisbie	Sterling Homes		Thank You for allowing me to submit comments on the proposed 2023 amendments to the RBES. I strongly oppose amending RBES at this time. RBES is currently a self certification system designed to remain a self certification system. Continuing to make the RBES more rigorous without training or enforcement in place drives up the cost of new homes in VT while creating homes that are not safe. RBES without enforcement (Authority having Jurisdiction- owning the program) further exacerbates an uneven playing field between those who try to comply and those who do not. This proposed change is very difficult to achieve from a building science standpoint as related to current best and common building practices. There are a lot of ways to build an unsafe wall assembly attempting to comply with this new regulation that will negatively affect future occupants. This highlights the risk of zero enforcement and no training. Currently Efficiency VT does not support builders unless the proposed home goes beyond energy Code. If that were to continue the radical change of building practices (beyond cavity insulation) will have spotty training with no enforcement. Cost is also a significant factor. A recent 7 Days article highlighted more eloquently than I am capable the affordability crisis of housing in VT. Expensive Housing Is Limiting Who Gets to Live Where in Vermont — and Clouds the State's Future The proposed RBES changes will add $20,000 or more to a typical 1,500 square foot new home. All to save perhaps $500 a year in heating and cooling costs. Not a good return on investment. This higher cost is especially impactful as a percentage cost of a new starter or "workforce housing" home. Summary. With no enforcement and with no building codes there's very little chance the proposed amendment will be applied, be reliable, and effectuate change while dramatically increasing the cost of a new home.	Statute requires the PSD to update the RBES "promptly after the issuance of updated standards for residential construction under the IECC." A building science section will be added to the RBES Handbook.	PSD has modified recommended measures due to cost-effectiveness
12/9/2022	Edward Levite	VBRA		I oppose amending RBES at this time. I understand the need for us to protect our environment for future generations and do what I can everyday. On a recent call with The Public Service Department a number of people much smarter about building and building science than I outlined substantial issues with the proposal. No one for sure could even state what these changes would do to protect the environment. There simply is no data to support it. In fact, one gentlemen made a comment that what VT is discussing is at the forefront. Really? Is it a race to meet no matter what the cost to us on the health of the building? I questioned the savings assumed. Seemed to me that some of the pieces required for "points" are not even factored into the cost. That a conduit for future EV at $250 seemed to be the only piece calculated in the cost.	There is clear evidence that improved thermal shell and equipment efficiency reduces carbon emissions in the short and long term. Cost effectiveness modeling presumed that points were acquired using the least cost strategy, but those costs were estimated and included based on feedback from builders, developers and other stakeholders.	

Date	Commenter	Affiliation	Chapter Ref.	Comment Summary	PSD response	Decision and Resulting Changes Made
12/9/2022	Edward Levite (cont.)	VBRA		More importantly, we continue to struggle to develop affordable housing. We continue to struggle with Act 250, permitting and administrative cost before a shovel goes in the ground. Increasing costs to assume a household can save energy costs is only going to make matters worse for affordable housing. What if that additional $20,000 causes the borrower to need PMI? Then the cost to them is even more! Making the cost savings longer than assumed. An appraiser will not automatically add $20,000 in home value because the home has the latest RBES standard. In fact, I am confident it would add zero additional value. We all need windows, we all need wall structures, etc. A window with a little better R value is not going to add value. I feel we need to understand the true safety of the structure prior to just trying to be the first State to go to the max on RBES. Why do we need to rush when we could be causing years of health issues and financial strain?	Housing affordability is an ongoing challenge, especially in the current economic conditions. The proposed changes to RBES have been analyzed for cost-effectiveness compared to the current RBES using the best available estimates of fuel costs, construction costs and mortgage rates. and have been determined to be cost effective from the customer's perspective as required by statute.	PSD has modified recommended measures due to cost-effectiveness, including window u-values.
12/9/2022	Denis Bourbeau	Bourbeau Custom Homes, Inc.		Please see below my comments regarding the proposed 2023 amendments to the RBES. I oppose amending the RBES at this time. I do understand that the goal to continue to amend the RBES requirements is to keep Vt. on track to build 100% net Zero homes by 2030. This is a goal that will increase the cost of housing that is already unaffordable for the majority of Vermonters who live and work here. The legislature is currently working hard to come up with solutions to this dire issue that is threating the future of our State housing inventory and the proposed amendments are working 100% against making any progress in affordability, they are making affordability much worse. You have heard many comments on the lack of enforcement of the current codes, * increasing builder liability due to building and health issues that will occur if these new building structures are not constructed correctly or maintained properly by the future homeowner's * in accurate cost estimates to meet the new codes and in accurate estimates on total savings to the owner.	Increasing the upfront cost of residential new construction needs to be weighed against the long-term costs of heating and cooling homes. The proposed RBES results in positive cash flow from day one compared to the current code.	Changes to the cost-effectiveness analysis were made based on up to date estimates of incremental costs from a variety of stakeholders including builders. This updated analysis resulted in the reduction in proposed insulation values for wall systems insulation and increased window u-value in order to provide a cost-effective package of improvements.
12/9/2022	Denis Bourbeau (cont.)	Bourbeau Custom Homes, Inc.		I agree with all of these points but want to add the following to points that nobody seems want to think or talk about. 1) As we continue to push to completely electrify our housing energy and transportation needs that our current electricity grid will not be able to handle the added demand. This will require huge infrastructure investments that will raise electrical rates to an unaffordable rate. Simply supply and demand economics. All the savings models will then not work at all. 2) When our homes and cars are 100% powered by electricity, we will be at a huge security and survival risk. Natural disasters that take out power grids will cause massive devastation as we will not be able to supply adequate back up power by a portable generator to be able to heat your entire house and charge your car so you can move around. We currently can heat and drive your car without electricity with a small generator. 3) We are exposing ourselves to domestic and international terrorism that is currently trying to take out the power grid that will cripple everyone. One person this past week was able to take out power to an entire city for days with a gun. What would happen to you and your electric home if it had no power for days and it was below zero. We do need to be careful what we ask for and Vt. should not be on the forefront when the costs and risks will hurt the state and the majority of our population.	These are important issues to keep in mind, specifically with respect to the utility's Integrated Resource Plans.	
12/9/2022	Isaac Elnecave	PHIUS		Phius appreciates the opportunity to provide comments suggesting amendments to the proposed adoption of both the 2023 REBS and 2023 CEBS. Phius congratulates the Vermont Department of Public Service (VT DPS) for proposing to adopt one of the strongest energy codes in the country. However, Phius believes that VT DPS can include two amendments that would upgrade the energy code. 1.Add a Phius alternative compliance path to the 2023 Residential Building Efficiency Standard (RBES) 2.Add a Phius alternative compliance path to the 2023 Commercial Building Efficiency Standard (CBES) Suggested Amendments: (Amended language underlined) R401.2 Compliance Projects for both Base Code and Stretch Code shall comply with one of the following: 1 Package Plus Points: R402 through R404 2 REScheck 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 4 Phius 2021 CORE (or later edition): Section R406.8 through R406.9	The energy code is a minimum standard. Builders can always exceed RBES and CBES and build to the Passive House standard. The PSD is concerned about picking a particular standard like Passive House over other available standards such as Energy Star, LEED, etc without additional analysis on each standard and their differences. Adding additional standards would also require more resources to continually review and understand the standards to ensure they are above or equivalent to the RBES and that they incorporate all the minimum requirements in RBES.	

Date	Commenter	Affiliation	Chapter Ref.	Comment Summary	PSD response	Decision and Resulting Changes Made
12/9/2022	Isaac Elnecave	PHIUS		Section R406.8 Passive House Alternative Compliance Option R406.8.1 Scope. This section establishes criteria for compliance via the Phius CORE 2021 (or later edition) standard. R406.8.1.1 Projects shall comply with Phius CORE 2021 (or later edition) R406.8.1.2 Phius documentation. Prior to the issuance of a building permit, the following items must be provided to the code official: 1. A list of compliance features. 2. A Phius precertification letter. Prior to the issuance of a certificate of occupancy, the following item must be provided to the code official: 1.A Phius CORE 2021 (or later edition) project certificate.	The energy code is a minimum standard. Builders can always feel free to exceed RBES and CBES.	
12/9/2022	Sandra Vitzthum			I have been working on code improvement for at least three cycles. These suggestions are for two reasons: (1) to create a path for administration and enforcement, which may develop before the next code update; (2) to give clear authority to the Division of Fire Safety to administer energy code issues particularly where they conflict with other building codes. I also want clean up odd and redundant language about certificates with the goal of increasing compliance. I should mention I have been working with the American Institute of Architects Policy Committee on these issues, as well as regional planning commissions.		
12/9/2022	Sandra Vitzthum (cont.)		R101.6	For any residential building under the jurisdiction of the Division of Fire Safety, the provisions of this code will be administered and enforced by their designated code official or authority having jurisdiction. [Discussion: it needs to be explicitly clear that DFS has authority to resolve conflicts between other construction codes and RBES, as well as enforce completion of certificates. This includes single family homes offered as B&Bs and multifamily homes.] For residential buildings not under the jurisdiction of the Division of Fire Safety, muncipalities may designate a code official or authority to the extent allowed by Vermont statute. [Discussion: This enables – finally – a path towards energy code oversight. The intent is to encourage local assistance and education. It is acknowledged that no municipality has authority to enforce without statutory language.] In any instance where there is no state or local code official or authority having jurisdiction, the Vermont Public Service Department is not considered to be the "authority having jurisdiction, where one exists," and those sections of this code requiring involvement by that entity do not apply. All other code requirements still apply.	DFS fire safety codes explicitly take precedence over the RBES. However, the PSD does not have the authority to write the DFS in as the administrator or enforcer of the RBES. That would require a statutory change. The Department believes that is the prerogative of municipalities to designate a code official or AHJ. This could be one avenue toward increased compliance with the code, at least in those jurisdictions.	
12/9/2022	Sandra Vitzthum (cont.)		**R101.6.1 Deputies** (new subsection)	With concurrence of the appointing authority, the *code official or authority having jurisdiction* shall have the authority to appoint a deputy, inspectors, plan examiners, and consultants. Such deputies will have powers as delegated by the *code official or authority having jurisdiction.* *[Discussion: Some Vermont towns would like to have a consultant, volunteer, or staff review projects and assist homeowners. This needs to be enabled. Also the authority for a "duly authorized representative" described below needs to be explained.]*	The proposed changes have legal implications that are beyond the scope of this code update.	
12/9/2022	Sandra Vitzthum (cont.)		**R110.1 General. (new subsection)**	In order to hear and decide appeals of orders, decisions, or determinations made by the code official relative to the application and interpretation of this code, there shall be and is hereby created a board of appeals. The board of appeals shall be appointed by the applicable governing authority and shall hold office at its pleasure. The board shall adopt rules of procedure for conducting its business and shall render all decisions and findings in writing to the appellant with a duplicate copy to the code official.	The PSD does not have the authority to create a Board of Appeals. Code disputes are explicitly dealt with in civil court until that mechanism is changed, and that can only happen through legislation.	
12/9/2022	Sandra Vitzthum (cont.)		**R110.2 Limitations on authority. (new subsection)**	An application for appeal shall be based on a claim that the true intent of this code or the rules legally adopted thereunder have been incorrectly interpreted, the provisions of this doe do not fully apply, or an equivalent or better form of construction is proposed. The board shall not have authority to waive requirements of this code **except for historic buildings in accordance with NFPA Chapter 43.**	See above.	
12/9/2022	Sandra Vitzthum (cont.)		**R110.3 Qualifications. (new subsection)**	The board of appeals shall consist of members who are qualified by experience and training and are not employees of the jurisdiction.	See above.	

Date	Commenter	Affiliation	Chapter Ref.	Comment Summary	PSD response	Decision and Resulting Changes Made
12/9/2022	Sandra Vitzthum (cont.)		**R110.4 Administration. (new subsection)**	The code official shall take immediate action in accordance with the decision of the board. [Discussion: this entire normal section of building codes is missing. It needs to be included for situations where there is a code official. This section goes with the other important administrative rules in this chapter. In cases where a project has no code official, this chapter is already exempted.]	See above.	
12/9/2022	Sandra Vitzthum (cont.)		**R202 General Definitions**	AUTHORITY HAVING JURISDICTION. The officer or other designated authority charged with the administration and enforcement of this code, or a duly authorized representative, where authorized by the Division for Fire Safety or a municipality. For purposes of this code, the Department of Public Service is not the code official or authority having jurisdiction. [Discussion: Current wording misses where the authority comes from. We need to stop avoiding this issue.] CODE OFFICIAL OR AUTHORITY HAVING JURISDICTION. The officer or other designated authority charged with the administration and enforcement of this code, or a duly authorized representative, where authorized by the Division for Fire Safety or a municipality. For purposes of this code, the Department of Public Service is not the code official or authority having jurisdiction and shall not be required to conduct inspections of construction or construction documents. [Discussion: same issue as above.]	The DFS does not have the authority or the resources to enforce the code, and would need to agree to the addition of this language.	No change.
12/9/2022	Sandra Vitzthum (cont.)		**R401.3 Certificate of Compliance**	[Discussion: This section is confusing as written. I suggest breaking it down with subsections and reorganizing.] **R401.3.1 Scope.** Upon completion and before occupancy of any project subject to the Residential Building Energy Standards, a certificate of compliance must [*not may!*] be completed and signed by a builder, a licensed professional engineer, a licensed architect or an accredited home energy rating organization, and these professionals may be hired either by the homeowner or by the builder. [*moving up language from below*] 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. This certificate with the qualified signature shall certify that residential construction meets the RBES.	Agree that the issuance of a certificate is a requirement. The "may" in this context refers to who may sign the certificate, not whether the certificate will be issued.	Section R401.3 now reads: "An RBES certificate is required to be issued. The certificate should be issued upon completion and before occupancy of any project subject to the Residential Building Energy Standards…."
12/9/2022	Sandra Vitzthum (cont.)		**R401.3.2 Certificate form.**	The required certificate is available from the Department of Public Service, in paper or online: https://publicservice.vermont.gov/sites/dps/files/documents/RBES%20Cert%202020_FINAL_20200916_v4_fillable.pdf A copy is also included as an appendix to this code and handbook. [Discussion: It is confusing to allow "substantially similar certificate]	The certificate is made available on the PSD website and in the RBES handbook.	No change.
12/9/2022	Sandra Vitzthum (cont.)		**R401.3.3 Posting and filing.**	After signing the certificate, the certifier must affix 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 certifier shall also 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.~~ [Discussion: clarify language and delete repetition.]	Your suggested deletions are specified in statue.	No change.
12/12/2022	Rupal Choski	Madison Indoor Air Quality		MIAQ's portfolio comprises of at least 15 companies including Airxchange, Broan NuTone/Venmar, InnergyTech, Heatex, and NovelAire. Through these companies, MIAQ offers Energy Recovery Ventilators to the residential and commercial markets that could be impacted by Vermont's Department of Public Service (DPS) proposed revisions to the Commercial Building Energy Standards. MIAQ greatly appreciates Vermont's DPS active stakeholder outreach and request for feedback on the regulation. Due to our continuous review of market demands and advancement to higher efficiency equipment, MIAQ feels uniquely qualified to provide feedback to Vermont's DPS staff on the issues they wish to address.		

Date	Commenter	Affiliation	Chapter Ref.	Comment Summary	PSD response	Decision and Resulting Changes Made
12/12/2022	Rupal Choski (cont.)	Madison Indoor Air Quality	Sections R304.1.1 and R403.6.1	The Home Ventilating Institute (HVI) is the only ISO-accredited certification body that lists residential heat or energy recovery ventilation (H/ERV) systems based on testing in accordance with CAN/CSA C439, Standard Laboratory Methods of Test for Rating the Performance of Heat/Energy-Recovery Ventilators), which prescribes the test conditions and method for calculating an H/ERV's Sensible Recovery Efficiency (SRE). Therefore, to provide additional clarity, MIAQ recommends revising the requirement in the RBES proposal to the following: **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, determined in accordance with HVI Publication 920, while also meeting compliance with Sections 304.2 through 304.11 or demonstrating compliance with one of the following alternatives … **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), determined in accordance with HVI Publication 920, at an airflow greater than or equal to the design airflow.	Agreed.	Section R304.1.1 Compliance now reads, " Compliance with Section 304 shall be achieved by installing a balanced whole house balanced ventilation system with minimum 70 SRE and 1.2 cfm/Watt, determined in accordance with HVI Publication 920 and listed in HVI Publication 911, while also meeting... " Section R403.6.1 has been deleted and R403.6 now reads, "Follow the mechanical ventilation requirements in R304."
12/23/2022	Jennifer Peterson			The Vermont RBES Certificate is supposed to be recorded in the town land records, but the form does not give room for a recording stamp. I am requesting that your department change the page to legal-size and leave about 1.5" at the top so that Clerks have room to add the recording stamp. My stamp is 2" wide x 1.25" high, but Clerks don't use uniform stamps, so I can't say what size another clerk would need. I typically have to copy the letter-size form onto legal-size paper. It would be nice if the form was read-to-go since it's required to be recorded.	The Department will consider providing a 1.5" to 2" square space for the recording stamp on the RBES and CBES certificates.	Consider during certificate redesign
12/7/2022	Enrique Bueno	Vermont Passive House		Airtightness of 1 ACH50 should be required	This is a significant increase and well beyond what is required in the IECC. However, points are offered in the prescriptive compliance pathway to achieve this level of airtightness.	
12/7/2022	Enrique Bueno	Vermont Passive House		Triple panes casement windows should be required (u-0.14)	This is well beyond any requirements for windows outside of passive house construction. . Points are available in the prescriptive compliance pathway for windows with lower U-values than the minimum requirement. The PSD has concerns about cost and availibility of windows as well as the elimination of window choice by restricting window type to casement only.	
12/7/2022	Enrique Bueno	Vermont Passive House		Ratio of 50/50 for rigid exterior insulation and interior batting shoud be maintained	Assuming what is refered to here is the R-value of the insulation being maintained at 50/50 exterior/interior, this would represent significant cost in both material and time to install the exterior sheathing and may require re-engineering to maintain required shear strength, etc. Durable wall systems that have less than 50% continuous insulation on the exterior can be constructed in Vermont as long as proper attention is paid to moisture management.	The RBES Handbook will be expanded to include guidance on building science and moisture management and will offer examples of durable wall systems for the Vermont climate.

Levenson, Keith

From: PSD.Info@vermont.gov on behalf of Department of Public Service <PSD.Info@vermont.gov>
Sent: Thursday, November 3, 2022 12:17 PM
To: PSD - Code Update Res
Subject: Form submission from: Energy Code Update Comments

Follow Up Flag: Follow up
Flag Status: Completed

Categories: Residential Code

EXTERNAL SENDER: Do not open attachments or click on links unless you recognize and trust the sender.

Submitted on Thursday, November 3, 2022 - 12:16pm Submitted by anonymous user: [65.19.75.89] Submitted values are:

E-Mail: aweinhagen@hinesburg.org
Name: Alex Weinhagen
Affiliation: Town of Hinesburg
Comment Area: Residential
Comment: Section R402.7.1 (page 92 of the redline document), first sentence.
Update the section reference at the end of the sentence. Change from R407.5 (which has been deleted) to R402.7.

The results of this submission may be viewed at:
https://publicservice.vermont.gov/node/2545/submission/242

Levenson, Keith

From: PSD.Info@vermont.gov on behalf of Department of Public Service <PSD.Info@vermont.gov>
Sent: Monday, November 7, 2022 10:17 AM
To: PSD - Code Update Res
Subject: Form submission from: Energy Code Update Comments

Follow Up Flag: Follow up
Flag Status: Completed

Categories: Residential Code, Commercial Code

EXTERNAL SENDER: Do not open attachments or click on links unless you recognize and trust the sender.

Submitted on Monday, November 7, 2022 - 10:16am Submitted by anonymous user: [65.19.75.25] Submitted values are:

E-Mail: kevincdennis@gmail.com
Name: Kevin Dennis
Affiliation:
Comment Area: Residential and Commercial
Comment:
Self-certified compliance effectively equates to the honor system. I am aware of no towns which actually enforce submission of the form, and even then they are unqualified to evaluate the accuracy, and unable because there is no actual means of inspection. This results in an "architect tax" where architects are bound by professional and ethical standards to adhere to the codes, and contractors are not. Similar when Eff VT is involved.

On the CBES side, DFS reviews drawings for life safety compliance. Their expertise is in life safety, not energy. Again, while design professionals are voluntarily demonstrating compliance, there is no review or enforcement of energy code.

The results of this submission may be viewed at:
https://publicservice.vermont.gov/node/2545/submission/243

southburlington
PLANNING & ZONING

November 8, 2022

Kelly Launder
Barry Murphy
Vermont Department of Public Service
Delivered via email to:
psd.codeupdateres@vermont.gov
psd.codeupdatecomm@vermont.gov

Re: Feedback on Proposed 2023 RBES and 2023 CBES

Dear Kelly and Barry,

The South Burlington Planning Commission welcomes the opportunity to provide comments on the proposed 2023 updates to the Residential Building Energy Standards and Commercial Building Energy Standards.

The Commission appreciates the diligence and work that went into this update, and offers the following recommendation, approved at its October 25, 2022 meeting:

> **That the Residential and Commercial codes require that buildings and roofs be oriented to maximize solar potential and to require that solar ready zones on new commercial buildings be required to have solar PV systems that reasonable maximize those solar ready zones.**

Should you have any questions, please feel free to contact me as staff liaison to the Commission.

Sincerely,

Paul Conner, AICP
Director of Planning and Zoning

cc: Jessica Louisos, Planning Commission Chair
Jessie Baker, City Manager
Helen Riehle, City Council Chair

Snyder Homes
Your Builder of Choice

November 28, 2022

To: June Tierney, Commissioner, Dept. of Public Service

From: Chris Snyder, President

RE: Energy Code Updates

Dear Commissioner,

I am writing to express my concern about the proposed energy code changes developed by the Department of Public Service. Our State's policy goals of providing affordable, energy efficient homes for all will be impacted by this proposed change. I believe that the changes should be delayed for two years.

Snyder Homes builds approximately 35 homes and 100 plus apartments a year in Chittenden County. All of our projects are permitted through municipal processes, and comes under Act 250 regulations including the requirements to exceed code by at least 10%. We have a lot of experience in building science and energy efficiency because of the oversight and involvement of Efficiency Vermont on all projects.

We have reviewed the cost impact of the code changes to our homeowners and tenants. Unfortunately, the proposed changes will increase the costs of the homes dramatically, and the homeowners will not be able to realize a benefit.

The review completed by the Dept. does not account properly for the cost of the improvements. We have estimated that the increased cost to meet the code and stretch code for Act 250 projects is over $17,500 per home. The benefits for these future homeowners will not be realized for many, many years.

In the past, we have utilized Efficiency Vermont to offset some of the costs associated with the construction of the home. We have recently learned that Efficiency VT will **not** be participating in providing rebates to homes that would be created to meet the "Missing Middle". They will only be participating with government funded affordable housing projects, and high-end custom homes.

Further, Act 250 projects are required to meet stretch code. This creates a dis-incentive to construct dense residential neighborhoods. From a policy perspective, the State wants and needs to develop higher density, land efficient housing options. The negative impact of requiring a higher code for Act 250 projects is in direct conflict with this goal.

I recommend that LCAR direct the Dept of Public Service to maintain the 2020 RBES, delay the implementation of the proposed code changes for a minimum of two years to allow for a

comprehensive program that would include increased funding by Efficiency VT to cover the cost of the improvements for homes within Act 250 designated projects.

Respectfully,

Christopher Snyder
Chris Snyder
President
Snyder Homes

Levenson, Keith

From: PSD.Info@vermont.gov on behalf of Department of Public Service <PSD.Info@vermont.gov>
Sent: Tuesday, November 29, 2022 9:52 AM
To: PSD - Code Update Res
Subject: Form submission from: Energy Code Update Comments

Follow Up Flag: Follow up
Flag Status: Completed

Categories: Residential Code

EXTERNAL SENDER: Do not open attachments or click on links unless you recognize and trust the sender.

Submitted on Tuesday, November 29, 2022 - 9:51am Submitted by anonymous user: [185.212.5.78] Submitted values are:

E-Mail: Sustainbuildersllc@gmail.com
Name: Nick Sennett
Affiliation: Owner Operator
Comment Area: Residential
Comment:
Commenting mostly on insulation values for walls and other area. But the overall updates are doing everything but making it possible to provide more affordable housing and remodels. Which is all we hear about from the state and the people that live here. That working class families can not afford the work. When will it be enough insulation and at what point does the carbon foot print we put into the house out weigh the energy usage.

The additional costs when you require these increased values of insulation and the continues insulation increasing the cost substantially. Not just with the additional labor and material to add this foam or other CI but the additional labor and material that is required to trim out windows, doors the challenges this adds to securing the sheathing and siding.... The list goes on. I understand why we would like this but this should be an option not requiring people to do this. This state is just continuing to make building in this state more expensive at the cost of being "Green" which is causing the cost of living to just increase and push more young people like myself to other states. Rents are already high in this state but now we are going to require new buildings to have more costs which lead to bigger rents and again the same problem we have now with not enough rentals or affordable rentals (relaying on government subsidies).

I understand that we want to make homes more efficient but this is going to continue to price working families out of new homes or large remodels. We are getting to a point where a code house could almost be considered a passive house. I know this is your goal but this is not affordable for most working class families. When is enough..... Enough

The results of this submission may be viewed at:
https://publicservice.vermont.gov/node/2545/submission/244

HUNTINGTON HOMES
SINCE 1978

November 29, 2022

To: June Tierney, Commissioner Vermont Department of Public Service

From: Jason Webster, Owner Huntington Homes, Inc

Re: Proposed RBES Amendments

Dear Commissioner,

Huntington Homes, Inc is a modular manufacturer located here in Vermont. We build 75 residential homes a year, half of which are in Vermont. Our work in MA, CT, NY, NH, and ME gives us an inside view on how other states run their energy code programs. And Vermont truly stands alone in how it runs it's program (or lack thereof).

I strongly oppose the current amendments as-written. The enabling legislation of RBES requires that any proposed amendment to the RBES pass a three prong test. And I believe the proposed amendments fail all three tests. Each is outlined below.

The enabling legislation (30 VSA Section 51) for the Vermont Building Energy Standards directs the Commissioner of Public Service to amend the RBES from time to time using the IECC model codes as a guideline. The enabling legislation includes a mandatory three prong test for any amendment. Applicable provision of the legislation quoted below.

(1) Any amendments to the RBES shall be:
    a. Consistent with the duly adopted State energy policy, as specified in section 202a of this title, and consistent with duly adopted State housing policy;
    b. Evaluated relative to their technical applicability and reliability; and
    c. Cost-effective and affordable from the consumer's perspective.

I'll take each in order.

<u>Consistent with the duly adopted energy and housing policy.</u>

- Energy Policy. The 2022 Vermont Comprehensive Energy Plan sets a goal of all new construction to be net-zero ready by 2030. The Energy Plan then spends two pages detailing the historic problems of compliance, oversight, and licensure. The Energy Plan goes further and notes "Lack of compliance undermines the objective of the building energy standards, particularly in the residential sector". The proposed 2023 RBES amendments does nothing to address the compliance problem.

- Housing Policy. The 2022 Housing Annual Action Plan lays out four goals. It then spends 92 pages outlining how they'll measure and achieve their goals. There is one mention of energy efficiency in this Action plan, and it states "ensure a robust analysis of costs is considered in the development of State energy-efficiency standards and building codes.". I say that the DPS has failed to adequately assess the costs of the proposed amendments. See further discussion below.

<u>Technical applicability and reliability</u>.

- Technical Applicability. The proposed amendments to the 2023 RBES are related to Energy, but they are effectuated by Building. And Vermont has no active program for building codes for single family residential construction. Vermont is alone in this regard. All neighboring states review and enact their Energy Code within the bounds of Building, Electrical, and Plumbing Codes. Because of this all neighboring states are still working off the 2015 and 2018 IECC as they also update their Building Codes to work in tandem. Historically Vermont adopting the latest version of the IECC hasn't been a problem because the energy requirements of the IECC followed "standard" or general building practices. But the 2021 IECC goes well beyond standard practices. It requires complicated wall assemblies that some builders understand, but many do not. Building them wrong can be disastrous (google "interstitial condensation"). These advanced wall assemblies MUST be built within the guidelines of the Building Code and good building science. Building them without the guidance and oversight of a Building Code will very likely increase premature failure of our

homes. This isn't durable or safe for Vermonters. For this reason I say that the proposed amendments can't be technically applied.

- Reliability. The current RBES effectively has no enforcement, applications, permits, inspections, or certifications. It is a self-certified, after-the-fact-type code. There is a general consensus among everyone else involved in construction that a very high percentage of new builds aren't built with RBES in mind. The last study done by the DPS on technical code compliance (regardless of self-certification status) was done in 2015 and that study found only 66% of homes built then met the standards of the time. The technical requirements of the code in 2015 were pretty basic and generally a codification of good building practices (ie what builders were building anyway). The census of those involved with this code amendment is that as the code gets tougher the technical compliance gets lower. I dare guess that maybe 30% of homes built today meet the technical requirements of the 2020 RBES. With the significant jump in the technical standards of the proposed 2023 RBES I'd guess that the compliance rate drop near 10% under the proposed code. For this reason I say these proposed amendments fail the test of reliability.

With no building codes, and with no enforcement there's very little chance the proposed amendment will be applied, reliable, and/or effectuate change.

<u>Cost-Effective and Affordable from a consumers prospective</u>.

The DPS Filing states a $12k cost and $900 annual savings under the proposed regulations. But I believe the DPS has erred in their analysis. I was part of the working group that ran these calculations and I think you are using a proposed wall assembly that wouldn't meet the Building Code (for structural shear reasons) therefore it shouldn't be compared. The more applicable cost calculation used a double stud assembly and that package added $18,300 to the cost of a new home and netted a $480/year savings. That's a 38 year simple payback. It's not an investment a business would make. It shouldn't be something the DPS forces Vermonters to buy.

There is also a strong argument that we shouldn't only be looking at the cost jump from the current 2020 RBES to the proposed 2023 RBES. We all agree that most builders aren't building to the current Energy Code, they're still building what they've always built. That historic home is most inline with the 2015 RBES. And the cost jump from the 2015 RBES to the proposed 2023 RBES is $30,300 on a typical 1800sf home. Or an 8.4% price increase on that home.

The DPS goes further and makes an argument that the energy savings is cash flow positive against the increased mortgage payments. But this is not how banks see it. They don't give credit for forward / future costs. Bottom Line is that a mortgage payment on a more expensive home is more expensive. If banks don't use future cash flow for determining a loan neither should the DPS in a proposed regulation.

A Marketwatch study in March 2021 found Vermont to be the least affordable new home market in the country. Only 16% of Vermont households could afford the mortgage payment on a median priced new home, and that was when mortgage rates were 4% and before housing prices really took off. State policy should be figuring out how to get more Vermonters into more new homes (which everyone agrees we desperately need). Not how to make them more complicated and more expensive. For these reasons I say the proposed amendments fail the test of cost-effective and affordable from a consumers prospective.

In Summary. The proposed amendments do not address the compliance problems noted in the state Energy Policy and present in these rules since 1997. The proposed amendments haven't demonstrated cost effectiveness. The proposed amendments contain no oversight or certifications to make sure new homes are consistently built safe and durable. The proposed amendments do not satisfy the three tests outlined in the enabling legislation. The DPS should not advance these amendments at this time. The DPS should acknowledge the fundamental flaws I and others have outlined above and propose a new set of rules that contain real oversight, certifications, inspections, and compliance measures. If not there's almost zero chance we'll actually get to net-zero ready by 2030.

Sincerely,

Jason Webster
Co-President, Owner
Huntington Homes, Inc

Levenson, Keith

From: John Linn, AIA <john@hillviewdesign.com>
Sent: Wednesday, November 30, 2022 8:56 AM
To: PSD - Code Update Res
Subject: RBES code updates

Follow Up Flag: Follow up
Flag Status: Completed

Categories: Residential Code

EXTERNAL SENDER: Do not open attachments or click on links unless you recognize and trust the sender.

Hi, my name is John Linn. I'm a licensed architect and have been working in the building profession since 1997. I am one of the owners of Hillview Design Collaborative and Hillview Building Company. Together we make up a design-build firm in Richmond, Vermont. Since our inception we've pushed clients to build high efficiency and net-zero ready homes. The homes we build exceed current codes and would be compliant with the proposed RBES rules. We have been very fortunate to find clients that share our values regarding energy efficiency.

I'm writing in response to the request for input on the proposed 2023 amendments to the RBES. Personally I feel that while the goal is admirable the amendments as proposed are going to further unbalance the market between builders that are following the rules and those that are not. The new rules create much more stringent rules while the support builders currently receive is being effectively reduced.

The current approach to enforcement of code compliance is through litigation. This requires a homeowner to know enough about building to understand that their beautiful new home has flaws below the surface. Are they supposed to know that their home has continuous insulation or is properly air sealed? Are they responsible for confirming that the R value listed on the RBES certificate is what was actually installed? Even if the homeowner had their suspicions or a problem presented itself they would have to have someone do fairly expansive forensic investigation to determine that the building didn't meet code. Then they'd need to pay to have a fellow builder or architect take the stand to prove that the original builder created a sub-standard structure. I have heard of less than a handful of projects being called out for lack of code compliance which is pretty incredible considering the energy code has been around for over 20 years. Does the board really feel that all of the buildings created in that timeframe have met the applicable code? What's the point of creating more stringent codes if there's no effective way of requiring builders to meet them? It feels very contradictory for me as a builder and architect to be arguing for more oversight and/or enforcement but that's the best way I can see to ensure that the RBES actually does what it's intended to do. Adding more oversight or enforcement with a lack of support will further drive up the cost of already expensive construction.

Until the end of 2022 all of our company's new home construction has been supported by Efficiency Vermont either through their base or high efficiency home programs. They've provided HERS ratings, blower door tests, site visits and design advice throughout the process. Currently a project enrolled in an Efficiency Vermont program has third party oversight from beginning to end including job site inspections. Efficiency Vermont provided rebates if a project met their program requirements. As I understand it in 2023 this support will be reduced to just the advice. Builders will now

be responsible for trying to find HERS raters and subcontractors capable of doing accurate blower door tests. This reduction in support at a time when the code is becoming much more stringent is very unfortunate timing.

Having seen the lack of code compliance and resistance to change that some builders are currently showing, I feel that the state should be offering more incentives to meet code while maintaining (or even increasing) oversight to confirm that new construction is meeting code. I feel that the Efficiency Vermont programs were the closest thing we had to that. Either reinstating their system for builder support or creating a similar one seems the most effective way to provide the help that most builders will need. Allow all new construction to be enrolled in a similar program even if it's just meeting base RBES requirements and provide incentives for doing so. These incentives should be directed toward the permanent portions of the house. The point of purchase rebates for light bulbs and heat pumps that are currently offered don't address the insulation, air sealing, windows and thermal envelope of a home. Those are more or less permanent portions of a home that can't be changed out or added as technology changes like solar panels or more efficient heating sources. More energy efficiency incentives could help reduce the cost of building similar to the subsidies and tax free fuel that the state is offering to electric vehicles. I think creating appropriate incentives and finding a way to distribute those while enforcing code compliance is where we should be headed. Not simply making more strict rules that have no effective means of enforcement.

Thank you for taking the time to read this and your consideration.

John Linn, AIA

--

Hillview Design Collaborative

hillviewdesign.com

John Linn, AIA

Architect/Partner

802.434.2225 (O)

802.734.0934 (C)

11/30/2022

To: June Tierney, Commissioner - Department of Public Service

From: Vermont Builders and Remodelers Association

Re: Residential Building Energy Standards updates

Dear Commissioner Tierney,

Thank you for the opportunity to submit comments regarding the update of the 2020 Vermont Residential Building Energy Standards (RBES).

The Vermont Builders and Remodelers Association (VBRA) requests that the RBES update to the 2021 International Energy Conservation Code (IECC) be delayed.

The focus of our opposition to adoption of the 2021 code:

1. Vermont has no building code (beyond energy code) that addresses comprehensive modern building science. With RBES being the only code and energy use the sole focus, builders may be able to hit the R-value, but at great risk of an improperly built home. Some builders will have the knowledge to understand the interaction between energy code and proper ventilation, but many will not. The new codes require complicated wall assemblies and ventilation systems that – without the oversight of a comprehensive building code and inspection - will push the level of necessary whole-house expertise beyond the skill of many builders. Building incorrectly has serious consequences for the health and safety of Vermonters.

2. There is no inspection, enforcement or certification of the code we do have. RBES are self-certified. As requirements become tougher the level of compliance will decrease. It's been over a decade since the DPS conducted a code compliance study, and at that time found that only 72% met the standards. If a similar study were performed today, we would expect a sizable decrease from that margin. Without enforcement an increasingly high percentage of homes are built without RBES in mind. Without comprehensive building code too many will be built with *only* RBES in mind.

3. VBRA is concerned that the cost increases associated with the 2021 code will not be merely "incremental," and will instead add significant and unnecessary costs to residential construction. VBRA members report cost increases of $17,500 – $18,300 per home, locking more and more potential homeowners out of buying their first home or for current homeowners to move up to a new home. As Vermont grapples with a housing crisis, we question the advisability of a drive for increasing R-values that do as much harm as good to housing affordability.

In summary, we ask the DPS to consider delaying the adoption of the 2021 IECC code until the above issues have been discussed and solutions created for the stated issues.

VBRA members will submit individual letters, attend the Dec. 2 virtual public hearing to express concerns in more detail, and engage with LCAR when that committee takes up the rules.

Respectfully submitted,

Dixie O'Connor, President VBRA

Levenson, Keith

From: PSD.Info@vermont.gov on behalf of Department of Public Service <PSD.Info@vermont.gov>
Sent: Friday, December 2, 2022 11:27 AM
To: PSD - Code Update Res
Subject: Form submission from: Energy Code Update Comments

Categories: Residential Code

EXTERNAL SENDER: Do not open attachments or click on links unless you recognize and trust the sender.

Submitted on Friday, December 2, 2022 - 11:26am Submitted by anonymous user: [69.50.61.235] Submitted values are:

E-Mail: dupontcstr@aol.com
Name: Kevin duPont
Affiliation:
Comment Area: Residential
Comment: Good morning, I think that it is out of line to try to enact this proposed update without addressing inspection first. The added cost associated with these changes are bore out with real savings the the homeowner can realize. Housing in VT is expensive enough with out this new code. If these measures are put into place without inspection, there is a real concern about doing more harm than good. It may be setting up situations of trapped moisture and premature building failure.

The results of this submission may be viewed at:
https://publicservice.vermont.gov/node/2545/submission/245

Levenson, Keith

From: PSD.Info@vermont.gov on behalf of Department of Public Service <PSD.Info@vermont.gov>
Sent: Friday, December 2, 2022 2:54 PM
To: PSD - Code Update Res
Subject: Form submission from: Energy Code Update Comments

Categories: Residential Code

EXTERNAL SENDER: Do not open attachments or click on links unless you recognize and trust the sender.

Submitted on Friday, December 2, 2022 - 2:54pm Submitted by anonymous user: [190.71.30.34] Submitted values are:

E-Mail: silvio@modern-mill.com
Name: Silvio
Affiliation: Modern Mill
Comment Area: Both
Comment:
As part of the production team of Modern Mill, I was assigned the task following the changes on the RBES and CBES standards.

I have been readin throught the changes and aside from the R-value requirements which I feel would be one of the changes that would affect us the most.

I would like to know your opinion in how these changes could affect our product in the area or Vermont. In case you are not familiar with our company, we produce 100% wood-free composite boards mainly used for exterior cladding with products used mainly as siding and decking.

We have had some people concerned about how these changes could affect the usage of our product and we would just like to know how concern we should be if we should be concerned at all with these changes.

Hope this question is not too much of a nuisance for you, look forward to hearing from you. Thank you very much for your attention.

The results of this submission may be viewed at:
https://publicservice.vermont.gov/node/2545/submission/246

Levenson, Keith

From: Jeff Stetter <jstetter@pellasales.com>
Sent: Monday, December 5, 2022 3:02 PM
To: PSD - Code Update Res
Subject: RBES Comments

Categories: Residential Code

EXTERNAL SENDER: Do not open attachments or click on links unless you recognize and trust the sender.
Based upon reviewing the slide deck from the RBES 12/2/2022 presentation, I offer the following for consideration:

Table R402.1.2.1- Insulation and fenestration requirements by component for standard packages for base code and stretch code.

- Ramifications of a .27 U-Value Requirement for Fenestration.
  - With the current U-Value requirements of .28 to .30, Aluminum Clad Wood windows include options to typically meet the requirement with standard Cardinal Low-E270 Glass with Argon. With the proposed .27 requirement across the board most, if not all, Aluminum Clad Wood Windows (double hungs, casements, awnings, etc) will require switching to a glazing package which includes an additional interior coat of Low-E. Depending on the line of windows, this can increase the overall window cost between 9-16%. These are real numbers. To change to triple pane windows would increase the base cost between 38-46%.
  - The glazing package that requires an additional interior coat of Low-E lowers the interior surface temperature of the glass, and thus decreases the window's resistance to condensation.
  - Vinyl windows can typically meet the standard without any increase in cost.
  - Fiberglass windows have fewer options to meet the new standard without triple pane and typically will have increased cost.

Table R402.1.2.2

- Multifamily housing is so inherently more efficient than single family. Most of the large multifamily projects being constructed these days have most units under 600sf. Seems like small units of this scale should be rewarded.
- Seems like a 1500sf house should have less points required than a 2500sf house??

Table R402.1.2.3

- I like the Insulation Embodied Carbon Emissions points requirements. Seems to me that's likely the most valuable part of this code in terms of saving the planet.

R402.4.3 Fenestration Air Leakage
Seems like reducing air leakage to "no more than 0.2 cfm per square foot" would be a viable reduction. This would be a good base level for window air leakage rates.

I am the Architectural Representative for Pella Windows for Vermont. Pella offers 8 lines of windows in Vinyl, Fiberglass, Wood and Aluminum Clad Wood. Feel free to reach out with any questions or concerns.

Jeff Stetter, AIA
Pella Architectural Consultant
802.498.4682

Pella®

Celebrating 60 Years in Vermont

International Code Council
73 Allston Avenue
Middletown, RI 02842
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wnash@iccsafe.org
www.iccsafe.org

December 6, 2022

Kelly Launder,
Department of Public Service
112 State Street
Montpelier, VT 05620

Via email: kelly.launder@vermont.gov

RE: Vermont Residential Building Energy Standards

Dear Kelly,

My name is William Nash, and I am a Senior Governmental Relations Manager in Vermont for the **International Code Council** (Code Council) and your liaison to the Code Council. Please allow this letter to serve as written comments supporting the pending update to the 2020 Vermont Residential Building Energy Standards (RBES) based on the 2018 and 2021 **International Energy Conservation Code** (IECC).

The Code Council is a member-focused association dedicated to helping the building safety community and the construction industry provide safe and sustainable construction through developing codes and standards used in the design, build, and compliance process. Most U.S. states (including Vermont,) communities, Federal agencies, and many global markets choose the International Codes (I-Codes) to set the standards for regulating construction, fire prevention, and energy conservation in the built environment. The IECC is in use or adopted in 48 states, the District of Columbia, the U.S. Virgin Islands, and Puerto Rico, among other jurisdictions (you can view an adoption chart at: **Code_Adoption_Maps.pdf (iccsafe.org).)**

The I-Codes (including the 2018 and 2021 IECC) are updated and revised every three years through a **governmental consensus process**. Beginning with the 2024 code development cycle, the IECC is updated every three years through a **standards development process** that adheres to the American National Standards Institute (ANSI) Essential Requirements for openness, balance, consensus, and due process. Both code-development processes incorporate the latest technology, new building products, installation techniques, economics, and cost while incorporating the most recent advances in public and first responder safety. It encourages input from all individuals and groups and includes many beneficial changes to the model code that Vermont is considering adopting.

We respectfully recommend that Vermont adopt the most updated version of the IECC model code (2021 version.) However, we recognize Vermont's unique characteristics and significant efforts that Vermont leaders have made, including their commitment to a safe built environment via up-to-date codes for their visitors and citizens. In addition, the I-Codes correlate without conflicts to eliminate confusion in building design, inconsistent code enforcement, or interpretation among different jurisdictions. Jurisdictions that

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utilize the most current edition of the I-Codes thereby ensure the highest standards for safety, energy efficiency, sustainability, economic incentive, and long-term resiliency of their built environment.

The Code Council would like to commend the State of Vermont for its consistently outstanding work in reviewing and proposing to update the Vermont RBES based on the 2018 & 2021 IECC. The proposed amendments and update of this code, while incorporating amendments that reflect the unique character and needs of Vermont, will ensure that the Vermont RBES remains technically viable, allow for consistency in code application and enforcement, allow for economic investment in building construction, and provide for the most significant safety of the public and emergency responders while embracing modern technology, energy efficiency, and building practices.

Technical assistance and training from the Code Council is always available to groups including, but not limited to: Vermont Design Professionals, Vermont Plans Examiners, The Vermont Plumbers' Examining Board, The State Department of Public Safety, Department of Public Service, and the State Fire Marshal's Office and inspection staff. These groups will continue to have access to, among other things, Code Council training programs and materials, product Evaluation Reports, certification programs, and Code Council technical staff, who assist with code opinions and interpretations based on the IECC and other referenced materials.

Thank You for the opportunity to submit these comments. The Code Council is honored to partner with the State of Vermont to support the adoption and administration of the Vermont RBES, and we look forward to continuing to serve your needs for many more years. Don't hesitate to contact me via email or cell phone (information noted below) if you have any questions, concerns, or comments about the IECC/RBES adoption or anything else ICC related.

Sincerely,

William J. Nash, Jr.
Senior Regional Manager - Government Relations
International Code Council
wnash@iccsafe.org
888-422-7233; Ext. 4876

December 7, 2022

Kelly Launder
Department of Public Service
112 State Street
Montpelier, VT 05620

RE: Comments for proposed changes to Vermont Residential Building Energy Standards Amendments

Dear Ms. Launder,

We write as the Montpelier Housing Committee, a committee tasked with addressing the critical shortage of housing units to accommodate the needs of current residents and residents looking to move to Montpelier for work. We write to ask you to reconsider a portion of the new electrical requirements in the proposed changes to the Vermont Residential Building Energy Standards (RBES) that would have the unintended consequence of deterring the improvement and development of housing units in Montpelier and around the state.

The proposed changes to the RBES appear to require, via R404.3, owners of multi-family buildings subject to these rules (e.g., triplexes, duplexes, and presumably single-family homes with accessory dwelling units (or, ADUs)), should they alter the building's electrical system, to ensure that each unit has a parking spot capable of supporting a level 2 charger. This requirement also appears to apply to owners of single-family homes who seek to add an ADU or otherwise divide their house into more units, as these changes are likely to necessitate altering the electrical system in the process.

It is realistic to conclude that in most situations this will mean that each unit must have 150 or 200 amp service despite the exemption in R404.4 specifying that multi-family buildings do not need to supply 200 amp service per unit. While there are exemptions to R404.3 in the RBES when there is no parking space for a dwelling unit or when the parking space is distant, Montpelier, and presumably many other municipalities, require at least one parking space per dwelling unit. Thus, in most situations, compliance by multi-family dwellings with R404.3 will be unavoidable.

It is unclear from the text of Chapter 5 of the REBES what changes to a building's electrical system would meet the threshold of "alterations." However, a comparable technical code, the Vermont Electrical Safety Rules, is construed broadly by Vermont state electrical inspectors to require owners of multi-family buildings to ensure any portion of the electrical system they modify is brought fully up to the current code requirements. If this same interpretation applies to the RBES, actions such as adding or doing any work on an outside electrical outlet, increasing

the number of outlets in one's garage or basement to meet the current Vermont Electrical Safety Rules, replacing one's electrical panel, and other changes to address problems or safety hazards in, or to bring up to modern standards, the electrical system of a multi-family building, would trigger the imposition of R404.3.

Much of the housing stock in Montpelier and elsewhere in Vermont is older and presumably is neither currently served by 200 amp service nor meets every requirement in the recently revised Vermont Electrical Safety Rules. For a homeowner who wants or needs to improve the electrical system in an already existing multi-family building, or in a single-family home that is being turned into a multi-family building, the additional cost to upgrade to 200 amp service for each unit may be prohibitive.

For instance, according to my utility company, Green Mountain Power, switching the current 100-amp service to 200-amp service for my dwelling unit and the ADU in my home would be just shy of $4000 based on an estimate for their work outside the building plus what they generally see required by an electrician for updates to the meter sockets inside the building. This total does not include the cost of level 2 charging equipment for each unit. $4000 is a significant amount of money that far eclipses the negligible value that would be served by increasing the amps available to a building that already has adequate electrical service under the Vermont Electrical Safety Rules and by making the parking space for each unit available for a level 2 charger that may remain unused or under used for years.

The outsized cost of the electrical changes required by R404.3 will foreseeably deter or prevent improvements to the condition of electrical system in multi-family building and deter the modification of an existing single-family home to add one or more housing units. For homeowners who chose to proceed nonetheless, the costs spent on the service upgrade will be unavailable for improvements that *would* have significant impacts for homeowners and future tenants, such as increasing insulation to reduce energy costs and to make the living space more comfortable. The individual and societal return on investment from R404.3 for multi-family dwellings that fall within the RBES and are not fully new construction appears negative.

In conclusion, we ask that you exempt all but fully new construction single- and multi-family dwellings that fall within the RBES from needing to supply level 2 capable parking spots. This revision to the proposed language would make R404.3 more consistent with the decision to exempt multi-family buildings that fall within the RBES from needing to supply 200 amp service for each unit and prevent the unintended consequences to the housing supply identified in this letter.

Additionally, the following clarifications to the rules would aid homeowners' understanding of the rules and improve compliance. Single-family buildings with attached ADUs are not treated

as multi-family buildings in some codes and laws; we ask that you clarify that the term multi-family building, as used in the RBES, includes single-family homes with ADUs. It is also not clear what sections of the rules an owner must comply with when altering an existing building. The addition of plain language in the rules clarifying this, or the development of a guidance document on this question and the question of what the threshold for "alteration" is, would help address the noncompliance problem that is identified around minute 24 of the Department's training video "Part 1 Code Background" on YouTube.

Thank you for your consideration and attention to the housing crisis in Vermont.

Sincerely,

Diane Sherman, Chair, Montpelier Housing Committee

Submitted on behalf of the Montpelier Housing Committee:
Irene Mendez, Vice Chair
Carol Moorman
Emma Zavez
Jack McCullough
Jessica Oparowski
Jo Anne Troiano
Rebecca Copans
Sean Sheehan
Stan Brinkerhoff
Cary Brown (not present for vote)

American Chemistry Council | Plastics Division

December 8, 2022

Commissioner June E. Tierney
State of Vermont Department of Public Service
112 State Street
Montpelier, VT 05620

RE: Vermont Residential Building Energy Standards and Vermont Commercial Building Energy Standards

Submitted electronically to:
psd.codeupdateres@vermont.gov
psd.codeupdatecomm@vermont.gov

Dear Commissioner Tierney:

The American Chemistry Council appreciates the opportunity to comment on the proposed rules to amend the Vermont Commercial Building Energy Standards (CBES) and Vermont Residential Building Energy Standards (RBES).

The American Chemistry Council (ACC) is a national trade association representing chemicals and plastics manufacturers in the United.

Over 96% of all manufactured goods are directly touched by the business of chemistry, making this industry an essential part of every facet of our nation's economy. The industry supports a quarter of U.S. gross domestic product (GDP) and creates more than half a million skilled, good-paying American jobs. The products of chemistry enable higher living standards and are crucial to meeting the needs of a growing global population.

The American Chemistry Council's Plastics Division represents America's Plastic Makers℠. Plus the half million+ scientists, engineers, technicians, and other innovators who make plastics for many essential and lifesaving products that are vital to modern life. Our members produce products for the whole of the U.S. market and in some cases have a global presence as well.

This includes but is not limited to plastic building materials like foam plastic board insulation, spray foam insulation and air sealants, house and building wraps, liquid applied water resistive barriers, plastic pipe, plastic glazing, and roof membranes. These products provide a wide range of benefits including thermal, air, and moisture management.

ACC has concerns with the proposed amendments to Vermont CBES and RBES that give preference to low embodied carbon insulation materials. If adopted, this would be a significant expansion of the energy code; no other state has adopted any mandated or optional points for low embodied carbon insulation materials.

We encourage the consideration of the following information:

All materials require an investment of carbon to produce them including those with high embodied carbon like concrete, steel, and glass. However, only some materials provide carbon savings benefits during the operational life of the building like insulation and air barriers.

The building and construction sector accounts for 37 percent of global carbon emissions. Embodied carbon accounts for 10 percent while building operations account for 27 percent of emissions of those emissions.[1] Building materials like concrete, steel, and glass account for the largest portion of the embodied carbon. Cement, steel and glass are the next highest contributors, which means insulation makes up an extremely small portion of a building's embodied carbon.

Despite its relatively small percentage in overall building embodied carbon impact, insulation does however have a significant contribution to operational energy and greenhouse gas emissions savings. Energy Star estimates that you can save an average of 15% on heating and cooling costs by air sealing and adding insulation to the typical existing U.S. home.[2]

Insulation products offer significant savings with a minor impact on the building's embodied carbon profile. The preference for low embodied carbon insulation could lead to improper product selection and negatively impact the operation carbon use of the building. Insulation materials provide important benefits beyond thermal protection like air sealing and vapor management which are beneficial to a building's overall performance.

Insulation manufacturers have been optimizing their products to lower their carbon footprints for many decades. They have also been very transparent, and Environmental Product Declarations (EPDs) are available for most products.

- We support a whole building approach that includes operation carbon benefits and product transparency.
- We believe that manufacturers that have been optimizing the carbon intensity of their products should be rewarded rather than disincentivized from doing the right thing.
- We believe Vermont should recognize product contributions to operational carbon savings.
- We believe insulation choice should not be limited by this policy as insulation products save more carbon and energy than it takes to produce them.[3]

[1] See: GABC_Buildings-GSR-2021_BOOK.pdf (globalabc.org)
[2] See: Methodology for Estimated Energy Savings from Cost-Effective Air Sealing and Insulating | ENERGY STAR
[3] See: Life Cycle Greenhouse Gas Emissions Reduction from Rigid Thermal Insulation Use in Buildings by Michael H. Mazor, John D. Mutton, David Russell, Gregory A. Keoleian :: SSRN

ACC members have been making great progress in lowering their embodied carbon emissions. Their innovative and durable building materials enable greater carbon savings over their service life than it takes to produce them. Their progress has also minimized the difference in CO_2 emissions between different insulation products.[4]

A recent report by McKinsey & Company also demonstrates the carbon benefits of plastic building materials in comparison to alternative products. In fact, this report shows that in most cases plastic materials provide lower total GHG emissions over their life. This climate-related benefit commonly associated with the use plastics, including plastic construction materials, is further detailed in McKinsey's report.[5]

Insulation manufacturers have been providing transparency information for the industry in the form of Environmental Product Declarations (EPDs) that provide CO_2 embodied carbon emissions data for over a decade. This data was not intended for comparison purposes. If it is used in this manner, it is important for users to be educated regarding the limitations of comparisons as well as the tools and data sources they are using. Unfortunately, many tools do not accurately account for industry improvements in a timely manner or follow standard guidance for comparing products. They often allow products with different baseline assumptions and utilize different Product Category Rules. They also often include comparisons between industry and product specific EPDs, etc.

Due to the above concerns, we recommend that total carbon accounting be used to understand the full impact different products have over the life of the building. We do not recommend providing incentives for embodied carbon as a single attribute that could lead to regrettable substitutions.

Embodied carbon decisions should not be made prior to considering the other primary and necessary functions of building materials like their ability to eliminate other products, mitigate air leakage, manage moisture, etc. Operational offsets must be considered.

Decoupling the embodied carbon of products like insulation can have negative effects on building performance and the performance characteristics of the insulation regarding thermal protection, moisture management and air leakage should not be sacrificed for relatively small differences in embodied carbon.

ACC along with several other insulation industry associations published a Building Decarbonization Statement of Policy Principles that supports this total carbon or whole building view of the carbon impacts.[6] This is important so that decisions are not made that would affect

[4] See Life Cycle Greenhouse Gas Emissions Reduction from Rigid Thermal Insulation Use in Buildings by Michael H. Mazor, John D. Mutton, David Russell, Gregory A. Keoleian :: SSRN
[5] See Climate impact of plastics | McKinsey
[6] See Building Decarbonization Statement of Policy Principles (americanchemistry.com)

the building performance (thermal, air, moisture management, etc.). Please see more regarding the Insulation Industry Decarbonization Policy Principles here:
Building Decarbonization Statement of Policy Principles (americanchemistry.com)

Thank you again for the opportunity to comment. Please feel free to contact me if you have any questions.

Sincerely,

Amy Schmidt
American Chemistry Council
Director, Plastics Building and Construction
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700 2nd Street, NE | Washington, DC | 20002
O: (202) 249-6610 C: (989) 513-2169
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evernorth

Investing in communities. Building possibilities.

To: Richard Faesey – Energy Futures Group
Kelly Launder – Department of Public Service
From: Kathy Beyer - Evernorth
Charlie Willner - Evernorth
Date: December 6, 2022
Re: 2023 RBES code revisions

Introductory comments:

Evernorth has very much appreciated being included in the RBES/CBES Advisory Group during these past few months. Evernorth and our local nonprofit partners have worked with Efficiency Vermont and our architects and engineers to build among the most energy efficient multifamily buildings in the state. And as long-term owners of these buildings, we also have feedback data on where energy efficiency measures are working, and in some cases, where they are not working.

We are submitting our comments in a time of unprecedented increases in construction costs. We are closing on construction that is 30% more costly than it was a year ago. With this construction cost environment, it is imperative that our choices in the 2023 energy code update includes a thorough assessment of the energy efficiency gains in comparison to a payback analysis. With each building, each decision made, we balance both the climate crisis and the housing crisis. The authorizing statute for the revision of the energy standards embodies this balance: any amendments to RBES will be consistent with State energy policy, State housing policy, evaluated relative to technical reliability, and cost-effective and affordable from the consumer's perspective.

Diving more into the details of the code update, we have appreciated the Department's efforts to start to differentiate between single family and multifamily buildings. Multifamily buildings are inherently more energy efficient than single family homes, and also have much more complex building systems. The state energy plan's goal of net zero for all new construction by 2030 should be interpreted in a different approach for multifamily buildings. It is imperative that this distinction starts to be made in the energy code update for 2023, and in the discussions around net zero by 2030.

Lastly, the Department is keenly aware of the lack of enforcement for the energy code. Each cycle of the code update, where enforcement is not addressed, creates an ever-growing gap between buildings that are constructed by conscientious owners, and those built by owners who are ignorant, or do not care about the energy code. The march towards net zero by 2030 is a fallacy, without code enforcement.

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Energy Code Guiding principles:

We appreciate the move to using an energy use target (EUI) target to guide code recommendations. Will there be any monitoring done on buildings built to the new code to see where the actual EUI's land compared to the predicted EUI's? This data would shed some light on how we are actually doing vs how we think we should be doing, and could guide future code revisions. Without this data we're placing a lot of faith in energy models which in our experience are often a poor predictor of actual performance.

Have the cost of insulation and mechanical system upgrades been compared to the cost effectiveness of installing additional solar capacity? A detailed costing may show that solar panels are a more cost-effective way of driving down project EUI.

Feedback on specific code sections:
RBES 404.5

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.

We suggest that the Exception read
"Buildings where a majority of the living units serve tenants at or below %80 percent of area median income."

R101.6 Authority having jurisdiction.
In any instance where there is no state or local *code official or authority having jurisdiction*, the Vermont Public Service Department is not considered to be the "*authority having jurisdiction*, where one exists," and those sections of this code requiring involvement by that entity do not apply. All other code requirements still apply.

We feel it is worth noting that the majority of municipalities in Vermont lack an "authority having jurisdiction".

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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 ~~Addition > 250 < 500 square foot~~	1	2
Addition ~~> 5010 <~~to 1,000 square feet~~Addition > 500 < 1,000 square foot~~	2	3
Addition > 1,000 square feet	3	4
Multifamily <1,~~000~~250 square feet	2	3
Multifamily 1,~~000~~250 to 2,500 square feet	4	5
~~Multifamily~~ < 2,5~~0~~00 square feet	~~5~~4	7
~~< 2,000~~2,500~~1~~ to 4,000 square feet~~< 2,000 square foot~~	~~7~~5	12
~~2,000 to 4,000 square foot~~	~~7~~	
> 4,000 square feet	10	15

We request two additional categories “Multifamily < 900 sqft” with Base Code points of 1 and stretch code 2, and “Multifamily < 650 sqft” with no additional points requirements. This recognizes the inherent energy efficiency of building small energy efficient apartments.

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

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
		durable, air barrier.
Windows, skylights and doors	The space between window/door jambs and framing, and skylights and framing shall be sealed with minimally-expanding foam.	—
	~~Rim joists shall include the on exterior~~	

At windows, skylights and doors, caulk with backer rod and sealant as well as flexible membranes should also be acceptable air barriers. This is common practice in the building industry and may be required by some manufacturers.

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~~ two (~~3~~2) air changes per hour or ~~X~~ 0.15 ~~c~~CFM50~~fm~~/Sq. Ft. Building Shell~~square feet of 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*.

Should this be read to mandate air leakage testing of individual dwelling units within a multifamily building as well as whole building testing, or just one or the other? It may be simpler for section R4402.4.1.2 to only apply to single family homes, and then point multifamily dwellings to section CBES C402.4. If this section does not point to C402.4 than the following sentence should be ammended as shown

….. and reported at a pressure of .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~~. *Buildings six (6) stories and taller shall have an air leakage rate not exceeding .25cfm/ft2 of the building thermal envelope area of all six sides of the building at a pressure differential of 75 Pascals.*

R402.7 Solar-ready zone.

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 m^2) of roof area oriented between 110 and 270 degrees of true north shall comply with Section R407.5.

Multifamily buildings appear to be exempt from the solar ready zone. Was that the intention?

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.

Programmable thermostats are the cause of much confusion in multifamily buildings, the functionality is typically not understood by tenants. We request an exception to the programmability requirements be included for multifamily buildings.

In our experience, thermostat manufacturer's do not typically custom program residential thermostats. Perhaps the thermostat should be configured by the mechanical or controls contractor.

Also, our thermostats typically allow tenants to adjust the thermostat within a certain range. Is the intent of 403.1.1 that the maximum of the adjustable range for heating is 70F (meaning the tenant cannot adjust the heating setpoint above 70F)? Or is the intent simply that the setpoint start at 70F and the tenant may change the setpoint when they move into a space?

R403.5 Service hot water systems.
Energy conservation measures for service hot water systems shall be in accordance with Sections R403.5.1 through R403.5.4.

R403.5.1 Heated water circulation and temperature maintenance systems ~~(Mandatory)~~.
Where installed, ~~H~~heated water circulation systems shall be in accordance with Section R403.5.1.1. Heat trace temperature maintenance systems shall be in accordance with Section R403.5.1.2. Automatic controls, temperature sensors and pumps shall be accessible. Manual controls shall be readily accessible.

R403.5.1.1 Circulation systems.
Where installed, ~~H~~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 ~~start the pump based on the identification of a demand for hot water within the occupancy. The controls 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).

To better align requirements for multifamily buildings we request an exception to R403.5 that reads
Exception: Systems serving multiple dwelling units shall comply with Section C404 of the 2023 edition of the Vermont Commercial Building Energy Standards (CBES), but will not be subject to the additional requirements outlined in Tables C406.1.1 and Table 406.1.2.

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

CBES section C403.1 notes that “projects must achieve the required number of credits based on building occupancy group as outlined in Table c406.1.1 and Table C406.1.2.” Buildings that fall under RBES already have additional points requirements placed on them, and should not have another set of requirements mandated by the CBES provisions. We request the following language be added to the end of the section R403.8 “, but will not be subject to the additional requirements outlined in Tables C406.1.1 and Table 406.1.2.”

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.~~5~~3.

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

This code section represents a large cost impact to multifamily projects. We recommend the addition of a definition for *"ELECTRIC VEHICLE CHARGING - LEVEL 2 CAPABLE (MULTI-FAMILY): provide appropriate sized pathway to the building electrical room to accommodate a future electrical upgrade for Level 2 EVSE electric vehicle charging; provide adequate wall and floor space in the building electrical room for future EV charging related electrical equipment; provide the appropriate sized pathways to exterior on-grade surface parking spaces for future Level 2 EVSE electric vehicle charging; if the building includes garage or covered parking, provide a line diagram on the electrical drawings demonstrating a pathway for future Level 2 EVSE electric vehicle charging. Quantity of future Level 2 EVSE electric vehicle charging stations shall be as required by Table R404.3."*

Table R404.3: Exterior parking is "struck-through" - does that mean there are no requirements for exterior parking? What does the "4" in the line below to the right refer to?
Recommended changes:

i. Strike "or Multifamily Building" from first line under BUILDING/PARKING TYPE column.
ii. Add new line below first line for "Multifamily Building". Add the following language to this new line under "MINIMUM REQUIRED NUMBER…": *25% of provided parking spaces (refer to DEFINITIONS for differing requirements for covered/garage spaces versus exterior on-grade surface parking spaces.*
iii. Delete remaining lines in the Table. The single digit 4 under "MINIMUM REQUIRED NUMBER…" doesn't seem to apply to anything.

Duncan Wisniewski ARCHITECTURE

To: Richard Faesy, Energy Futures Group
Kelly Launder, DPS
From: Bob Duncan
Date: December 7, 2022

re: comments on 9-23-2022 Draft RBES/CBES 2023

RBES/CBES 2023 General Comments

1. An energy code without enforcement is problematic at best. And the lack of any such enforcement places builders and architects trying to follow the code at a distinct disadvantage to those who don't. Lack of enforcement can lead to poor construction methods, whether through best intentions or not, that may lead to serious health and safety issues and building materials failures. It is imperative that we have an enforcement process that includes education (construction methods and energy code), and it's also imperative that the inspectors charged with enforcement are trained in the very complexity of building codes and building science. The Department of Public Service should lobby and encourage the Legislature to address this very important issue. The Inflation Reduction Act has $250M over five years to assist state and local governments and partnerships in efforts to upgrade energy codes, training, enforcement, etc. Some entity in state government should lead the way in applying for these funds to guide the way forward in education and enforcement. These funds are available through a competitive grants program, announcement of which is expected soon. I can provide more information on this topic, and have shared it also with the Division of Fire Safety.
2. A very minor point: why do Certificates of Compliance need to be notarized? It's just one more hassle in the process.
3. Important issues to be considered regarding EV Level 2 Capable charging stations:
   a. If a multi-family building includes garage parking, as many of them do, we do not yet know what the additional DFS requirements will be regarding EV stations, but we do know that DFS has serious concerns about them.
   b. If building electrical equipment is sized for the immediate building needs (not including future EV), then the utility will most likely size the transformer for the immediate building needs; when the time comes to upgrade for EV, the electrical gear will need to be replaced, and the transformer will also likely need to be replaced (both at considerable cost). If the building electrical equipment is sized for building and future EV needs, then the upfront costs for the additional gear size will be higher, as will the utility costs for the increased transformer size (if the utility is even willing to provide a transformer bigger than what the initial demand for power is), and perhaps even increased vault size (which on tight sites in downtown locations may be challenging).
   c. Quantity of spaces to be 'EV capable': except for the range limitations of EVs, won't EV owners' charging patterns be similar to FF owners' patterns? In other words, not everyone fills the tank/charges the battery every day? And if parking spaces are unassigned (the case in most rental units, maybe even some ownership units), then people who need a charge will park where the available chargers are. Even though we may hope/expect all cars to be EVs at some future point, it still seems to me that having 25% of spaces EV capable is more than sufficient. After all, charging times may vary substantially in the future, even today's battery systems may become obsolete in favor of some currently unknown technology.
   d. There is a difference between earlier RBES and CBES editions and the current ones which changes the nomenclature from 'EV ready' to 'EV capable' and the limit on the number of 'EV capable' locations does not exceed the number of parking spaces provided. However, further limiting the number of charging stations based upon a percentage of provided spaces makes sense, as more and more projects are providing <1 parking space/dwelling unit, and more and more zoning ordinances are being revised to not require parking spaces (leaving the decision to the project developer). The current language in CBES appears to require one charging station/dwelling unit plus a percentage of other spaces, and the CBES language for EV capable seems to require that all the infrastructure but for the actual charger itself must be in place. This requires increased service size, increased electrical equipment, increased electrical room size, conduit runs to all charging station locations, etc. This has very large upfront construction costs that will be a burden and impediment for many developers of multi-

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family housing. While the explosion in EV registrations in VT is a surprise to many people, it's also clear that battery technology and charging capability is going to be rapidly changing as well. Given the uncertainty of how the EV revolution will unfold, I think considerably more thought needs to be invested in the best way to prepare ourselves and our buildings for the electrification of transportation. Please see proposed changes described below in definitions as well as quantity of EV capable space requirements.

4. The summary sheets for both RBES and CBES point out that the "base energy standards for for multifamily buildings remain consistent between RBES and CBES". For example:
   a. Requirements for R-2 occupancy roof and wall envelopes are not aligned in Table C402.1(2) and Table R402.1.2.1. There are differences between them for both wall and roof assemblies (see comments below about CBES roof assemblies; while flat roofs are far less common in SF homes, there are some, and there are certainly MF budings that fall under RBES that have flat roofs). For instance, CBES lists three options for wood-framed walls: 1) R-13 cavity + R18 ci, 2) R19 cavity + R14ci, or R27ci; but RBES has 4 options: 1) R21 cavity + R12ci, 2) R23 cavity + R10ci, 3) R15 cavity + R15ci or 4) R28 - 8.25" SIPS panel. Currently, the most cost effective (and safe from a building science perspective) wood-framed wall is R19 cavity + R12ci. Should be able to do the RBES R21 cavity + R12ci without too much difficulty, but the CBES R19 + R14ci is a much more costly wall, unless we can find a ci that's rated to R7/inch. Once we get above 2" ci thickness, the fasteners to secure strapping over the ci get heavier-duty and longer or we need to switch to a different and more costly anchoring system for the siding. It's unclear to me why the differences between the two, if the intent was to make them consistent.
   b. EV charging station requirements are also not consistent for multi-family buildings between RBES and CBES. The proposed changes outlined below will align the two.

RBES 2023 Comments

1. I recommend the addition of a definition for *"ELECTRIC VEHICLE CHARGING - LEVEL 2 CAPABLE (MULTI-FAMILY): provide appropriate sized pathway to the building electrical room to accommodate a future electrical upgrade for Level 2 EVSE electric vehicle charging; provide adequate wall and floor space in the building electrical room for future EV charging related electrical equipment; provide the appropriate sized pathways to exterior on-grade surface parking spaces for future Level 2 EVSE electric vehicle charging; if the building includes garage or covered parking, provide a line diagram on the electrical drawings demonstrating a pathway for future Level 2 EVSE electric vehicle charging. Quantity of future Level 2 EVSE electric vehicle charging stations shall be as required by Table R404.3."* Refer to Item 4 below for changes to Table R404.3.
2. Table R402.1.2.1: ceiling insulation: neither ceiling option addresses continuous insulation on top of roof sheathing for a flat roof. Note 'g' covers this, but does not address whether the U-factor of 0.023 can be an average, i.e., some min thickness at roof drains sloping upward at 1/4"/LF by means of tapered insulation. Section C402.1.2.1.1 allows tapered insulation to be averaged. Does RBES have a similar section?
3. Table R402.1.2.3: can average r values for flat roofs get points if the average R meets the table requirements?
4. Table R404.3: Exterior parking is "struck-through" - does that mean there are no requirements for exterior parking? What does the "4" in the line below to the right refer to?
   a. Recommended changes:
      i. Strike "or Multifamily Building" from first line under BUILDING/PARKING TYPE column.
      ii. Add new line below first line for "Multifamily Building". Add the following language to this new line under "MINIMUM REQUIRED NUMBER…: *25% of provided parking spaces (refer to DEFINITIONS for differing requirements for covered/garage spaces versus exterior on-grade surface parking spaces."* NOTE: the 25% number (which is coincidental to the proposed language requiring 25% of additional parking spaces) is intentional to reduce the proposed requirement from one/DU (or one/parking space if total parking is less than total dwelling units) to a number that seems much more consistent with how the demand will unfold over time (for reasons stated above).
      iii. Delete remaining lines in the Table. The single digit 4 under "MINIMUM REQUIRED NUMBER…" doesn't seem to apply to anything.
5. R404.5, Exception: should low-income occupants should be identified in some way? <50% of median? 60%? 80%?
6. R402.4.6: does this requirement for air sealed outlet boxes apply when the boxes are inboard of the air barrier?
7. R402.7.9: does this requirement for reserved dual pole circuit breaker apply to each dwelling unit panel in a multi-family building?

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CBES 2023 Comments

1. The revised sentence in C102.1.1 is not grammatically correct.
2. Definitions:
   a. Add " - FOR ALL USES EXCEPT MULTIFAMILY" after ELECTRIC VEHICLE CAPABLE SPACE (EV CAPABLE SPACE).
   b. Add new definition: ELECTRIC VEHICLE CAPABLE SPACE (EV CAPABLE SPACE) - MULTIFAMILY ONLY - Add definition from Item 1 above under RBES 2023 Comments. Provides consistency between RBES and CBES.
   c. "LARGE DIAMETER CEILING FAN" should be inserted after the definition of "LABELED" and before "LEVEL 1 ELECTRIC VEHICLE CHARGING" (to maintain alphabetic order).
3. Table C402.1(2) roof insulation entirely above deck is R45ci (about 7.5" of polyiso). Sections C402.1.2.1.1 and C402.2.1.1 allow tapered insulation to be averaged. And thanks for clarifying the minimum R12 at the roof drain. Does RBES have a similar section/s? I didn't see them, but I think they should align.
4. C401.2.2.1, New item 25 - Section 9.4.1.3(d)2: Since VT excludes Chapter 10 of IBC from the State code, does this still apply?
5. C402.4.2: enclosure testing of multiple dwelling units. This section clearly applies to CBES, but a multi-family RBES building does not have similar testing requirements?
6. C402.5.8: does this requirement for reserved dual pole circuit breaker apply to each dwelling unit panel in a multi-family building?
7. Table C405.13.1: delete Equation 4-11 and replace with the requirement to "*provide EV Capable spaces at 25% of the parking spaces provided for the multifamily development. Note that EV Capable requirements vary according to whether spaces are in a garage/covered versus exterior on-grade spaces (see DEFINITIONS).*"
8. C405.13.2: modify this Section so as to be consistent with the new definitions of EV Capable spaces as suggested above.

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December 9, 2022

Vermont Public Service Board
112 State Street
Montpelier, VT 05620

Re: EV Readiness in Building Energy Standards Update

Renewable Energy Vermont (REV) appreciates the opportunity to comment on the ongoing efforts to update Vermont's Commercial and Residential Building Energy Standards. As a state, our capacity to meet our climate goals rests heavily on the rapid electrification of our transportation and thermal sectors. REV applauds the Department's proactive efforts to prepare Vermont's building stock for this transition.

Incorporating strong EV Ready parking requirements and standards in both the CBES and RBES is a vital step to supporting widespread electrification. Access to convenient and reliable charging opportunities is essential for consumer adoption of EVs. Currently, most charging occurs at home, and ensuring that new single and, especially, multi-family properties have access to home charging will be a key factor for promoting equitable EV adoption opportunities. Ensuring that charging opportunities are readily available at commercial buildings will further facilitate EV adoption and provide for greater flexibility in when and where vehicles charge. As we electrify an increasing share of the economy, utilizing EVs as flexible sources of the load has potentially significant system advantages. These advantages stand to benefit vehicle owners, distribution utilities, and Vermont ratepayers alike. Standards that prepare new residential and commercial buildings for EV charging will have significant benefits for advancing our climate goals, promoting equitable access to the benefits of electrification, and building a robust and resilient grid.

The cost of installing charging infrastructure during a building retrofit is substantially higher than during new construction, as much as four times higher according to a report prepared for the California Electric Transportation Coalition, ChargePoint, and Tesla.[i] EV Ready codes such as those currently proposed, that result in expanded breaker panels, conduit, and wire access at parking spots will reduce the cost and complexity of making EV infrastructure widely available. REV strongly supports the EV readiness standards that have been proposed and encourages the Department to adopt them as drafted.

Sincerely,

Jonathan Dowds
Deputy Director

[i] Energy Solutions (2019). *Plug-In Electric Vehicle Infrastructure Cost Analysis Report for CALGreen Nonresidential Update* https://caletc.com/assets/files/CALGreen-2019-Supplement-Cost-Analysis-Final-1.pdf

Levenson, Keith

From: PSD.Info@vermont.gov on behalf of Department of Public Service <PSD.Info@vermont.gov>
Sent: Friday, December 9, 2022 11:34 AM
To: PSD - Code Update Res
Subject: Form submission from: Energy Code Update Comments

Categories: Residential Code

EXTERNAL SENDER: Do not open attachments or click on links unless you recognize and trust the sender.

Submitted on Friday, December 9, 2022 - 11:34am Submitted by anonymous user: [96.86.81.113] Submitted values are:

E-Mail: collin@sterlinghomesvt.com
Name: Collin H Frisbie
Affiliation:
Comment Area: Residential
Comment:
Thank You for allowing me to submit comments on the proposed 2023 amendments to the RBES. I strongly oppose amending RBES at this time.

RBES is currently a self certification system designed to remain a self certification system. Continuing to make the RBES more rigorous without training or enforcement in place drives up the cost of new homes in VT while creating homes that are not safe. RBES without enforcement (Authority having Jurisdiction- owning the program) further exacerbates an uneven playing field between those who try to comply and those who do not. This proposed change is very difficult to achieve from a building science standpoint as related to current best and common building practices. There are a lot of ways to build an unsafe wall assembly attempting to comply with this new regulation that will negatively affect future occupants. This highlights the risk of zero enforcement and no training. Currently Efficiency VT does not support builders unless the proposed home goes beyond energy Code. If that were to continue the radical change of building practices (beyond cavity insulation) will have spotty training with no enforcement. Cost is also a significant factor. A recent 7 Days article highlighted more eloquently than I am capable the affordability crisis of housing in VT.
Expensive Housing Is Limiting Who Gets to Live Where in Vermont — and Clouds the State's Future The proposed RBES changes will add $20,000 or more to a typical 1,500 square foot new home. All to save perhaps $500 a year in heating and cooling costs.
Not a good return on investment. This higher cost is especially impactful as a percentage cost of a new starter or “workforce housing” home.

Summary. With no enforcement and with no building codes there’s very little chance the proposed amendment will be applied, be reliable, and effectuate change while dramatically increasing the cost of a new home.

Thank you for your time.
Collin H Frisbie

link to article referenced above.
(sevendaysvt.com)https://www.sevendaysvt.com/vermont/expensive-housing-is-limiting-who-gets-to-live-where-in-vermont-and-clouds-the-states-future/Content?oid=37090819&media=AMP+HTML

The results of this submission may be viewed at:
https://publicservice.vermont.gov/node/2545/submission/248

Levenson, Keith

From: PSD.Info@vermont.gov on behalf of Department of Public Service <PSD.Info@vermont.gov>
Sent: Friday, December 9, 2022 1:09 PM
To: PSD - Code Update Res
Subject: Form submission from: Energy Code Update Comments

Categories: Residential Code

EXTERNAL SENDER: Do not open attachments or click on links unless you recognize and trust the sender.

Submitted on Friday, December 9, 2022 - 1:09pm Submitted by anonymous user: [64.223.181.68] Submitted values are:

E-Mail: elevite@unionbankvt.com
Name: Edward Levite
Affiliation: Citizen and board member of the Vermont Builders and Remodelers Association Comment Area: Residential Comment:
Thank You for allowing me to submit comments on the proposed 2023 amendments
to the RBES. I oppose amending RBES at this time.

I understand the need for us to protect our environment for future generations and do what I can everyday. On a recent call with The Public Service Department a number of people much smarter about building and building science than I outlined substantial issues with the proposal. No one for sure could even state what these changes would do to protect the environment. There simply is no data to support it. In fact, one gentlemen made a comment that what VT is discussing is at the forefront. Really? Is it a race to meet no matter what the cost to us on the health of the building?

I questioned the savings assumed. Seemed to me that some of the pieces required for "points" are not even factored into the cost. That a conduit for future EV at $250 seemed to be the only piece calculated in the cost.

More importantly, we continue to struggle to develop affordable housing. We continue to struggle with Act 250, permitting and administrative cost before a shovel goes in the ground. Increasing costs to assume a household can save energy costs is only going to make matters worse for affordable housing.

Assume that the cost increase is $20,000. Using a $250,000 loan amount, at 6% over 30-years makes the Principle and Interest payment $1,498.88. Adding
$20,000 for new RBES requirement to the loan amount will increase the monthly payment to $1,6118.79 or $119.91 more.

What if that additional $20,000 causes the borrower to need PMI? Then the cost to them is even more! Making the cost savings longer than assumed.

An appraiser will not automatically add $20,000 in home value because the home has the latest RBES standard. In fact, I am confident it would add zero additional value. We all need windows, we all need wall structures, etc. A window with a little better R value is not going to add value.

I feel we need to understand the true safety of the structure prior to just trying to be the first State to go to the max on RBES. Why do we need to rush when we could be causing years of health issues and financial strain?

Thank you!

The results of this submission may be viewed at:
https://publicservice.vermont.gov/node/2545/submission/249

Levenson, Keith

From: PSD.Info@vermont.gov on behalf of Department of Public Service <PSD.Info@vermont.gov>
Sent: Friday, December 9, 2022 1:56 PM
To: PSD - Code Update Res
Subject: Form submission from: Energy Code Update Comments

Categories: Residential Code

EXTERNAL SENDER: Do not open attachments or click on links unless you recognize and trust the sender.

Submitted on Friday, December 9, 2022 - 1:56pm Submitted by anonymous user: [50.255.135.125] Submitted values are:

E-Mail: sales@bhomes.org
Name: Denis Bourbeau
Affiliation: Bourbeau Custom Homes, Inc.
Comment Area: Residential
Comment:
Please see below my comments regarding the proposed 2023 amendments to the RBES.
I oppose amending the RBES at this time.
I do understand that the goal to continue to amend the RBES requirements is to keep Vt. on track to build 100% net Zero homes by 2030. This is a goal that will increase the cost of housing that is already unaffordable for the majority of Vermonters who live and work here. The legislature is currently working hard to come up with solutions to this dire issue that is threating the future of our State housing inventory and the proposed amendments are working 100% against making any progress in affordability, they are making affordability much worse.

You have heard many comments on the lack of enforcement of the current codes,
* increasing builder liability due to building and health issues that will occur if these new building structures are not constructed correctly or maintained properly by the future homeowner's
* in accurate cost estimates to meet the new codes and in accurate estimates on total savings to the owner.

I agree with all of these points but want to add the following to points that nobody seems want to think or talk about.

1) As we continue to push to completely electrify our housing energy and transportation needs that our current electricity grid will not be able to handle the added demand. This will require huge infrastructure investments that will raise electrical rates to an unaffordable rate. Simply supply and demand economics. All the savings models will then not work at all.

2) When our homes and cars are 100% powered by electricity, we will be at a huge security and survival risk. Natural disasters that take out power grids will cause massive devastation as we will not be able to supply adequate back up power by a portable generator to be able to heat your entire house and charge your car so you can move around. We currently can heat and drive your car without electricity with a small generator.

3) We are exposing ourselves to domestic and international terrorism that is currently trying to take out the power grid that will cripple everyone.
One person this past week was able to take out power to an entire city for days with a gun. What would happen to you and your electric home if it had no power for days and it was below zero.

We do need to be careful what we ask for and Vt. should not be on the forefront when the costs and risks will hurt the state and the majority of our population.

The results of this submission may be viewed at:
https://publicservice.vermont.gov/node/2545/submission/250

December 7, 2022

Kelly Launder
Assistant Director
Vermont Department of Public Service
112 State St.
Montpelier, VT 05620-2601

Dear Ms. Launder,

Phius (Passive House Institute US) is a non-profit 501(c)(3) organization committed to making high-performance passive building the mainstream market standard. Phius trains and certifies professionals, maintains the Phius climate-specific passive building standard, certifies and quality assures passive buildings, and conducts research to advance high-performance building**.** Buildings constructed to the Phius standard provide superior indoor air quality, resilience during power outages, and an extremely quiet, comfortable indoor environment. Project teams are increasingly adopting passive building principles and the Phius standard for single-family, multifamily, and commercial buildings to achieve Net Zero buildings, resulting in over 7,000 units certified, and totaling over 7.4 million square feet across North America.

Phius appreciates the opportunity to provide comments suggesting amendments to the proposed adoption of both the 2023 REBS and 2023 CEBS. Phius congratulates the Vermont Department of Public Service (VT DPS) for proposing to adopt one of the strongest energy codes in the country. However, Phius believes that VT DPS can include two amendments that would upgrade the energy code.

1. **Add a Phius alternative compliance path to the 2023 Residential Building Efficiency Standard (RBES)**
2. **Add a Phius alternative compliance path to the 2023 Commercial Building Efficiency Standard (CBES)**

1.Suggested Amendments:

A. Add a Passive House alternative compliance path to residential and low-rise multifamily projects certified by Phius.

Proposed Amended Language: (Amended language underlined)

R401.2 Compliance
Projects for both Base Code and Stretch Code shall comply with one of the following:

1 **Package Plus Points**: R402 through R404
2 **REScheck 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
4 Phius 2021 CORE (or later edition): Section R406.8 through R406.9

Section R406.8 Passive House Alternative Compliance Option

R406.8.1 Scope. This section establishes criteria for compliance via the Phius CORE 2021 (or later edition) standard.

R406.8.1.1 Projects shall comply with Phius CORE 2021 (or later edition)

R406.8.1.2 Phius documentation. Prior to the issuance of a building permit, the following items must be provided to the code official:

1. A list of compliance features.
2. A Phius precertification letter.

Prior to the issuance of a certificate of occupancy, the following item must be provided to the code official:

1. **A Phius CORE 2021 (or later edition) project certificate.**

B. Add a Passive House alternative compliance path to commercial and high-rise multifamily projects certified by Phius.

C401.2 Application
Commercial buildings shall comply with Section 401.2.1 or Section 401.2.2 or Section 408

Section C408 Phius Alternative Compliance Option

C408.1 Scope. This section establishes criteria for compliance via the Phius CORE 2021 (or later).

C408.1.1 Projects shall comply with Phius CORE 2021 (or later).

C408.1.1.1 Phius documentation. Prior to the issuance of a building permit, the following items must be provided to the code official:

1. A list of compliance features.

2. A Phius precertification letter.

Prior to the issuance of a certificate of occupancy, the following item must be provided to the code official:

1. A Phius 2021 CORE (or later) project certificate.

Rationale:

This amendment will simplify the path for those homebuilders/homebuyers/developers who would like a home/multi-family or commercial building that is more energy efficient than a similar building built to the 2021 IECC.[1]

In addition, because Phius requires a robust 3rd party review and construction inspection process, owners will be assured of a high-quality energy-efficient building that will allow code officials to focus on enforcing other sections of the energy code.

Comments:

Based on the enforcement/compliance concerns stated by multiple commenters at the RBES Public Hearing from December 2, 2022, these comments will focus on how the proposed amendment will help improve enforcement and ultimately compliance.

Description of Phius Standard

All buildings built to the Phius standard foreground five principles:

- Using continuous insulation throughout the building envelope to minimize or eliminate thermal bridging.
- Building a well-detailed and extremely airtight building envelope, preventing infiltration of outside air and loss of conditioned air while increasing envelope durability and longevity.
- Using high-performance windows (double or triple-paned windows depending on climate and building type) and doors - solar gain is managed to exploit the sun's energy for heating purposes in the heating season and to minimize overheating during the cooling season.
- Using balanced heat- and moisture-recovery ventilation to significantly enhance indoor air quality.
- Minimizing the space conditioning system because of lower space conditioning loads.

[1] [1] For more information on the Phius standard, energy savings and other jurisdictions using the Phius Alternative Compliance Path, please see the comments submitted by the Vermont Phius Alliance sent to the department on August 9, 2022.

The Phius standard incorporates all these principles. Moreover, to receive certification, all residential buildings must also meet the criteria laid out in these pre-requisite programs:

- US Environmental Protection Agency (EPA) ENERGY STAR Program
- EPA Indoor airPLUS program
- EPA WaterSense Program
- US Department of Energy (DOE) Zero Energy Ready Home program
- ASHRAE 62.2 ventilation requirements

The Phius Alternative Compliance Path Provides a Compliance Framework

The remainder of these comments will focus on how the Phius Alternative Compliance path can raise the compliance percentage particularly for residential projects.

All buildings seeking Phius certification go through a two-part process: design review, post-construction verification:

PART 1:

First, Phius certification staff reviews construction drawings, product specifications, and modeling to ensure that the building energy use is below the stringent values specified in the standard. In addition to reviewing energy performance, Phius evaluates building envelope components and details for moisture and condensation performance. After identifying and resolving all issues, the building design is design certified.

PART 2:

After design certification, a Phius-trained Rater/Verifier reviews the actual construction on-site ensuring that the building is constructed to the pre-certified plans and that it meets the criteria of the programs listed above. This review ensures that the building is built according to the model and the drawings. The work of the rater/verifier is itself subject to a QA/QC review. If changes to the design occur, the modeling is updated, and the new energy use of the building must still meet the Phius standards for certification. This process ensures that the completed building matches the modeled building.

The certification process functions as both a permitting and construction review ensuring that the finished project meets all the standards and requirements embodied within the Phius standard.

Addressing Code Compliance:

The Phius Alternate Compliance Path helps address the code compliance concerns in three ways:

1. It provides a proven path to code compliance. All projects that choose to meet the Phius standard will be code compliant.

2. As it is an alternate compliance path administered by a third party, it would not add costs to municipalities administering the code.

3.It provides a means for showing how a third-party enforcement system could work beyond Phius projects. As noted above, municipalities in Vermont typically will not have the resources to provide the requisite enforcement for single family projects. Third party enforcement does provide one solution. However, a third-party enforcement system must be appropriately designed with respect to training, certified personnel and the relationship between the third-party rater and the authority having jurisdiction. Currently, NYSERDA has established a third-party enforcement system and the Vermont Department of Public Service can use best practices from their program as well as the Phius certification process to establish its own.

Thank you for the opportunity to comment on these critical issues. Phius congratulates Vermont Department of Public Service (VT DPS) for proposing to adopt both the 2023 RBES and 2023 CBES, which, as among the strongest codes in the country, will result in significant energy savings and higher quality buildings and commercial buildings across Vermont. Phius also feels that by incorporating the suggested amendments, VT DPS will strengthen compliance with the energy code which addresses an important and long-standing concern.

Sincerely,

Isaac Elnecave
Policy Specialist
Phius

Aligning Authority and Enforcement in the RBES

Comments from Sandra Vitzthum, AIA
Sandra Vitzthum Architect, LLC
Montpelier, Vermont

Reference: "RBES 2023 Full Text Redline" dated 9/23/22. It is recommended that the below is reviewed alongside the rough draft red lines.

Briefly, I have been working on code improvement for at least three cycles. These suggestions are for two reasons: (1) to create a path for administration and enforcement, which may develop before the next code update; (2) to give clear authority to the Division of Fire Safety to administer energy code issues particularly where they conflict with other building codes. I also want clean up odd and redundant language about certificates with the goal of increasing compliance. I should mention I have been working with the American Institute of Architects Policy Committee on these issues, as well as regional planning commissions.

Specific recommendations are highlighted:

CHAPTER 1: SCOPE AND ADMINISTRATION

101.6 Authority having jurisdiction

For any residential building under the jurisdiction of the Division of Fire Safety, the provisions of this code will be administered and enforced by their designated code official or authority having jurisdiction.

[Discussion: it needs to be explicitly clear that DFS has authority to resolve conflicts between other construction codes and RBES, as well as enforce completion of certificates. This includes single family homes offered as B&Bs and multifamily homes.]

For residential buildings not under the jurisdiction of the Division of Fire Safety, muncipalities may designate a code official or authority to the extent allowed by Vermont statute.

[Discussion: This enables – finally – a path towards energy code oversight. The intent is to encourage local assistance and education. It is acknowledged that no municipality has authority to enforce without statutory language.]

In any instance where there is no state or local code official or authority having jurisdiction, the Vermont Public Service Department is not considered to be the "authority having jurisdiction, where one exists," and those sections of this code requiring involvement by that entity do not apply. All other code requirements still apply.

R101.6.1 Deputies (new subsection)

With concurrence of the appointing authority, the *code official or authority having jurisdiction* shall have the authority to appoint a deputy, inspectors, plan examiners, and consultants. Such deputies will have powers as delegated by the *code official or authority having jurisdiction.*

[Discussion: Some Vermont towns would like to have a consultant, volunteer, or staff review projects and assist homeowners. This needs to be enabled. Also the authority for a "duly authorized representative" described below needs to be explained.]

R107 Means of Appeals (Model code = R110)

R110.1 General.

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

R110.2 Limitations on authority.

An application for appeal shall be based on a claim that the true intent of this code or the rules legally adopted thereunder have been incorrectly interpreted, the provisions of this doe do not fully apply, or an equivalent or better form of construction is proposed. The board shall not have authority to waive requirements of this code **except for historic buildings in accordance with NFPA Chapter 43.**

R110.3 Qualifications.

The board of appeals shall consist of members who are qualified by experience and training and are not employees of the jurisdiction.

R110.4 Administration.

The code official shall take immediate action in accordance with the decision of the board.

[Discussion: this entire normal section of building codes is missing. It needs to be included for situations where there is a code official. This section goes with the other important administrative rules in this chapter. In cases where a project has no code official, this chapter is already exempted.]

CHAPTER 2 DEFINITIONS

R202 General Definitions

AUTHORITY HAVING JURISDICTION. The officer or other designated authority charged with the administration and enforcement of this code, or a duly authorized representative, where authorized by the Division for Fire Safety or a municipality. For purposes of this code, the Department of Public Service is not the code official or authority having jurisdiction.

[Discussion: Current wording misses where the authority comes from. We need to stop avoiding this issue.]

CODE OFFICIAL OR AUTHORITY HAVING JURISDICTION. The officer or other designated authority charged with the administration and enforcement of this code, or a duly authorized representative, where authorized by the Division for Fire Safety or a municipality. For purposes of this code, the Department of Public Service is not the code official or authority having jurisdiction and shall not be required to conduct inspections of construction or construction documents.

[Discussion: same issue as above.]

R401.3 Certificate of Compliance ~~(Mandatory).~~

[Discussion: This section is confusing as written. I suggest breaking it down with subsections and reorganizing.

R401.3.1 Scope.

Upon completion and before occupancy of any project subject to the Residential Building Energy Standards, a certificate of compliance must [not may!] be completed and signed by a builder, a licensed professional engineer, a licensed architect or an accredited home energy rating organization, and these professionals may be hired either by the homeowner or by the builder. [moving up language from below] 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. This certificate with the qualified signature shall certify that residential construction meets the RBES.

R401.3.2 Certificate form.

The required certificate is available from the Department of Public Service, in paper or online: https://publicservice.vermont.gov/sites/dps/files/documents/RBES%20Cert%202020_FINAL_20200916_v4_fillable.pdf A copy is also included as an appendix to this code and handbook.

[Discussion: It is confusing to allow "substantially similar certificates."]

R401.3.3 Posting and filing.

After signing the certificate, the certifier must affix 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 certifier shall also 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.~~

[Discussion: clarify language and delete repetition.]

MADISON
IAQ
making the world safer, healthier, and more productive

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Madison, WI 53718
www.madison.net

December 12, 2022

Vermont Department of Public Service
June E. Tierney, Commissioner
112 State Street
Montpelier, VT 05620-2601

(Submitted via email to: psd.codeupdateres@vermont.gov)

Re: Madison IAQ Comments in Response to Residential Building Energy Standards Proposals

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Dear State of Vermont Department of Public Service:

Madison Indoor Air Quality (MIAQ) respectfully submits these comments in response to State of Vermont Department of Public Service's update to the building codes, specifically to the Residential Building Energy Standards (RBES).

MIAQ is one of the largest and most successful privately held companies in the world with a significant footprint in the HVAC market. MIAQ's mission is to make the world safer, healthier, and more productive by creating innovative solutions that deliver outstanding customer value. MIAQ's portfolio comprises of at least 15 companies including Airxchange, Broan NuTone/Venmar, InnergyTech, Heatex, and NovelAire. Through these companies, MIAQ offers Energy Recovery Ventilators to the residential and commercial markets that could be impacted by Vermont's Department of Public Service (DPS) proposed revisions to the Commercial Building Energy Standards.

MIAQ greatly appreciates Vermont's DPS active stakeholder outreach and request for feedback on the regulation. Due to our continuous review of market demands and advancement to higher efficiency equipment, MIAQ feels uniquely qualified to provide feedback to Vermont's DPS staff on the issues they wish to address. We thank Vermont's DPS staff for taking time to read these comments and encourages them to work with Madison IAQ to address our thoughts and concerns during the rulemaking process.

Sections R304.1.1 Compliance and R403.6.1 Heat or energy recovery ventilation

The Home Ventilating Institute (HVI) is the only ISO-accredited certification body that lists residential heat or energy recovery ventilation (H/ERV) systems based on testing in accordance with CAN/CSA C439, *Standard Laboratory Methods of Test for Rating the Performance of Heat/Energy-Recovery Ventilators*), which prescribes the test conditions and method for calculating an H/ERV's Sensible Recovery Efficiency (SRE).

Therefore, to provide additional clarity, MIAQ recommends revising the requirement in the RBES proposal to the following:

> **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, determined in accordance with HVI Publication

920, while also meeting compliance with Sections 304.2 through 304.11 or demonstrating compliance with one of the following alternatives: …

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), determined in accordance with HVI Publication 920, at an airflow greater than or equal to the design airflow.

Madison Indoor Air Quality appreciates the opportunity to provide these comments. If you have any questions regarding this submission, please do not hesitate to contact me.

Sincerely,

Rupal Choksi
Regulatory Director, Innovation | Madison Indoor Air Quality (IAQ)
Madison, WI
(608) 237-8446
rchoksi@madisoniaq.com