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2024 RBES Overview – Substantial changes from 2020 & how to Comply

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The Vermont Residential Building Energy Standard – VT RBES

- Law enacted RBES in Legislation: Act 20 of 1997
- Typically, a three-year code revision cycle with public review process
- Based on the International Energy Conservation Code (IECC) *with Vermont-specific additions and exemptions*
- As of September 1, 2020 the 2020 RBES applies to all projects commencing or permitted on or after this date



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- Energy Affordability Initiative
- Energy Saving Resources

Efficiency

Overview

Energy efficiency resources are often less expensive than the equivalent supply resources. State policy for least-cost energy planning therefore highlights efficiency as a key tool to meet the state's energy needs in the most cost-effective manner. Expenditures on energy efficiency stay local, create good jobs, help the local economy, and reduce the state's environmental footprint. The Department of Public Service carries out and/or oversees numerous energy efficiency and energy conservation programs, while also serving as the Vermont State Energy Office under the U.S. Department of Energy, State Energy Program. Extensive information about all of these programs can be found below.

Residential

[Residential Building Energy Standards \(RBES\)](#)

This energy code affects all new homes (and additions, alterations, renovations, or repairs) built after July 1, 1998. RBES is currently in the process of being revised. Last revisions took effect on September 1, 2020.

[Vermont Accreditation Procedure for Home Energy Rating System \(HERS\) Providers](#)

The Vermont Accreditation Procedure for Home Energy Rating System Providers sets minimum standards for rater training, operating procedures and policies, software programs, and quality control. These standards assure that customers can rely on the representations of accredited providers.

[Energy Saving Resources](#)

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 - Building Energy Standards Update
 - Commercial Building Energy Standards
 - Energy Code Collaborative
 - Residential Building Energy Standards**
 - HERS Provider Accreditation Procedure
 - Energy Affordability Initiative

Residential Building Energy Standards

Free hard copies of the 2020 RBES code book are available now, and hard copies of the updated 2020 Vermont Residential Energy Code Handbook are available by calling the Energy Code Assistance Center, 1-855-887-0673. Or you can download an electronic copy of the [RBES Handbook](#). Electronic copies of the codebook are available for purchase through the [International Code Council \(ICC\)](#). There is also a free viewable-only copy of the codebook on the [ICC website](#).

Overview

The [Vermont Residential Building Energy Standard \(RBES\) - 30 V.S.A. § 51](#) affects all new homes built after July 1, 1998. It is the energy code for all residential buildings 3 stories or less above grade in Vermont.

The new 2020 RBES took effect on September 1, 2020, and applies to construction commenced on or after the effective date. RBES applies to all new residential construction, including additions, alterations, renovations, and repairs. This effective date applies to both the RBES Base code and the RBES Stretch code. The RBES Stretch code is used to satisfy criterion 9(f) of all Act 250 projects.

2020 Residential Building Energy Standards (RBES)

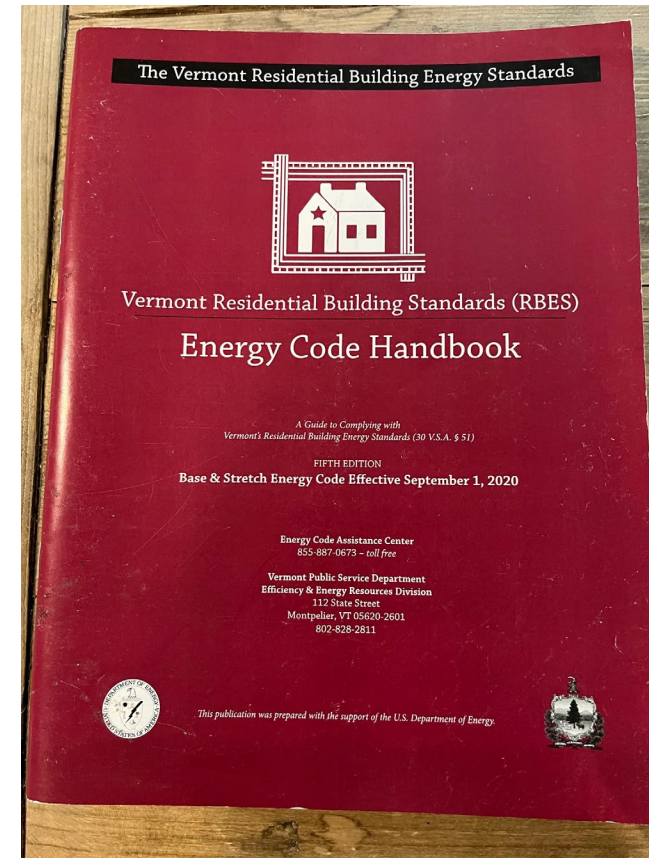
- [2020 Residential Energy Code Handbook](#) (includes both base and stretch codes)
- [2020 Vermont Residential Building Energy Standards](#) - Free Viewable*
- [2020 RBES Certificate](#)
- [2020 RBES Owner/Builder Disclosure Statement](#)
- [Historic Buildings Exemption Report](#). This form should be completed and sent to the State Historic Preservation Office (SHPO) for approval if compliance with the energy code may adversely affect a historic building.
- [REScheck Software](#) REScheck™ has been developed by the Department of Energy (DOE) to show compliance with the Vermont 2020 Residential Building Energy Standards. (Note: this is a beta version of REScheck Web™. Guidance of how to fill out REScheck can be found on the [Building Energy Codes Program resource page](#). Please email keith.levenson@vermont.gov if you experience any issues with this software.)

*Note: if you are having trouble accessing the free viewable version of either RBES online, click on the [ICC Digital Codes Library search webpage](#) or go to the [ICC Digital Codes Library webpage](#) and search for "Vermont". Then click on "FREE VIEW" under the icon for the 2020 RBES.

2020 Residential Building Energy Standards (RBES)

- [2020 Residential Energy Code Handbook](#) (*includes both base and stretch codes*)
- [2020 Vermont Residential Building Energy Standards](#) - Free Viewable*
- [2020 RBES Certificate](#)
- [2020 RBES Owner/Builder Disclosure Statement](#)
- **[Historic Buildings Exemption Report](#)**. This form should be completed and sent to the State Historic Preservation Office (SHPO) for approval if compliance with the energy code may adversely affect a historic building.
- [REScheck Software](#) REScheck™ has been developed by the Department of Energy (DOE) to show compliance with the Vermont 2020 Residential Building Energy Standards. (Note: this is a beta version of REScheck Web™. Guidance of how to fill out REScheck can be found on the [Building Energy Codes Program resource page](#). Please email keith.levenson@vermont.gov if you experience any issues with this software.)

The full RBES code and the RBES Handbook



There is an important difference between the official RBES Code Book and the RBES Handbook

- The official ICC RBES Code contains ALL of the applicable code requirements of compliance for all residential construction as defined in the Code and outlined in this training.
- The Handbook/Guidebook is a summary *guide* highlighting some of the key requirements and methods for compliance with the official RBES Code.
- The Handbook/Guidebook should NOT be used as a substitute nor replacement of the official ICC RBES Code.
- The full content of the RBES Code should always be referenced for compliance with Vermont law

Efficiency Vermont's role?



*photo credit – Greatest movie featuring Vermont ever

For support and any questions regarding the application of the VT RBES

Energy Code Assistance Center
20 Winooski Falls Way, 5th Floor
Winooski, Vermont 05404
855-887-0673

Vermont Public Service Department
Efficiency and Energy Resources Division
112 State Street Montpelier VT 05620-2601
802-828-2811

What's in store for 2023

The RBES update process

- Every 3 years, the VT PSD implements a code update process, keeping in line with the update frequency of the International Energy Conservation Code (IECC) which is the model ICC code on which the VT RBES is based
- The VT RBES has been tailored over many years to be specific to Vermont's climate zone (Zone 6) AND to the State of Vermont's climate and energy policies
- The code update process is work done under contract by the PSD with third party consultants and focused working groups, as well as with public hearings and procedures for public input and comment.
- The 2023 RBES work wrapped up late in 2022, with public hearings and public comment periods between September and December of 2022

How it all sugared out..

- On June 9th 2023, the Legislative Committee on Administrative Rulemaking approved the final Proposed 2023 VT RBES language that was filed on April 25th 2023
- This procedural requirement of LCAR review is mandated as the VT RBES updates are an amendment to State Statute
- The final draft of the Proposed 2023 VT RBES was modified significantly for LCAR approval after the public comment period was closed late in 2022. There have been substantial concerns raised within the residential construction industry in the state regarding the implications of the approved code changes.
- A separate legislative Act - S.100 / Act47 that was passed under the leadership of the Senate Committee on Economic Development, Housing and General Affairs established a “Building Energy Code Subcommittee” to gather information and industry input on current statewide issues and concerns regarding RBES application
- This committee will begin work in July 2023 and report back to the Senate Committee before the beginning of the 2023/24 legislative session
- The proposed implementation/effective date of the now 2024 VT RBES will be July 1st 2024

Which buildings must comply with the 2023 VT RBES?

New construction, low-rise residential

- One and two family dwellings
- Multifamily housing *that is a residential building or mixed-use building with three or more dwelling units* three stories or less in height.
- *Multi-family buildings of four stories or more in height must comply with the VT CBES*
- Does not include commercial buildings
 - But does include residential part of mixed-use
- “Tiny Houses” now are recognized as a stand-alone building category with their own specific envelope and mechanical requirements

Existing low-rise residential buildings

- Additions
 - Only the addition needs to conform
- Renovations and alterations have their own requirements defined in the Code (Chapter 5 – Existing Homes)
- Repairs

All projects that require Act 250 permits are required to meet Stretch Code

Stretch Code is also required in certain jurisdictions in VT that have adopted it

*currently only South Burlington

Exempt Buildings – Definitions under Section R101.5.2

Unconditioned Buildings

Mobile Homes

Hunting Camps

Summer Camps

Yurts

Owner-Built Homes



R40 1.3 Certificate of Compliance (Mandatory)



A certification may be issued and signed by a builder, a licensed professional engineer, a licensed architect or an accredited home energy rating organization. If certification is not issued by a licensed professional engineer, a licensed architect or an accredited home energy rating organization, it shall be issued by the builder. Any certification shall certify that residential construction meets the RBES.



The 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.



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.

The VT RBES Certificate-

To be completed by the builder and filed with the Town and the VT PSD



2020 Vermont Residential Building Energy Standards (RBES) Certificate

This certificate is for projects started on or after September 1, 2020.
 Before completing this form, refer to the instructions in Chapter 8 of the Residential Energy Code Handbook (5th edition).
 For additions, alterations, renovations or repairs, only fill out applicable portions of certificate.

Property Address (Street, City, ZIP Code) _____

Construction START Date _____ Construction FINISH Date _____ Act 250 (Y/N): _____ Act 250 Permit # _____

#Units _____ #Stories _____ #Sq. Ft. _____ #Bedrooms _____

Foundation: Basement Slab On Grade Crawl Space Other: _____

Applicable Code: Base Stretch

Project Description

Single family Renovation / alteration *

Multi-family Addition *

Log home Repair *

*Existing Home Project Description: _____

Compliance Method **Option 1: Package-Plus-Points** *Ref. RBES for full requirements of each point option*

(MUST select Option 1, BASE / STRETCH (circle one) Points required: _____ (Base requires 4-10pts / Stretch 6-12pts, Option 2, or Option 3) Package # _____ Points achieved: _____ see Tables R402.1.2.2 and R407.2.1.2)

Envelope: Slab, R-10 under all (1pt) ACH50 ≤ 2.0 and qualifying HRV/ERV (3pts for Base OR 1pt for Stretch)

Envelope: Walls-Upgraded, R20+12 (2pts) ACH50 ≤ 1.0 and qualifying HRV/ERV (4pts) Solar ready (1pt, Base only)

Envelope: Walls-High-R, R-40 (3pts) ENERGY STAR DHW (1pt) On-site generation (1-4pts)

Envelope: Ceiling, R-80 flat / 60 sloped (1pt) ENERGY STAR electric DHW (2pts) _____ kW _____ pts

Envelope: Windows 0.27 (1pt, Base only) Low flow fixtures (1pt) Solar hot water (2pts)

Envelope: Windows 0.22 (2pts) Drain water heat recovery (1pt) Building energy monitoring (1pt)

Pre-drywall blower door (1pt), result _____ User-demand hot water recirculation (1pt) Level 2 EV-ready (1pt)

ENERGY STAR heating and cooling (1pt) Water certification (2pts) 6 kWh battery backup (1pt)

Advanced heating and cooling (3pts) List cert. type _____ !See RBES for MF exception

Option 2: REScheck™ software (Base only)

HRV/ERV installed (mandatory)

_____ Tested ACH50 (must be under 2.0)

_____ UA (from REScheck™)

Option 3: HERS/IERI

_____ HERS Result (Overall)

_____ HERS without Renewables

_____ REM/Rate Version #

IAF incorporated into model

Approved Rater Name: _____

(Maximum HERS: 61 Base, 54 Stretch)

Thermal Envelope

Basement: R- _____ Basement / Crawl Space Walls _____ Basement Insulation Depth (ft) U- _____ Basement Windows NFRC Default

Slab: R- _____ Unheated Slab (Under) R- _____ Heated Slab (Under) R- _____ Perimeter Slab Edge

Wall/Ceiling: R- _____ Above-Grade Walls R- _____ Flat Ceilings _____ Area (sq ft) R- _____ Sloped Ceilings _____ Area (sq ft)

Other: R- _____ Floors over Unheated Spaces R- _____ Attic Access Hatch / Door NA

Fenestration U- _____ Windows NFRC Default U- _____ Doors NFRC Default U- _____ Skylights NFRC Default

Air Sealing / Blower Door Test _____ ACH50 (Building volume used: _____ cu ft) Blower Door Result _____ CFM50

(must report either ACH50 _____ CFM50/sq ft of building shell (6 sides; Thermal shell area used: _____ sq ft) Date of Test _____

or CFM50/sq ft for Base Code) *Bo#* measurements are required for Stretch Code Air Leakage Tester Name: _____

Ventilation System Balanced, SRE _____ % Flow verification: Rated, OR Measured → _____ Exhaust air flow (total cfm) _____ Supply air flow (total cfm)

(must select one) Exhaust-Only Flow verification: Rated, OR Measured → _____ Exhaust air flow (total cfm)

Combustion Safety Exterior (outdoor) air supply is provided for solid fuel-burning appliances and fireplaces, OR NA (no solid fuel burning appliance or fireplace in home)

(verify all) Solid fuel burning appliances and fireplaces have gasketed doors with compression closure, OR NA (no solid fuel burning appliance or fireplace in home)

Spillage testing conducted on combustion equipment not directly-vented, OR NA (no equipment, or all equipment directly-vented)

Mechanical System Design Load Calculation Method: ACCA Manual J, OR Other Approved Method (List) _____

(must complete all) Calculation details: (Ref. RBES R302 for design temperature exceptions)

_____ Winter design temp, outdoor dry-bulb (VT range: -11 to 1°F) _____ Summer design temp, outdoor dry-bulb (typ. max 84°F), OR No cooling

_____ Winter design temp, indoor (max 72°F) _____ Summer design temp, indoor (min. 75°F), OR No cooling

_____ Heating design load, Btu/hr _____ Cooling design load, Btu/hr, OR No cooling

_____ Primary heating system size, Btu/hr _____ Primary cooling system size, Btu/hr, OR No cooling

_____ HSPF or COP or AFUE (circle which) _____ SEER or COP (circle which), OR No cooling

Programmable thermostat, OR Exempt, list reason _____

Ducts Ducts located completely within conditioned space, OR NA (no ducts)

_____ Duct tightness result (CFM @ 25 Pa)

Test performed at Rough-in (max 3 CFM per 100 sq ft of cond. floor area), OR Post-construction (max 4 CFM per 100 sq ft of cond. floor area)

Other Requirements Mandatory (Base and Stretch): Mechanical system piping, min. R-3 Multi-family: EV charging requirement is met: _____ #spaces

90% of lamps high efficacy Automatic or gravity dampers for vent. system intake and exhaust

Mandatory (Stretch Code Only): Single-family: Solar ready Single-family: One Level 1 EV-charging space

Where applicable: Circulating service hot water piping, R-3 Pools: All requirements per R403.10 are met Automatic controls for snow-melt systems

2020 Vermont Residential Building Energy Standards (RBES) Certificate

This certificate is for projects started on or after September 1, 2020.

Before completing this form, refer to the instructions in Chapter 8 of the Residential Energy Code Handbook (5th edition).

For additions, alterations, renovations or repairs, only fill out applicable portions of certificate.

Property Address (Street, City, ZIP Code) _____

Construction START Date _____ Construction FINISH Date _____ Act 250 (Y/N) _____ Act 250 Permit # _____

Units _____ # Stories _____ # Conditioned Sq. Ft. _____ # Bedrooms _____

Foundation: Basement Slab On Grade Crawl Space Other: _____

Applicable Code: Base Stretch

Project Description

Single family Renovation / alteration*

Multi-family Addition*

Log home Repair*

*Existing Home Project Description: _____

Compliance Method
MUST select Option 1, Option 2, or Option 3

Option 1: Package-Plus-Points Ref. RBES for full requirements of each point option
 BASE / STRETCH (circle one) Points required: _____ (Base requires 4-10pts / Stretch 6-12pts, see Handbook Tables 5-2 and 5-5)
 Package # _____ Points achieved: _____

Option 2: REScheck software (cannot be used for Stretch Code) Passes
 _____ UA result _____ Max. UA

- Envelope: Slab, R-10 under all (1pt)
- Envelope: Walls-Upgraded, R20+12 (2pts)
- Envelope: Walls-High-R, R-40 (3pts)
- Envelope: Ceiling, R-80 flat / 60 sloped (1pt)
- Envelope: Windows 0.27 (1pt, Base only)
- Envelope: Windows 0.22 (2pts)
- Pre-drywall blower door (1pt), result _____
- ENERGY STAR heating and cooling (1pt)
- Advanced heating and cooling (3pts)
- ACH50 ≤ 2.0 and qualifying HRV/ERV (3pts for Base OR 1pt for Stretch)
- ACH50 ≤ 1.0 and qualifying HRV/ERV (4pts)
- ENERGY STAR DHW (1pt)
- ENERGY STAR electric DHW (2pts)
- Low flow fixtures (1pt)
- Drain water heat recovery (1pt)
- User-demand hot water recirculation (1pt)
- Water certification (2pts)
- List cert. type _____
- Solar ready (1pt, Base only)
- On-site generation (1-4pts) _____ kW _____ pts
- Solar hot water (2pts)
- Building energy monitoring (1pt)
- Level 2 EV-ready (1pt)
- 6 kWh battery backup (1pt)

Option 3: HERS/ERI

_____ HERS Result (Overall)

_____ HERS without Renewables

_____ REM/Rate Version #

IAF incorporated into model

Approved Rater Name: _____

(Maximum HERS: 61 Base, 54 Stretch)

*See RBES for MF exception

Thermal Envelope

Basement: R-_____ Basement / Crawl Space Walls _____ Basement Insulation Depth (ft) U-_____ Basement Windows NFRC Default

Slab: R-_____ Unheated Slab (Under) R-_____ Heated Slab (Under) R-_____ Perimeter Slab Edge

Wall/Ceiling: R-_____ Above-Grade Walls R-_____ Flat Ceilings _____ Area (sq ft) R-_____ Sloped Ceilings _____ Area (sq ft)

Other: R-_____ Floors over Unheated Spaces R-_____ Attic Access Hatch / Door NA

Fenestration U-_____ Windows NFRC Default U-_____ Doors NFRC Default U-_____ Skylights NFRC Default

Air Sealing / Blower Door Test

(must report either ACH50
or CFM50/sq ft for Base Code)

_____ ACH50
_____ CFM50/sq ft of building shell (6 sides)
Both measurements are required for Stretch Code

Date of test _____

Air Leakage Tester Name: _____

Ventilation System

(must select one)

Balanced, SRE _____ % Flow verification: Rated, OR Measured → _____ Exhaust air flow (total cfm) _____ Supply air flow (total cfm)

Exhaust-Only Flow verification: Rated, OR Measured → _____ Exhaust air flow (total cfm)

Combustion Safety

(verify all)

Exterior (outdoor) air supply is provided for solid fuel-burning appliances and fireplaces, OR NA (no solid fuel burning appliance or fireplace in home)

Solid fuel burning appliances and fireplaces have gasketed doors with compression closure, OR NA (no solid fuel burning appliance or fireplace in home)

Spillage testing conducted on combustion equipment not directly-vented, OR NA (no equipment, or all equipment directly-vented)

Mechanical System

(must complete all)

Design Load Calculation Method: ACCA Manual J, OR Other Approved Method (List) _____

Calculation details: (Ref. RBES R302 for design temperature exceptions)

_____ Winter design temp, outdoor dry-bulb (VT range: -11 to 1°F) _____ Summer design temp, outdoor dry-bulb (typ. max. 84°F), OR No cooling

_____ Winter design temp, indoor (max 72°F) _____ Summer design temp, indoor (min. 75°F), OR No cooling

_____ Heating design load, Btu/hr _____ Cooling design load, Btu/hr, OR No cooling

_____ Primary heating system size, Btu/hr _____ Primary cooling system size, Btu/hr, OR No cooling

_____ HSPF or COP or AFUE (circle which) _____ SEER or COP (circle which), OR No cooling

Programmable thermostat, OR Exempt; list reason _____

Ducts

Ducts located completely within conditioned space, OR NA (no ducts)

_____ Duct airtightness test result (CFM @ 25 Pa)

Test performed at Rough-in (max 3 CFM per 100 sq ft of cond. floor area), OR Post-construction (max 4 CFM per 100 sq ft of cond. floor area)

Other Requirements

Mandatory (Base and Stretch): Mechanical system piping, min. R-3 Multi-family: EV charging requirement is met: _____ # spaces

90% of lamps high efficacy Automatic or gravity dampers for vent. system intake and exhaust

Mandatory (Stretch Code Only): Single-family: Solar ready Single-family: One Level 1 EV-charging space

Where applicable: Circulating service hot water piping, R-3 Pools: All requirements per R403.10 are met Automatic controls for snow-melt systems

General Requirements

Arrangement and Format of the VT RBES

The 2020 VT RBES, like other codes published by the ICC, is arranged and organized to follow sequential steps that generally occur during a plan review or inspection. The 2020 VT 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

Compliance for New Construction *and Additions*

- Chapter 4 of ICC Document
 - Sections R402.1-R408.1.2

3 Compliance Options

- Package Plus Points –
 - For Base **AND** Stretch code compliance
 - Sections R402 through R404
 - Now a **Single** packages table with expanded points
- Software Method / REScheck
 - Utilizing the U.S. Department of Energy's REScheck software
 - Section R405 and the provisions of Sections R401 through R404 indicated as "Mandatory"
- Home Energy Rating System (HERS)
 - Utilizing an independent third-party Resnet-certified HERS rater and Rating software to show compliance
 - Section R406.4

R402.1.2.1

Package Plus Points Approach

Why choose this path for RBES compliance?

It's conceivably "simple" to follow

- Prescriptive compliance dictates the options for the building envelope that will meet the intended performance requirements of the code.
- Builders/Clients/(NOT homeowners..) can choose a Package and design project outcomes and plans around the requirements of the package.
- Does not require modeling performance with a software tool or hiring a third party to do the performance modeling for you.
- There are other surrounding requirements deeper into RBES that need to be met that rely on strong communication, shared deliverables, and technical knowledge from other trades that the owner of the project (GC?, Architect?, Lead Carpenter? Homeowner?) will need to facilitate and communicate effectively.

Section R402.1.2.1 – Package Plus Points Compliance Option

Projects shall comply by completing all of the following steps:

- There are no longer two separate tables for Prescriptive Package options for Base and Stretch code. There is a single combined Packages Table that applies to both Base and Stretch
- Select one of the *TWO* packages listed in Table R402.1.2.1
- Determine the number of points needed to comply with Table R402.1.2.2 based on building size *AND/OR Stretch Code compliance*
- Incorporate a sufficient number of points from Table R402.1.2.3 to meet the points requirements from Table R402.1.2.2

2020 VT RBES - Table R402.1.2.1 – Insulation Requirements by Component for Base Packages

Component ^a	Package 1 Standard	Package 2 SIPS	Package 3 Thick Wall	Package 4 Cavity Only	Package 5 Log Homes
Ceiling	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 in RBES code language
Wood Frame Walls	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-30	R-30	R-30	R-38	
Basement/Crawl Space Wall ^c	R-15 (continuous) OR 20 (cavity) OR R-13+5	R-15 (continuous) OR 20 (cavity) OR R-13+5	R-20 (continuous) OR R-13+10 ^e	R-20 (continuous) OR R-13+10 ^e	
Slab Edge ^d	R-15, 4 ft OR R-10 perimeter + R-7.5 under entire rest of slab	R-15, 4 ft OR R-10 perimeter + R-7.5 under entire rest of slab	R-10, 4 ft	R-15, 4 ft OR R-10 perimeter + R-7.5 under entire rest of slab	
Heated Slab ^d	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)	U-0.30 max.	U-0.30 max.	U-0.30 max.	U-0.28 max.	
Skylight ^b	U-0.55 max.	U-0.55 max.	U-0.55 max.	U-0.55 max.	
Air Leakage ⁱ	≤3.0 ACH50 ^h tested	≤3.0 ACH50 ^h tested	≤3.0 ACH50 ^h tested	≤3.0 ACH50 ^h tested	
Duct Leakage	Inside thermal boundary	Inside thermal boundary	4 CFM25 per 100 sq. ft. of CFA ⁱ	Inside thermal boundary	
Percent High Efficacy Lamps ⁱ	90%	90%	90%	100%	

*2023 VT RBES will constrict this to one envelope package with multiple wall assembly options

2020 VT RBES - Package Plus Points – Table R402.1.2.2

Requires prescriptive package requirements be met AND # of points earned based on building sq. footage

Building Sq. footage is based on the finished conditioned building floor area within the thermal envelope including unfinished basements and storage/utility spaces

TABLE R402.1.2.2 REQUIRED POINTS BY BUILDING SIZE

BUILDING/DWELLING SIZE	REQUIRED POINTS
Alterations	0
Additions < 250 square feet	0
Addition > 250 < 500 square feet	1
Addition > 500 < 1,000 square feet	2
Addition > 1,000 square feet	3
Multifamily < 2,000 square feet	4
< 2,000 square feet	5
2,000 to 4,000 square feet	7
> 4,000 square feet	10

*2023 VT RBES will require more points per sq.ft. of conditioned area

2024 VT RBES - Table R402.1.2.1 – Insulation Requirements by Component for Base Packages – Out with the old

Component ^a	Package 1 Standard	Package 2 SIPS	Package 3 Thick Wall	Package 4 Cavity Only	Package 5 Log Homes
Ceiling	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 in RBES code language
Wood Frame Walls	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-30	R-30	R-30	R-38	
Basement/Crawl Space Wall ^c	R-15 (continuous) OR 20 (cavity) OR R-13+5	R-15 (continuous) OR 20 (cavity) OR R-13+5	R-20 (continuous) OR R-13+10 ^e	R-20 (continuous) OR R-13+10 ^e	
Slab Edge ^d	R-15, 4 ft OR R-10 perimeter + R-7.5 under entire rest of slab	R-15, 4 ft OR R-10 perimeter + R-7.5 under entire rest of slab	R-10, 4 ft	R-15, 4 ft OR R-10 perimeter + R-7.5 under entire rest of slab	
Heated Slab ^d	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)	U-0.30 max.	U-0.30 max.	U-0.30 max.	U-0.28 max.	
Skylight ^b	U-0.55 max.	U-0.55 max.	U-0.55 max.	U-0.55 max.	
Air Leakage ⁱ	≤3.0 ACH50 ^h tested	≤3.0 ACH50 ^h tested	≤3.0 ACH50 ^h tested	≤3.0 ACH50 ^h tested	
Duct Leakage	Inside thermal boundary	Inside thermal boundary	4 CFM25 per 100 sq. ft. of CFA ⁱ	Inside thermal boundary	
Percent High Efficacy Lamps ⁱ	90%	90%	90%	100%	

*2023 VT RBES will constrict this to one envelope package with multiple wall assembly options

Package Plus Points – Table R402.1.2.2

Requires prescriptive package requirements be met AND # of points earned based on building sq. footage

Building Sq. footage is based on the finished conditioned building floor area within the thermal envelope including unfinished basements and storage/utility spaces

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Additions < 250 square feet	0
Addition > 250 < 500 square feet	1
Addition > 500 < 1,000 square feet	2
Addition > 1,000 square feet	3
Multifamily < 2,000 square feet	4
< 2,000 square feet	5
2,000 to 4,000 square feet	7
> 4,000 square feet	10

*2023 VT RBES will require more points per sq.ft. of conditioned area

Table R402.1.2.1 – In with the new

*2023 VT RBES will constrict the prescriptive table to one envelope package (plus log homes) with multiple wall assembly options

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

Component ^f	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 ^h
Above Grade Wall ^b	U-0.044: Examples: R-20+5ci ^e R-13+10-ci R-20 (6 ½" ci (SIP) or other)	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-0.27 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	

Package Plus Points – Table R402.1.2.2

Required Points for by Building Size for Base Code and Stretch Code Requires prescriptive package requirements be met AND # of points earned based on building sq. footage

Building Sq. footage is based on the finished conditioned building floor area inside the thermal envelope including unfinished basements and storage/utility spaces

**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

*2023 VT RBES will require more points per sq.ft. of conditioned area than 2020 RBES

Stretch Code points requirements are now combined with Base code points table

2020 RBES Table R402.1.2.3 - Available Points by Component

Component		Description	Points
Envelope	Slab	R-10 below entire slab	1
	Walls - Upgraded	AG walls R-20+12 (or U-factor maximum 0.033 wall assembly) (Exception: not available for base package 3) OR ^b	2
	Walls – High-R	AG walls \geq R-40(cavity + continuous) (or U-factor maximum 0.025 wall assembly)	3
	Ceiling	R-80 attic / R-60 slopes	1
	Windows	Average U-factor \leq 0.27 OR ^b	1
		Average U-factor \leq 0.22	2
Air Leakage and Ventilation	Pre-Drywall	ACH50 is tested with blower door after full insulation/primary air barrier completion but before insulation is fully enclosed/covered OR ^b	1
	Tight	ACH50 \leq 2.0 and balanced ventilation with ECM ^e fans and \geq 70% SRE ^d for HRV ^c , \geq 65% SRE ^d for ERV ^c OR ^b	3
	Very Tight	ACH50 \leq 1.0 and balanced ventilation with ECM ^e fans and \geq 80% SRE ^d for HRV ^c , \geq 75% SRE ^d for ERV ^c	4
Heating and Cooling ^a	Basic	ENERGY STAR basic: (1) Gas/propane furnace \geq 95 AFUE, Oil furnace \geq 85 AFUE, (2) Gas/Propane Boiler \geq 90 AFUE, Oil Boiler \geq 87 AFUE, (3) Heat pump HSPF \geq 9.0; PLUS any AC is SEER \geq 14.5 OR ^b	1
	Advanced	Whole building heat/cool is (1) NEEP-listed heat pump combination ^j , (2) GSHP ⁱ , closed loop and COP \geq 3.3, (3) ATWHP ^f COP \geq 2.5 and 120F design temp, (4) Advanced wood heating system	3

*2023 VT RBES offers expanded Points options targeting whole-house electrification

2020 RBES Table 402.1.2.3 cont.d

Component		Description	Points
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	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	Solar Ready	Home is Solar Ready per R407.5, OR ^b	1
	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. 5 circuits and homeowner access to data	1
	EV Ready	Level 2 electric vehicle charger-ready per 407.4R407.3	1
	Battery	Min. 6 kWh grid-connected dispatchable demand-response-enabled battery backup	1

*2023 VT RBES offers expanded Points options targeting whole-house electrification

2023 RBES Table R402.1.2.3 - Points by Component for Base and Stretch Code

Base and Stretch code points options combined under a single table for 2023

*2023 VT RBES offers expanded Points options targeting whole-house electrification

The points options have expanded significantly

- Emphasis on whole-house electrification – high points value associated with using air-source, ground-source, and air-to-water whole-house heat pump systems
- Heat pump water heaters and water conservation are also emphasized.
- Many points options for increasing thermal shell performance and windows
- Insulation Embodied Carbon - Points available now for considering Global Warming Potential impact of insulation material choice
- Mechanical ventilation commissioning carries a point
- Tiered points for ACH targets below the new baseline maximum of 2 ACH/50

**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-40 around perimeter and below entire slab OR ^b	4
	Walls—Upgraded	R-25 around perimeter and below entire slab	3
		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	2
	Walls—High-R	R-35 double stud or similar (cavity and continuous) (U-0.028 wall assembly) OR ^b	2
		Above-grade walls ≥ R-40 double stud or similar (cavity and continuous) (or U-factor maximum 0.025 wall assembly) OR ^b	3
	Ceiling	R-48 SIP 10 1/4" XPS or similar (cavity and continuous) (U-0.021 wall assembly)	4
		R-80 ⁶⁰ attic flat / R-60 sloped flats (U-0.018) and R-49 slopes, vaulted and cathedral (U-0.020)	1
	Floors - Exposed	R-80 attic flats (U-0.013) and R-60 slopes, vaulted and cathedral (U-0.018)	2
		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	
Doors - Exterior	Average U-factor ≤ 0.21 OR ^b	3	
	Average U-factor ≤ 0.18	4	
	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	13
	Tight Better Electrical Efficiency	ACH50 ≤ 2.0 and Balanced ventilation with ECM fans and ≥70% SRE ^d for HRV ^e , ≥66% SRE ^d for ERV ^e OR ^b SRE ^d and ≥2.0 cfm/watt	3
	Very-Tight Mechanical Ventilation Testing	ACH50 ≤ 1.0 and balanced ventilation with ECM fans and ≥ 80% SRE ^d for HRV ^e , ≥76% SRE ^d for ERV ^e OR ^b 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.	41
		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
Heating and Cooling ^a	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

Water	Advanced Wood Heating System	Whole building heating/cooling is (1) NEEP-listed air source heat pump combination, (2) GSHP, closed loop and COP ≥ 3.3, (3) ATWHP COP ≥ 2.5 and 120F design temp, (4) Advanced wood heating system from http://www.rercvt.org/advanced-wood-heating-system/eligible-equipment-inventory-eei	35
	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
	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	13
	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	25
	Low flow	All showerheads ≤ 1.75 gpm/gpm, all lavatory faucets ≤ 1.0 gpm/gpm, and all toilets ≤ 1.28 gpf/gpf OR ^b	1
	Certified ^c Certified ^d	Certified water efficient design per WERS, WaterSense, or RESNET H2O RESNET HERS ²⁰⁰	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
Renewables	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	Home is Solar Ready per R407.6-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.	42
	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
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 ¹ 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
Insulation Embodied Carbon Emissions	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
	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 Demonstrate a calculated insulation GWP.	2

[https://legislature.vermont.gov/Documents/2024/WorkGroups/LCAR/22-P28%20-%20Vermont%20Residential%20Building%20Energy%20Standards%20\(RBES\)%20Amendments/W~none~22-P28%20-%20Vermont%20Residential%20Building%20Energy%20Standards%20\(BES\)%20Amendments~4-26-2023.pdf](https://legislature.vermont.gov/Documents/2024/WorkGroups/LCAR/22-P28%20-%20Vermont%20Residential%20Building%20Energy%20Standards%20(RBES)%20Amendments/W~none~22-P28%20-%20Vermont%20Residential%20Building%20Energy%20Standards%20(BES)%20Amendments~4-26-2023.pdf)

Beyond needing to meet specific component R-values...

Many sections detailing requirements for air barriers, insulation assemblies, and vapor control

R402.2 covers specifics around installing:

- Vented and unvented enclosed ceiling requirements
- Attic hatches, doors, and eave baffles
- Floors, basement walls, crawl space walls, slab on grade floors
- Vapor retarders
- Glazing requirements and exceptions
- Air leakage and detailed requirements on installing air barrier assemblies
- Air leakage testing requirements

Stretch Code



Stretch Code is a more stringent requirement of the RBES code and is required for any project that requires an ACT 250 permit

It is also required in those jurisdictions within the state that have adopted Stretch Code as a local requirement

- Towns that have adopted Stretch Code provisions:
 - South Burlington
- Williston, while not locally adopting Stretch Code, residential subdivisions require meeting a more stringent performance package than RBES base code
- Hartford and other communities in VT have been considering adopting Stretch code and may do so in the coming years

Compliance options for Stretch Code

Unlike Base Code compliance, residential projects required to meet the specifications of Stretch Code are limited to two Compliance Options instead of the three available for Base Code

Compliance with Stretch Code shall be documented via either:

- **Section R402.1.2.1** – Package Plus Points
- **Section R406.4** – ERI/HERS-based compliance

2020 VT RBES Stretch Code – Prescriptive packages - Table R407.2.1.1

Component ^a	Package 1 Standard	Package 2 SIPS	Package 3 Thick Wall
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-15, 4ft OR R-10 perimeter + R-7.5 under entire rest of slab	R-15, 4 ft OR R-10 perimeter + R-7.5 under entire rest of slab	R-15, 4ft OR R-10 perimeter + R-7.5 under entire rest of slab
Heated Slab ^d	R-15 (edge and under)	R-15 (edge and under)	R-15 (edge and under)
Fenestration ^b (Window and Door)	U-0.28 max.	U-0.28 max.	U-0.30 max.
Skylight ^b	U-0.55 max.	U-0.55 max.	U-0.55 max.
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
Duct Leakage	Inside thermal boundary	Inside thermal boundary	Inside thermal boundary
Percent High Efficacy Lamps ^l	90%	90%	90%

Building/Dwelling Size	Required Points
Multifamily < 2000 square feet average unit size	6 points
<2000 square feet	7 points
2000 to 4000 square feet	9 points
>4000 square feet	12 points

2024 VT RBES Stretch Code – Prescriptive package

Out with the old

Component ^a	Package 1 Standard	Package 2 SIPS	Package 3 Thick Wall
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-15, 4ft OR R-10 perimeter + R-7.5 under entire rest of slab	R-15, 4 ft OR R-10 perimeter + R-7.5 under entire rest of slab	R-15, 4ft OR R-10 perimeter + R-7.5 under entire rest of slab
Heated Slab ^d	R-15 (edge and under)	R-15 (edge and under)	R-15 (edge and under)
Fenestration ^b (Window and Door)	U-0.28 max.	U-0.28 max.	U-0.30 max.
Skylight ^b	U-0.55 max.	U-0.55 max.	U-0.55 max.
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
Duct Leakage	Inside thermal boundary	Inside thermal boundary	Inside thermal boundary
Percent High Efficacy Lamps ^l	90%	90%	90%

Building/Dwelling Size	Required Points
Multifamily < 2000 square feet average unit size	6 points
<2000 square feet	7 points
2000 to 4000 square feet	9 points
>4000 square feet	12 points

Table R402.1.2.1 – In with the new

*2023 VT RBES will constrict the prescriptive table to one envelope package (plus log homes) with multiple wall assembly options

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

Component ^f	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 ^h
Above Grade Wall ^b	U-0.044: Examples: R-20+5ci ^e R-13+10-ci R-20 (6 ½" ci (SIP) or other)	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-0.27 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	

Package Plus Points – Table R402.1.2.2

Required Points for by Building Size for Base Code and Stretch Code Requires prescriptive package requirements be met AND # of points earned based on building sq. footage

Building Sq. footage is based on the finished conditioned building floor area inside the thermal envelope including unfinished basements and storage/utility spaces

**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

*2023 VT RBES will require more points per sq.ft. of conditioned area

Stretch Code points requirements are now combined with Base code points table

Potpourri...



“Tiny Houses” are now recognized as their own special building category with specific performance requirements

R402.8 Tiny houses.

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

Tiny houses require the following:

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

Compliance with all other provisions of this code is required.

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

Electrification

Electric Service Panel - Require an electric service panel capable of powering the whole home or apartment with all electric end-uses

R404.64 200 Amp Electrical Service.

Each dwelling unit located in a Group R-2 building except multifamily units shall be supplied with at least have 200 amp electrical service in anticipation of increased electrical services that will need to be provided in the future.

Electrification continued

Electric Vehicles (EV) - Included "EV Capable" requirements to ensure that it will be easy to install EV Supply Equipment in the future

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

<u>BUILDING/PARKING TYPE</u>	<u>MINIMUM REQUIRED NUMBER OF <u>LEVEL 2 CAPABLE</u> EV CHARGING PARKING SPACES</u>
<u>Single Family Home or Multifamily Building</u>	<u>1 per dwelling unit 1 per dwelling unit or the number of parking spaces provided, whichever is less</u>
<u>Additional Parking Spaces</u>	<u>1 per dwelling unit 25% of remaining parking spaces not utilized by dwelling units, or 40 spaces, whichever is less</u>
<u>Exterior Parking</u>	<u>325%</u>
	<u>4</u>
	<u>4% of parking spots, rounded up to the nearest whole number</u>

Electrification continued

Solar - "Solar Ready" requirements to ensure that it will be easy to install solar photovoltaic panels in the future if not included in current project scope

- R402.7 – Solar Ready Zone – New detached one and two-family dwellings and townhouses with not less than 600sq.ft. of roof area oriented between 110 and 270 degrees of True North shall comply with this requirement (Section reference in the document needs to be fixed)
- R402.7.9 – Electrical Reserved Space – The main electrical service panel shall have a reserved space to allow installation of dual pole circuit breaker for future solar electric installation and shall be labeled "For Future Solar Electric"

Opportunities for Earning Points for 2024 VT RBES Prescriptive Compliance

Air Barrier Assemblies

Points available –

- **1.5 ACH/50 – 1 point**
- **1.0 ACH/50 – 2 points**
- **0.5 ACH/50 – 3 points**

Good Air Barriers are assemblies used to create a whole



Continuity – details need to transition to different building planes



Simple materials and processes can be just as good as specifically designed products

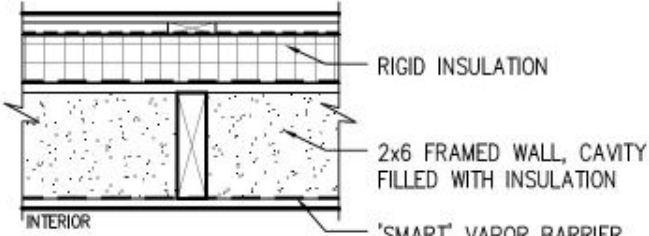
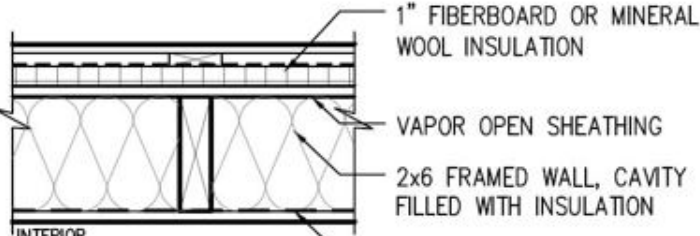



Continuous Insulation Wall Assemblies –

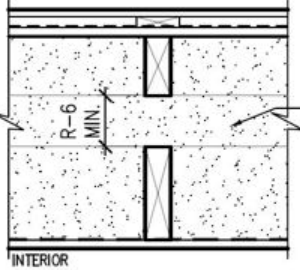
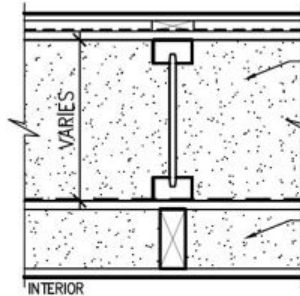
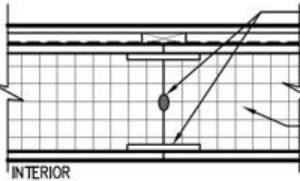
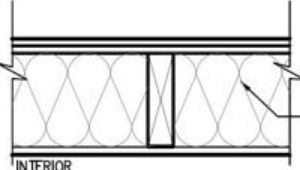
- U.036/R20+9CI -1 Pt.
- U.028/R35 DS – 2 Pts.
- U.025/R40 CI – 3 Pts.
- U.021/R48 SIP – 4 Pts.



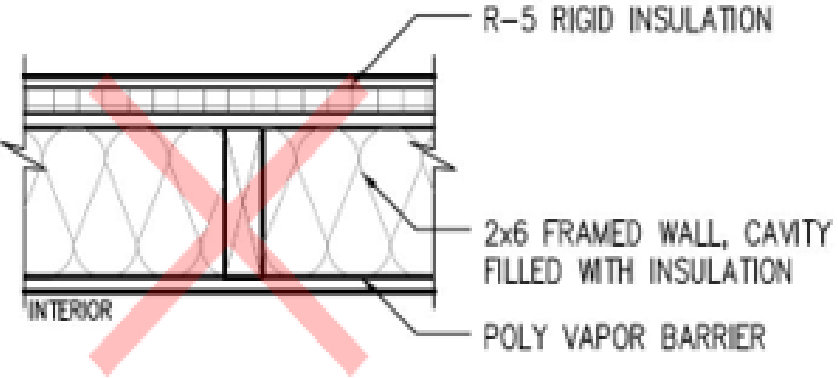
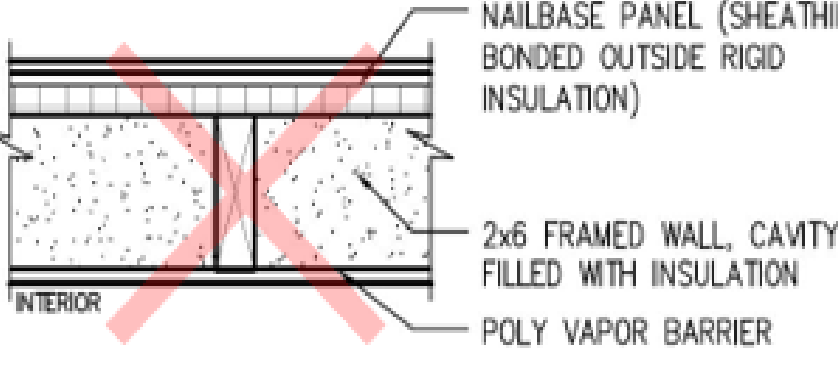
Prescriptive Compliant Wall Assembly Details

 <p>RIGID INSULATION</p> <p>2x6 FRAMED WALL, CAVITY FILLED WITH INSULATION</p> <p>'SMART' VAPOR BARRIER RECOMMENDED</p> <p>INTERIOR</p>	<p>EXTERIOR RIGID INSULATION</p> <ul style="list-style-type: none"> - Relies on <u>sufficient</u> insulation outboard of the sheathing to keep it above the dewpoint in winter; conservative building science suggests targeting minimum 50% of wall's total R-value outside the sheathing - Smart vapor retarder on the inside slows outward vapor drive yet allows inward drying; poly on interior can make this wall riskier - If exterior rigid is fibrous (e.g. fiberboard), wall can dry outwards depending on properties of exterior layers
 <p>1" FIBERBOARD OR MINERAL WOOL INSULATION</p> <p>VAPOR OPEN SHEATHING</p> <p>2x6 FRAMED WALL, CAVITY FILLED WITH INSULATION</p> <p>CLASS 1 OR 2 VAPOR RETARDER</p> <p>INTERIOR</p>	<p>THIN EXTERIOR RIGID INSULATION – VAPOR OPEN</p> <ul style="list-style-type: none"> - Sheathing spends time below dewpoint in winter, but with proper design, it can dry to both sides while resisting outward moisture drive in winter - Poly on interior limits ability of inward drying, and may increase risk
 <p>NAILBASE PANEL (SHEATHING BONDED OUTSIDE RIGID INSULATION), R-6 MIN. TYP., INSTALLED PER MANUF. INSTRUCTIONS</p> <p>2x6 FRAMED WALL, CAVITY FILLED WITH INSULATION</p> <p>'SMART' VAPOR BARRIER RECOMMENDED</p> <p>INTERIOR</p>	<p>NAILBASE PANEL</p> <ul style="list-style-type: none"> - Sheathing may spend time below dewpoint in winter, but likely first condensing surface is the foam; with proper design and attention to detail, it resists outward moisture drive in winter - Smart vapor retarder on the inside slows outward vapor drive yet allows inward drying; poly on interior limits ability of inward drying, and may increase risk - Limited drying potential, so good taping is important to limit air/vapor passing through

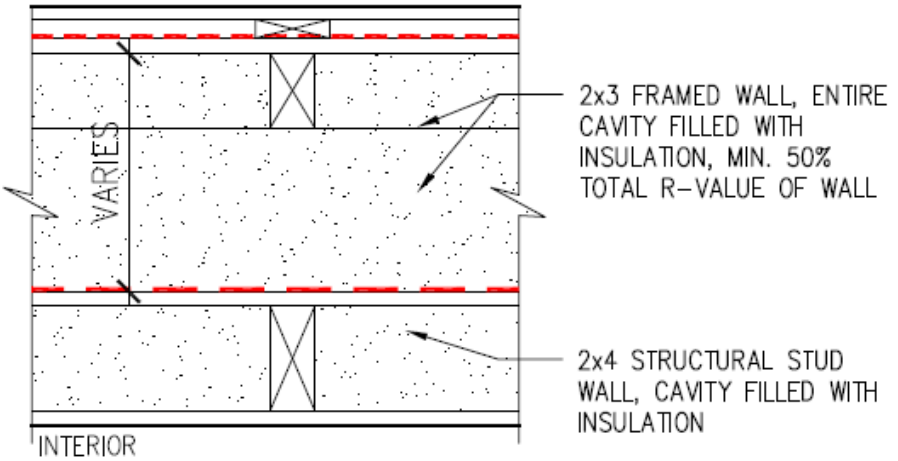
Prescriptive Compliant Wall Assembly Details

 <p>ENTIRE FRAMED CAVITY FILLED WITH INSULATION, R-6 MIN. BETWEEN FRAMING</p> <p>R-6 MIN.</p> <p>INTERIOR</p>	<p>DOUBLE STUD</p> <ul style="list-style-type: none"> - Depending on detailing, wall can dry in one or both directions - Fibrous insulation adds moisture buffering capability - Poly on interior limits ability of inward drying, and may increase risk
 <p>EXTERIOR I-JOIST OR LARSEN TRUSS, CAVITY FILLED WITH FIBROUS INSULATION, TYPICAL 50% TOTAL R-VALUE OF WALL</p> <p>VARIES</p> <p>2x INNER BEARING WALL. OPTIONAL: FILL WITH INSULATION OR LEAVE EMPTY FOR SERVICE CAVITY</p> <p>INTERIOR</p>	<p>TJI OR LARSEN TRUSS</p> <ul style="list-style-type: none"> - Relies on <u>sufficient</u> insulation outboard of the sheathing to keep it above the dewpoint in winter; conservative building science suggests targeting min. 50% of wall's total R-value outside the sheathing - Depending on detailing, wall can dry in one or both directions - Poly on interior limits ability of inward drying, and may increase risk
 <p>SEALANT, SPLINE, INSTALLED PER MANUFACTURER'S INSTRUCTIONS</p> <p>STRUCTURAL INSULATED PANEL (SIP)</p> <p>INTERIOR</p>	<p>SIP</p> <ul style="list-style-type: none"> - If detailed correctly, resists moisture movement and there are no internal condensing surfaces - Panel joints must be detailed correctly to avoid failure; note that timber frames may move over time, breaking essential seals, so taped seams (both interior and exterior) <i>in addition to</i> sealed joints recommended
 <p>2x6 FRAMED WALL, CAVITY FILLED WITH INSULATION</p> <p>INTERIOR</p>	<p>STANDARD 2X6</p> <ul style="list-style-type: none"> - Sheathing spends time below dewpoint in winter, but can dry to the exterior (and interior, if smart vapor retarder used rather than poly)

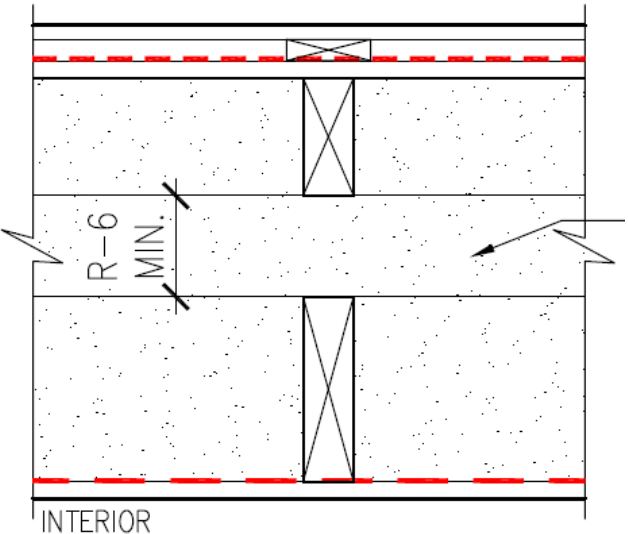
At-Risk Wall Assemblies

 <p>R-5 RIGID INSULATION</p> <p>2x6 FRAMED WALL, CAVITY FILLED WITH INSULATION</p> <p>POLY VAPOR BARRIER</p> <p>INTERIOR</p>	<h3>Thin Exterior Rigid Insulation without Drying</h3> <ul style="list-style-type: none">➤ Insulation isn't thick enough to prevent the sheathing from spending time below the dewpoint in winter➤ Poly prevents drying inwards and most foamboard limits drying outward; if any moisture finds its way into this wall, it cannot dry quickly or easily➤ Also considered a "vapor barrier sandwich"
 <p>NAILBASE PANEL (SHEATHING BONDED OUTSIDE RIGID INSULATION)</p> <p>2x6 FRAMED WALL, CAVITY FILLED WITH INSULATION</p> <p>POLY VAPOR BARRIER</p> <p>INTERIOR</p>	<h3>Nailbase Panel with Poly</h3> <ul style="list-style-type: none">➤ Insulation isn't thick enough to prevent the foam/sheathing from spending time below the dewpoint in winter➤ Poly prevents drying inwards and foam layer prevents limits outward; if any moisture finds its way into this wall, it cannot dry quickly or easily➤ Also considered a "vapor barrier sandwich"

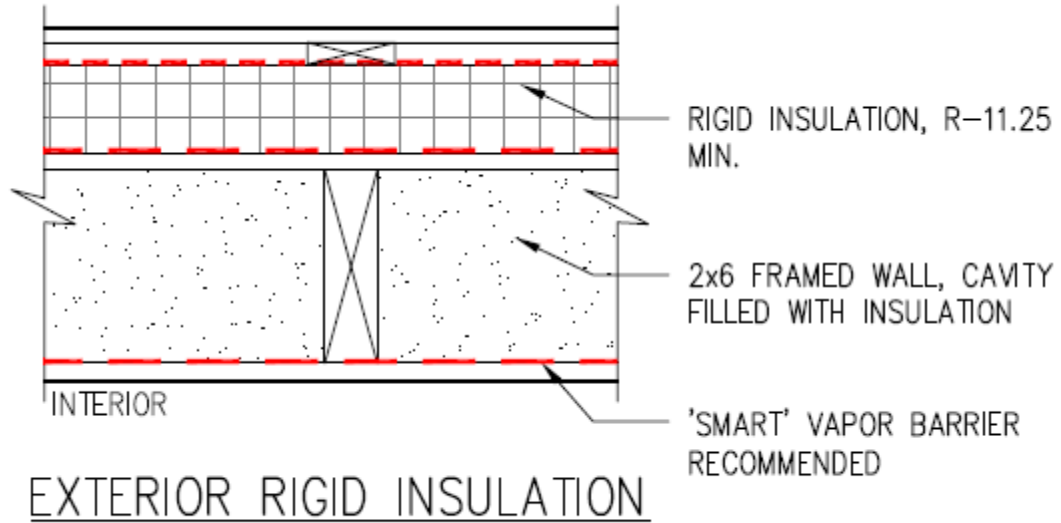
Double Wall



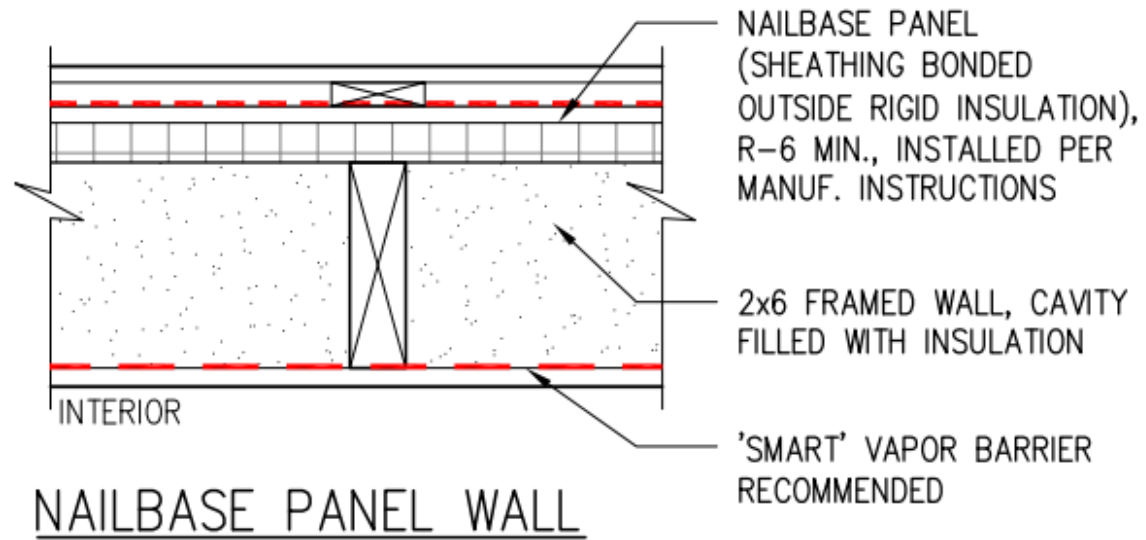
BUILDING SCIENCE DOUBLE WALL



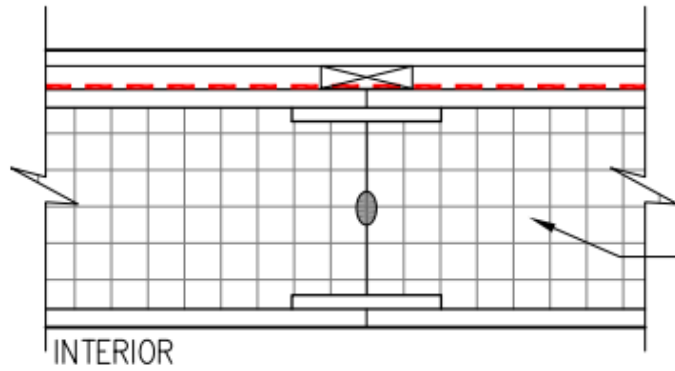
Exterior Rigid



Nailbase panel



SIP



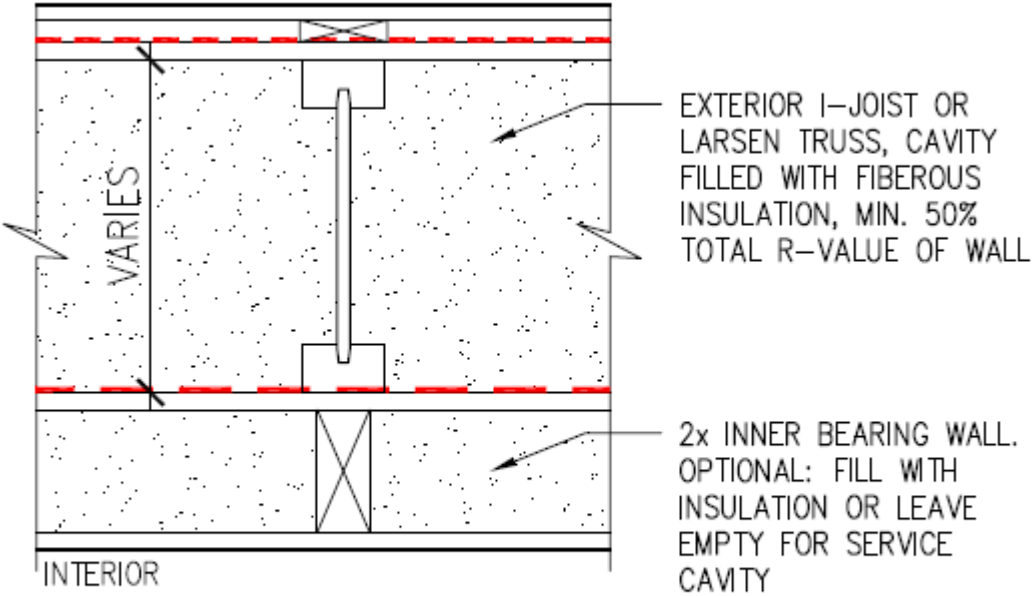
SIPS PANEL, R-22 MIN.,
INSTALLED PER
MANUFACTURER'S
INSTRUCTIONS



STRUCTURAL INSULATED PANEL



Arctic/TJI/Larsen Truss



ARTIC / TJI / LARSEN TRUSS WALL



Arctic/TJI/Larsen truss



Windows –

- **Max. 0.27 – 1 point**
- **Max. 0.25 – 2 points**
- **Max. 0.21 – 3 points**
- **Max. 0.18 – 4 points**

Windows

Triple-pane

Much warmer glass temperature

More North American options now available



Embodied Carbon Emissions in Insulation Materials

Points available for Low GWP intensity in building insulation materials

- Calculate building GWP intensity – **1 point**
- Demonstrate Calculated GWP intensity less than:
 - 0.5kg CO₂e/sq.ft – **2 points**
 - 0.0kg CO₂e/sq.ft. – **3 points**

Carbon drawdown in your next construction project

Choosing insulation materials with the lowest greenhouse gas impact

Embodied carbon refers to the greenhouse gas (GHG) emissions that went into the production of materials. A summary of common insulation materials appears in the table below. Materials that contain carbon and/or require less energy to produce have the lowest (best) GHG impact. At the other end, materials with high-GHG refrigerants tend to have the worst carbon footprint.¹

Material	Example manufacturers / products	GHG Impact ²	Notes
Wood fiber	Steico, Gutex	Lowest / Best	Boardstock, batts
Cellulose	Cleanfiber, GreenFiber	Lowest / Best	Densepack, loosefill
Fiberglass	CertainTeed Sustainable, Knauf EcoBatt	Low	Batts, boardstock, loosefill/densepack
Polyisocyanurate	DuPont Thermax	Low	Boardstock; Blowing agent: pentane
EPS* (expanded polystyrene)	Atlas, BASF Neopor	Low	Boardstock; Blowing agent: pentane
Open cell spray foam	Demilec APX, Lapolla Foam-Lok 450	Low	Site-blown; Blowing agent: water
Phenolic foam	Kingspan Kooltherm	Low	Boardstock; Blowing agent: pentane
Cellular glass	Glavel, Foamglas	Low	Aggregate, boardstock
Mineral wool	Rockwool, Owens Corning	Medium	Batts, boardstock
Closed cell spray foam, HFO	Demilec Heatlok HFO Pro, Lapolla ProSeal HFO	Medium	Site-blown; Blowing agent: HFOs
Next gen. XPS*, HFO/HFC	Owens Corning NGX series, DuPont XPS-ST-100 series	Medium / High	Boardstock; Blowing agent: HFO/HFC blend
Closed cell spray foam, HFC	Demilec Heatlok XT, Dow Froth-Pak	Highest / Worst	Site-blown; Blowing agent: HFCs
XPS*	Dow Styrofoam (blueboard), Owens Corning (pinkboard)	Highest / Worst	Boardstock; Blowing agent: HFCs

Mechanical Ventilation Points Options

- HRV or ERV equipment with ECM fans and $> 80\%$ SRE and $> 1.2\text{cfm/Watt}$
– 1 Point
- Mechanical Ventilation *SYSTEM* tested and commissioned to provide minimum flow rates require by Section R403.6
– 4 Points

Mechanical Ventilation Requirements

Chapter 3

Section R304

Design Criteria for Residential Ventilation Systems

R304.3 Whole House Ventilation – Mandatory

Every home and dwelling unit built to the 2023 RBES shall be mechanically ventilated by a *whole house balanced ventilation system* as defined in Chapter 2 - Definitions.

From Chapter 2 – Definitions:

Balanced Whole House Ventilation System – Balanced systems provide outdoor air for ventilation such that supply and exhaust air quantities are of equal capacity to achieve pressure equalization, such as heat recovery ventilator, and air-to-air heat exchanger or any other system that is designed to provide mechanical supply as well as mechanical exhaust.

R304.1.1 Compliance

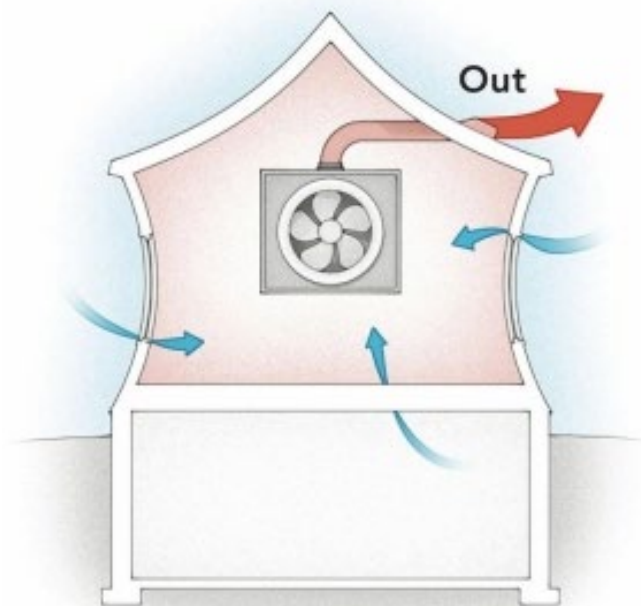
Compliance with Section 304 shall be achieved **by installing a balanced whole house (heat recovery) ventilation system with minimum 75% SRE and 1.2 cfm/watt while** also meeting compliance with Sections 304.2 through 304.11 or demonstrating compliance with one of the following alternatives:

As an alternative to meeting the requirements of **Section R304** by way of the Prescriptive approach, compliance may be demonstrated with one of the following alternatives:

- ASHRAE Standard 62.2-**2019** (Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings)
- ~~BSC Standard 01-2015 (Ventilation for New Low-Rise Residential Buildings)~~
- Passive house ventilation requirements (PHI or PHIUS)

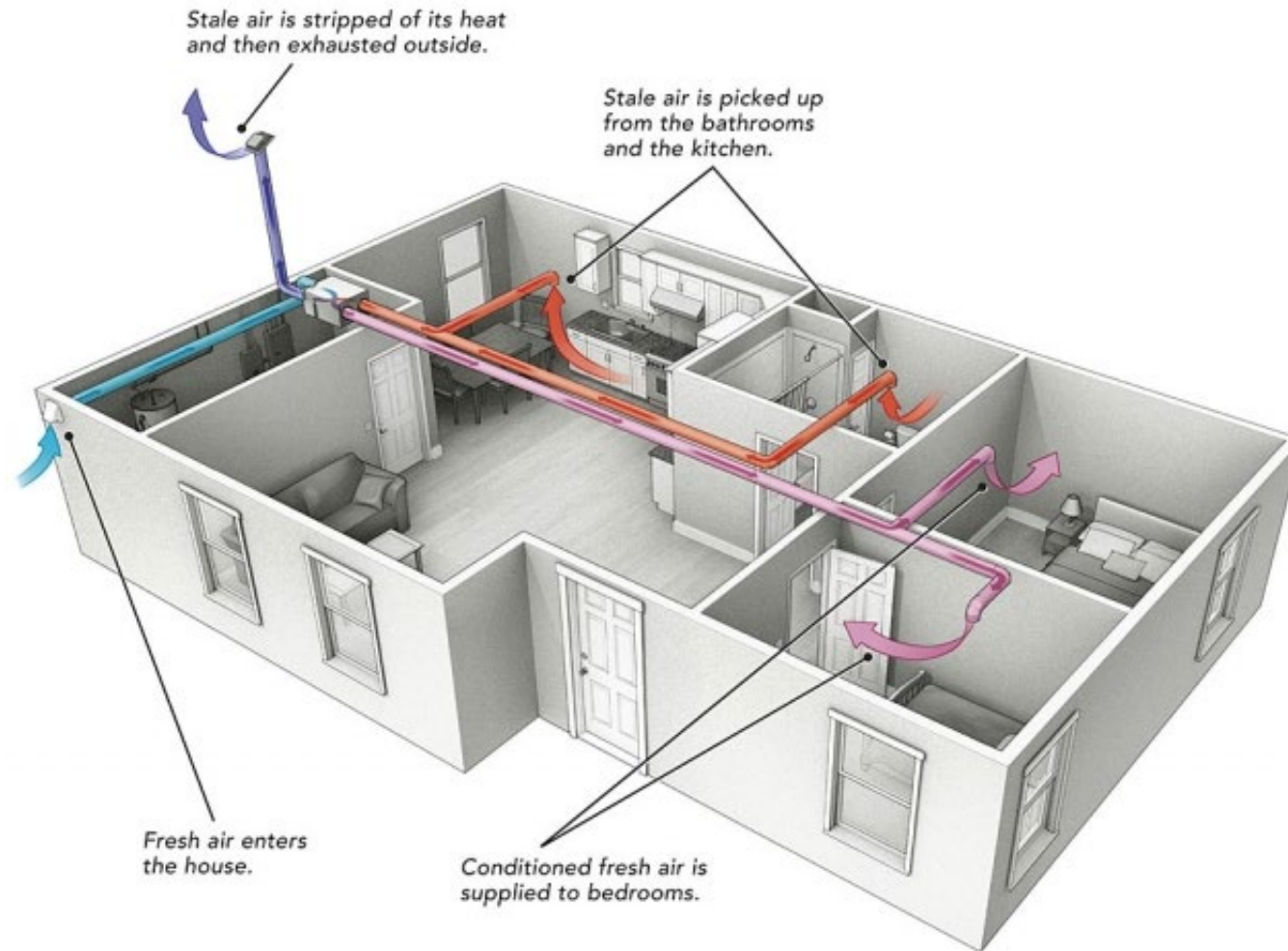
Exhaust-Only Fans Suck – That's their job

And probably ok if your house sucks too - VT RBES no longer allows for houses that suck



Balanced ventilation (HRV/ERV)

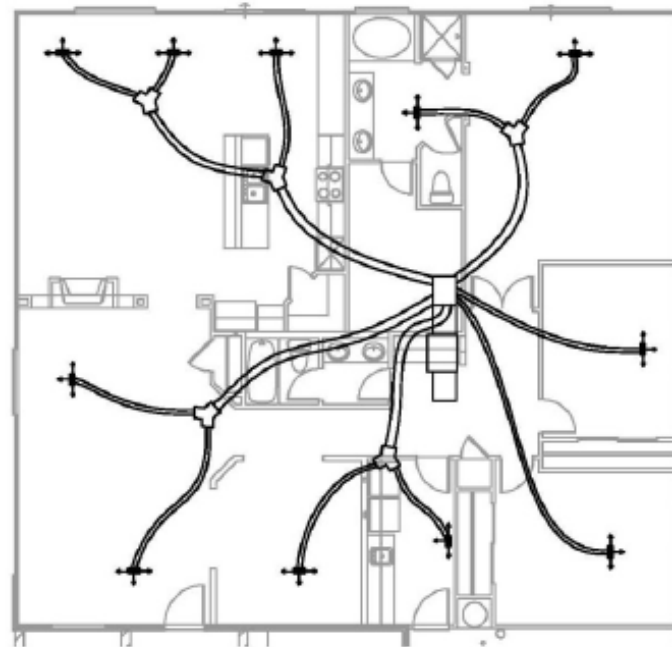
does not suck



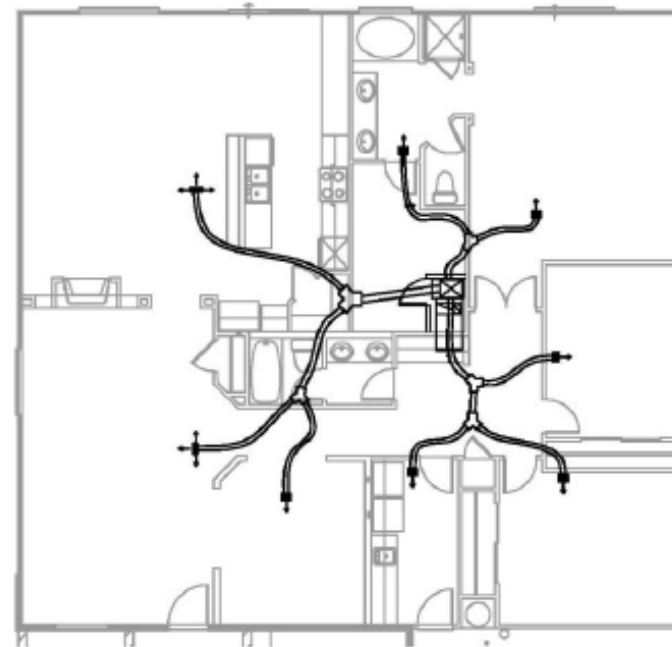
<http://www.greenbuildingadvisor.com/articles/dept/green-building-blog/breathe-easy-balanced-ventilation>

Duct Design is just as important as the ventilation fan

It's just a fancy box without a well planned and installed duct system



TRADITIONAL DUCT DESIGN

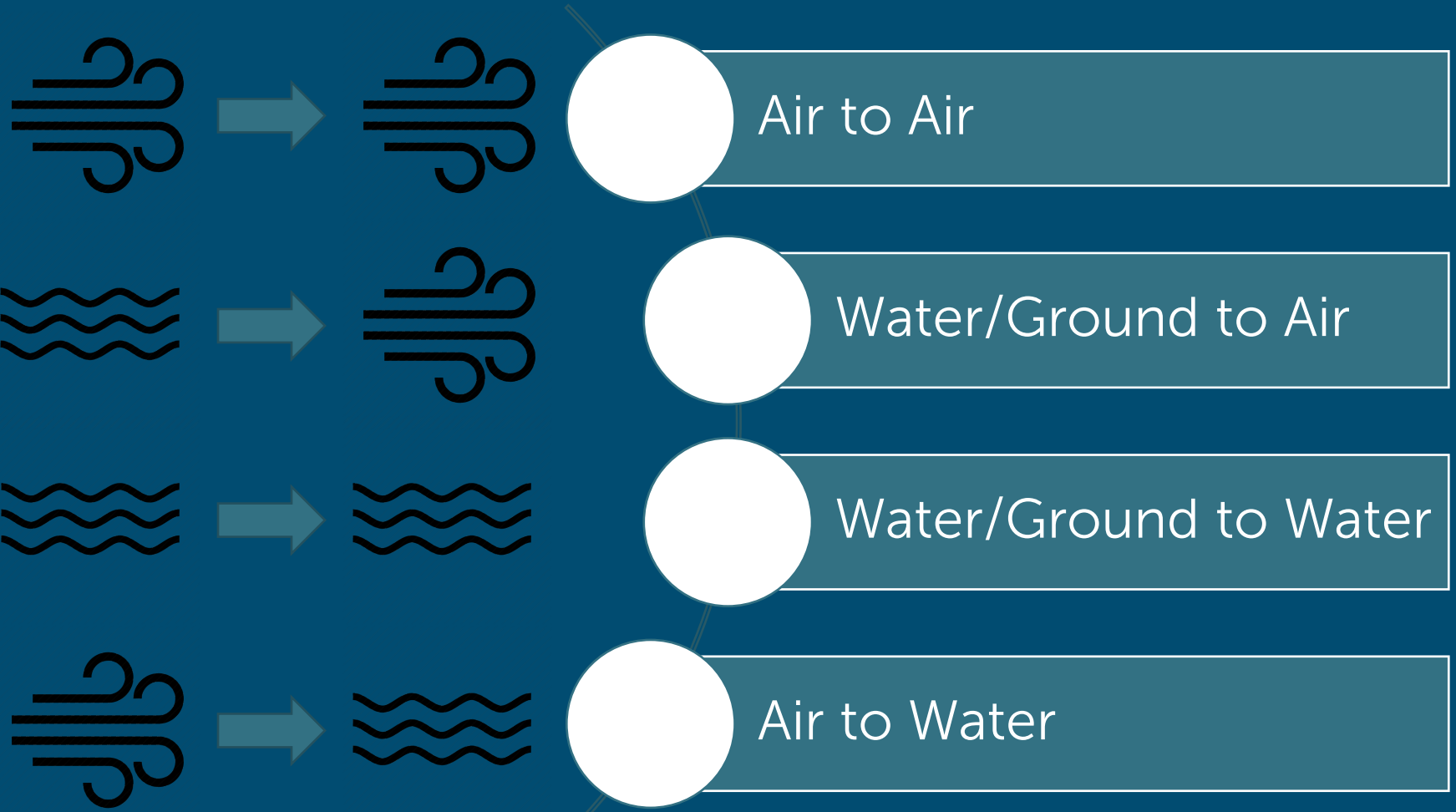


COMPACT DUCT DESIGN

Figure 1. Traditional versus compact duct design

Heating & Cooling –

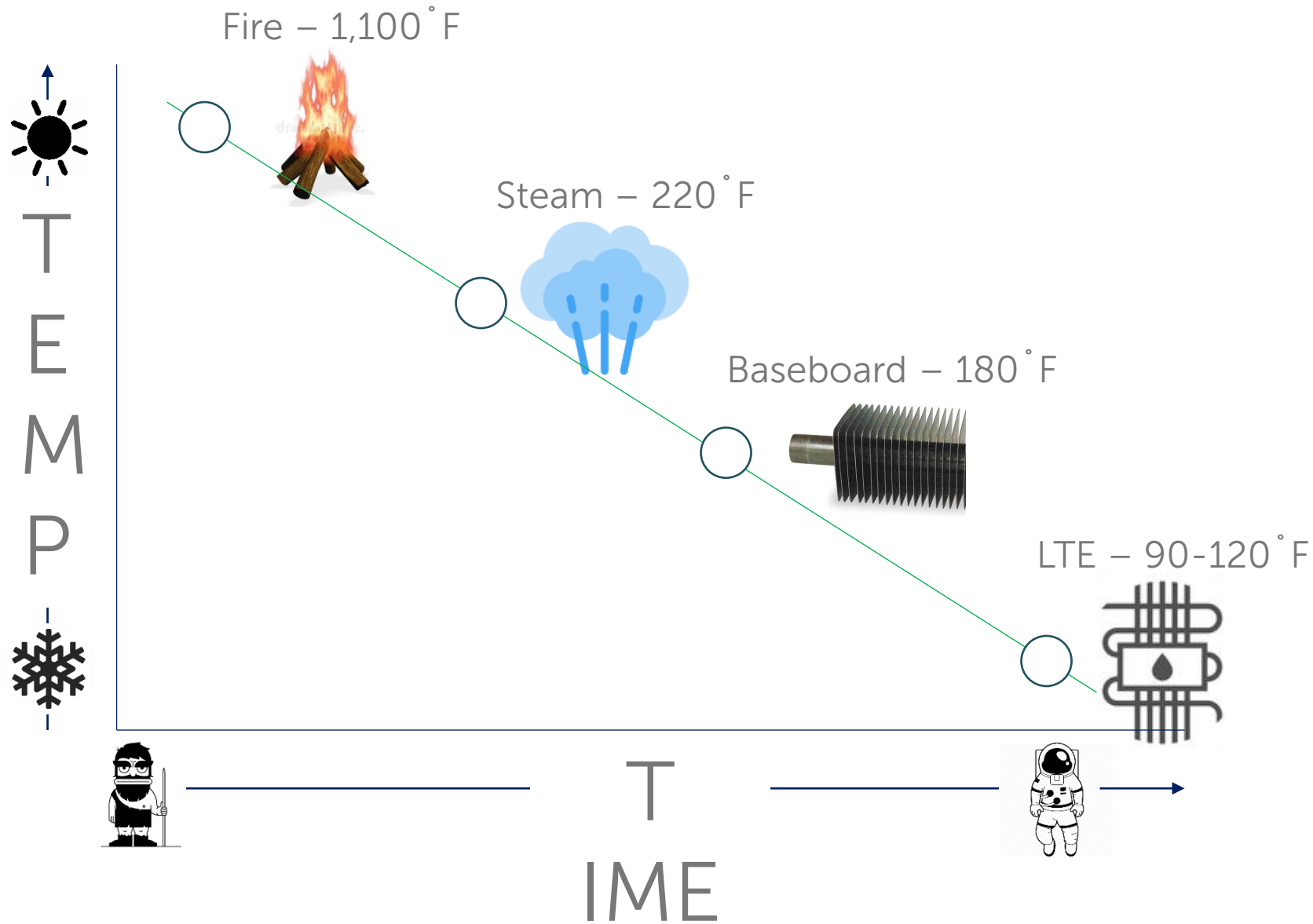
- Energy Star basic NG/LP furnace >95%AFUE – 1 point
- Energy Star basic Oil Furnace >85%AFUE – 1 point
- Energy Star basic NG/LP Boiler >90%AFUE – 1 point
- Energy Star basic Oil Boiler >87%AFUE – 1 point
- Cold Climate ASHP Energy Star V.6 labeled – 5 points
- Ground Source Heat Pump Energy Star labeled – 10 points
- Air to Water Heat Pump COP > 2.5 – 5 points
- Advanced Wood Heat – 5 points



Distribution – Future Proof Your Building

- Distribution should be thought of as **permanent**
- Low temperature (120 degrees and lower for hydronics) distribution is superior
- New Construction – is a no-brainer
- Heat pumps are low temp-delivered heating equipment – which is a good match to current building design loads for code built homes
- Low Temperature (>120degree) hydronic distribution – **1 point**

Distribution Temperature – The future is low



Water Use

Points available for water conservation, efficiency, and heating

- Heat Pump Water Heaters
 - UEF > 2.2 – 3 points
 - UEF > 3.3 – 5 points
- Low-flow water fixtures
 - < 1.75gpm showers/<1.0gpm faucets/<1.28gpm toilets – 1 point
 - Certified WaterSense – 2 points
- Drain Water Heat Recovery – 1 point
- User-demand hot water Re-circ – 1 point
- Pipe Insulation – 1 point
- Demand Response Controls – 1 point
- Point-of-use Electric water heating – 1 point

Renewables

- Solar-ready design – 2 points
 - Base code only
- On-site Solar generation – 1 point per 1.5 KW / max. 4 points
- Solar hot water – 2 points

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Who's got your back?

Efficiency
Vermont



**For additional support and any questions
regarding the application of the Residential
Building Energy Standard:**

Energy Code Assistance Center
20 Winooski Falls Way, 5th Floor
Winooski, Vermont 05404
855-887-0673

Vermont Public Service Department
Efficiency and Energy Resources Division
112 State Street Montpelier VT 05620-2601
802-828-2811

Questions?

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