2021 IECC RE Code Update

William Winkel, ME TPI, HERS Rater

3/25/2025

Agenda

- MUBEC Codes and Standards
- Compliance paths (options)
- Prescriptive Compliance Option
- Air Leakage Testing
- Duct Leakage Testing
- Mechanical Ventilation and Testing
- Electrical Power and Lighting
- Total Building Performance Option
- Energy Rating Index Option
- DOE ZERH and Phius Alternatives
- Additional Efficiency Package Options
- Appendices RB and RC
- Stretch Code

MUBEC Codes and Standards

- Subject to amendments in MUBEC Rules Chapters 1 - 7

EFFECTIVE BEGINNING APRIL 7, 2025 - MUBEC has adopted the following codes and standards:

The International Code Council (ICC) Codes:

- 2021 International Residential Code (IRC)
- 2021 International Building Code (IBC)
- 2021 International Existing Building Code (IEBC)
- 2021 International Energy Conservation Code (IECC)
- 2021 International Mechanical Code (IMC)

The American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Standards:

- 2019 ASHRAE 62.1 (Ventilation for Acceptable Indoor Air Quality)
- 2019 ASHRAE 62.2 (Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings)
- 2019 ASHRAE 90.1 (Energy Standard for Buildings except Low-Rise Residential Buildings) editions without addenda.

American Society of Testing Materials (ASTM)

- E-1465-2008, Standard Practice for Radon Control Options for the Design and Construction of New Low-Rise Residential Buildings.

Maine has adopted the national model codes and standards with amendments. The amendments are listed in Rule Chapters 1-7. Chapters can be found under MUBEC Rules and Laws.

MUBEC Amendments

The amendments are listed in Rule Chapters 1-7 below.

- Chapter 1 - Administration (PDF)
- Chapter 2 -Third Party Inspectors (PDF)
- Chapter 3 - IBC International Building Code (PDF)
- Chapter 4 - IEBC International Existing Building Code (PDF)
- Chapter 5 - IRC International Residential Building Code (PDF)
- Chapter 6 - IECC International Energy Conservation Code (PDF)
- Chapter 7 - IMC Uniform Building and Energy Code - Mechanical Code (PDF)

Compliance Paths (Options)

1. Prescriptive Compliance Option
   - Comply with Sections R401 through R404
   - Install one of the Additional Efficiency Package Options in R408.2
2. Total Building Performance Option
   - Comply with Section R405
   - Install one of the Additional Efficiency Package Options, or
   - Energy cost of the proposed design ≤ 95% of standard reference design
3. Energy Rating Index Option
   - Comply with Section R406
   - ERI ≤ 95% of the ERI target specified in Table R406.5

MUBEC adopted above code alternatives

- DOE Zero Energy Ready Homes certification
- Phius or PassiveHouse certification

R408.2
Additional Efficiency Package Options

Choose one:

1. Enhanced envelope performance option
2. More efficient HVAC option
3. Reduce energy use in service water heating option
4. More efficient thermal distribution system option
5. Improved air sealing with HRV/ERV option

Prescriptive Compliance Option

Can be met in one of three ways

1. Meet the maximum assembly u-factors in Table R402.1.2, or
2. Meet the minimum component R-values in Table R402.1.3, or
3. Meet the Total UA alternative in R402.1.5
   - ResCheck, Ekotrope or REM/Rate
   - Can also be calculated by hand or a spreadsheet
   - Allows for trade offs

- Plus, install one of the Additional Efficiency Package Options
- Comply with Sections R401 through R404

Prescriptive Insulation Requirements by Assembly

Changes from 2015 CZ 6 – 7 and 8

- Fenestration u-factor dropped from 0.32 to 0.30
- Ceiling u-factor dropped from 0.026 to 0.024

TABLE R402.1.2 MAXIMUM ASSEMBLY *U*-FACTORS[a] AND FENESTRATION REQUIREMENTS

CLIMATE ZONE	FENESTRATION *U*-FACTOR[f]	SKYLIGHT *U*-FACTOR	GLAZED FENESTRATION SHGC[d, e]	CEILING *U*-FACTOR	WOOD FRAME WALL *U*-FACTOR	MASS WALL *U*-FACTOR[b]	FLOOR *U*-FACTOR	BASEMENT WALL *U*-FACTOR	CRAWL SPACE WALL *U*-FACTOR
0	0.50	0.75	0.25	0.035	0.084	0.197	0.064	0.360	0.477
1	0.50	0.75	0.25	0.035	0.084	0.197	0.064	0.360	0.477
2	0.40	0.65	0.25	0.026	0.084	0.165	0.064	0.360	0.477
3	0.30	0.55	0.25	0.026	0.060	0.098	0.047	0.091[c]	0.136
4 except Marine	0.30	0.55	0.40	0.024	0.045	0.098	0.047	0.059	0.065
5 and Marine 4	0.30	0.55	0.40	0.024	0.045	0.082	0.033	0.050	0.055
6	0.30	0.55	NR	0.024	0.045	0.060	0.033	0.050	0.055
7 and 8	0.30	0.55	NR	0.024	0.045	0.057	0.028	0.050	0.055

For SI: 1 foot = 304.8 mm.

WALL COMPONENT	CAVITY *R*-value	STUDS, PLATES *R*-value	HEADERS *R*-value
Outside air film	0.25	0.25	0.25
Plywood siding	0.59	0.59	0.59
Continuous insulation	5	5	5
Plywood sheathing	0.83	0.83	0.83
Wood studs	—	4.38	4.38
Cavity insulation	13	—	—
$^1/_2$" gypsum board	0.45	0.45	0.45
Inside air film	0.68	0.68	0.68
Sum of thermal resistance	20.8	12.18	12.18

For SI: 1 inch = 25.4 mm.

Commentary Figure R402.1.2(1)
EXAMPLE OF *U*-FACTOR CALCULATION IN TABLE R402.1.4

Prescriptive Insulation Requirements by component

Changes from 2015 CZ 6 – 7 and 8

- Fenestration u-factor dropped from 0.32 to 0.30
- Ceiling R-value increased from R-49 to R-60

MUBEC changes:

CZ 6, 7 and 8

Wood Frame Wall R-value

30 or 20+10ci or 13+15ci or 0+20ci

~~30 or 20+5ci or 13+10ci or 0+20ci~~

TABLE R402.1.3 INSULATION MINIMUM *R*-VALUES AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION *U*-FACTOR[b, i]	SKYLIGHT[b] *U*-FACTOR	GLAZED FENESTRATION SHGC[b, e]	CEILING *R*-VALUE	WOOD FRAME WALL *R*-VALUE[g]	MASS WALL *R*-VALUE[h]	FLOOR *R*-VALUE	BASEMENT[c,g] WALL *R*-VALUE	SLAB[d] *R*-VALUE & DEPTH	CRAWL SPACE[c,g] WALL *R*-VALUE
0	NR	0.75	0.25	30	13 or 0&10ci	3/4	13	0	0	0
1	NR	0.75	0.25	30	13 or 0&10ci	3/4	13	0	0	0
2	0.40	0.65	0.25	49	13 or 0&10ci	4/6	13	0	0	0
3	0.30	0.55	0.25	49	20 or 13&5ci[h] or 0&15ci[h]	8/13	19	5ci or 13[f]	10ci, 2 ft	5ci or 13[f]
4 except Marine	0.30	0.55	0.40	60	30 or 20&5ci[h] or 13&10ci[h] or 0&20ci[h]	8/13	19	10ci or 13	10ci, 4 ft	10ci or 13
5 and Marine 4	0.30[i]	0.55	0.40	60	30 or 20&5ci[h] or 13&10ci[h] or 0&20ci[h]	13/17	30	15ci or 19 or 13&5ci	10ci, 4 ft	15ci or 19 or 13&5ci
6	0.30[i]	0.55	NR	60	30 or 20+10ci[h] or 13+15ci[h] or 0+20ci	15/20	30	15ci or 19 or 13&5ci	10ci, 4 ft	15ci or 19 or 13&5ci
7 and 8	0.30[i]	0.55	NR	60	30 or 20+10ci[h] or 13+15ci[h] or 0+20ci	19/21	38	15ci or 19 or 13&5ci	10ci, 4 ft	15ci or 19 or 13&5ci

For SI: 1 foot = 304.8 mm.

NR = Not Required.

Above Grade Walls continued

MUBEC added new section R402.2.13 Above grade Walls

R402.2.13.1 IRC Compliance

- Insulation for above grade walls must also show compliance with IRC Section R702.7 Vapor Retarders

R402.2.13.2 Exterior insulation

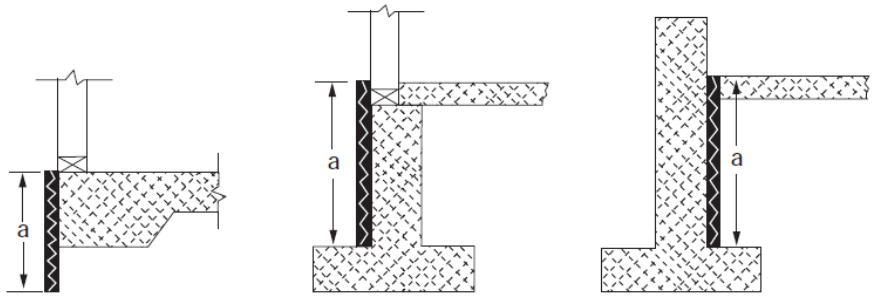
- "Where insulation for above grade walls uses less than R-10ci for exterior insulation, a dew point calculation showing that the temperature of the condensing surface is greater than 41 degrees F at 35% humidity shall be completed by a registered design professional or approved agency and provided to the code official for review."

  Exceptions:

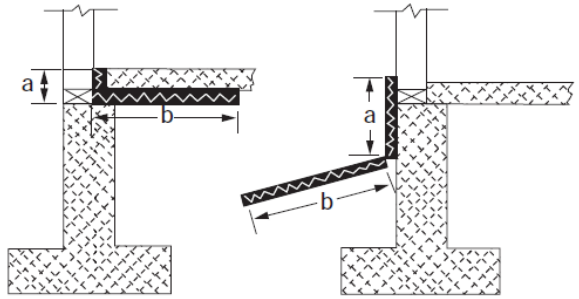
  - Cavity only insulation
  - Wall assembly has a permeability of > 5 perms

Slab on grade requirements

- Floor surface < 12” below grade
- Table R402.1.3 10ci, 4 ft
- Insulation must extend downward from **top** of slab
- Footnote d. clarifies location of additional R-5 for heated slabs
  - Heated slabs,R-5 underslab/R-10 slab edge
  - Heated slab edge insulation not required to extend below the slab



a = insulation depth



a + b = insulation depth

Commentary Figure R402.2.9.1
SLAB INSULATION METHODS

Air Leakage

- Table R402.4.1.1 Air Barrier, Air Sealing and Insulation Installation criteria still required for all compliance options

- R402.4.1.2 Testing required for buildings or dwelling units
  - Testing shall be conducted in accordance with ANSI/RESNET/ICC380, ASTM E779 or ASTM 1827
  - Exception for thermally isolated, heated garages when inspected to meet the requirements of Table R402.4.1.1.

Air Leakage Testing

Maximum air leakage rate = 3.0 ACH50 or 0.20 CFM50 per sf enclosure

Exception:

- Attached single and multiple-family building dwelling units
- Buildings or dwelling units that are 1,500 square feet or smaller

Maximum leakage rate 0.30 CFM50 per sf enclosure

Bulkhead enclosures

MUBEC added new section R402.4.7 Bulkhead enclosures

“Where a bulkhead enclosure is installed for basement access, a wall and vertical door must be installed at the base of the stairs, or where the bulkhead enclosure meets the basement wall, and must be air sealed in accordance with Table R402.4.1.1”

Duct Leakage Testing

- Testing required for all systems regardless of location in building
  - No exception for systems located entirely within the thermal envelope
  - Section R403.3.2 sets conditions for when ductwork is considered inside conditioned space for insulation requirements

- Leakage Limits
  - ≤ 4 CFM/100 sf conditioned floor area with air handler installed
  - ≤ 3 CFM/100 sf conditioned floor area without air handler installed
  - ≤ 8 CFM/100 sf conditioned floor area if ductwork and air handler are located entirely within the thermal envelope (within both the thermal and pressure boundary)
  - Leakage limits do not apply to Total Building Performance Option
  - Leakage limits do not apply to Energy Rating Index Option Option

- Building framing cavities shall not be used as ducts or plenums
- Exception: A duct air-leakage test shall not be required for ducts serving ventilation systems that are not integrated with ducts serving heating or cooling systems.

Mechanical Ventilation

Whole building or dwelling unit ventilation required

- Section M1505 of the 2021 IRC
- The 2021 IMC as applicable (Section 403.3.2)
- ASHRAE 62.2-2019
- Canadian Standard CSA F326
- HRV or ERV required in Climate Zones 7 and 8
- Exhaust only still allowed in CZ 6 (ASHRAE 62.2, IMC and IRC)
- Intermittent ventilation is acceptable for all

Mechanical Ventilation

Whole building or dwelling unit

ASHRAE 62.2-2019

- $Qtot = 0.03A_{floor} + 7.5(N_{br} + 1)$
- Infiltration credit allows for a reduction in required ventilation rate based on blower door test
- Infiltration credit is reduced for unbalanced ventilation
- Allows for additional 20% filtration credit for qualifying particulate filtration

IRC M1505 and IMC

- $Qtot = 0.01A_{floor} + 7.5(N_{br} + 1)$
- Allows for a 30% reduction in the required ventilation rate for:
  - A balanced, ducted system supplying air to each bedroom and to one or more of the following rooms
    - Living room
    - Kitchen
    - Dining room

Mechanical Ventilation

Local ventilation

ASHRAE 62.2-2019

- Kitchen exhaust
  - 100 CFM on demand range hood
  - 300 CFM for downdraft or other
  - 5.0 ACH continuous for enclosed kitchens
- Bathrooms
  - 50 CFM on demand
  - 20 CFM continuous

IRC 1505 and IMC

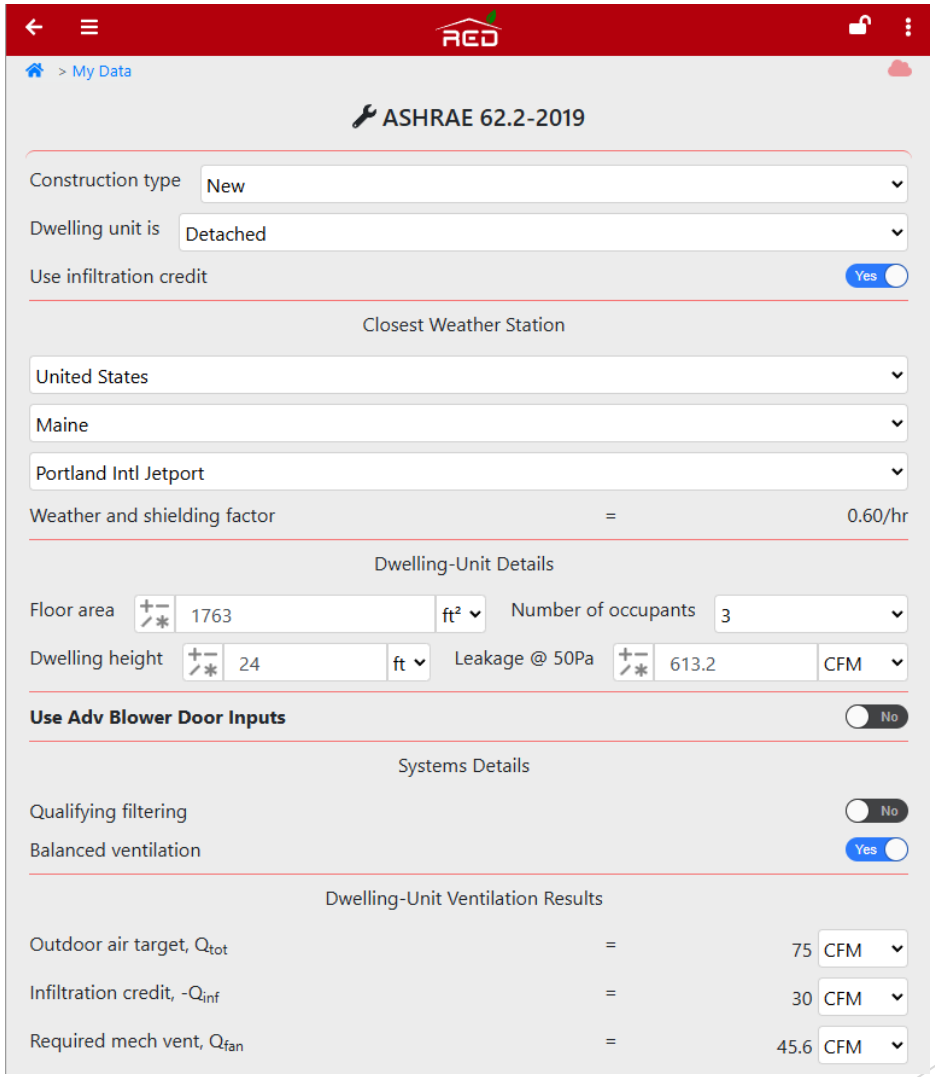
- Kitchen exhaust
  - 100 CFM on demand
  - 25 CFM continuous
- Bathrooms
  - 50 CFM on demand
  - 20 CFM continuous

Mechanical Ventilation

ASHRAE 62.6-2019 Example

$Qtot = 0.03A_{floor} + 7.5(N_{br} + 1)$

- Can apply a credit for infiltration based on CFM50
- Differentiates between balanced and unbalanced ventilation
- Allows for credit for qualifying particulate filtration



Mechanical Ventilation Testing Required

- R403.6.3 Testing - Mechanical ventilation systems shall be tested and verified to provide minimum ventilation rates
  - Required for whole-dwelling and local ventilation systems
  - Exception for kitchen range hoods ducted to outside with 6” or larger duct and not more than one 90° elbow or equivalent
  - Testing shall be performed according to ventilation equipment manufacturer’s instructions, or by using flow hood, flow box, flow grid or other airflow measuring device.

Electrical Power and Lighting

- 100% installed lighting fixtures shall be high efficacy
  - Excluding kitchen appliance lighting
- Exterior lighting for multifamily buildings, not including duplexes or townhouses, must comply with Section C405.4 of the IECC.

  Exceptions:
  - Solar powered lamps not connected to any electrical service
  - Luminaires controlled by a motion sensor
  - Lamps and luminaires that are high efficacy light sources

LIGHT SOURCE	EFFICACY
Lamps, including compact fluorescents, LED, T-8, or smaller-diameter linear fluorescent lamps	≥ 65 lumens per watt
Luminaires	≥ 45 lumens per watt

Interior lighting controls

- Permanently installed light fixtures require dimmers, occupant sensors, or controls built into the fixture

  Exceptions:

  - Bathrooms
  - Hallways
  - Exterior light fixtures
  - Lighting designed for safety or security

Exterior lighting controls

- Where total exterior lighting is > 30 watts, the permanently installed exterior lighting shall comply with the following:
  1. Lighting controlled by manual on/off switch that permits auto-off actions

     Exception: Lighting serving multiple dwelling units
  2. Lighting automatically shuts off when daylight is present and satisfies the lighting needs
  3. An override is allowed but must return to automatic within 24 hours

R405 Total Building Performance Option

Total Building Performance Option

- Uses simulated energy performance modeling usually done by HERS Rater
- Proposed design is compared to a standard reference design built to code
- Energy cost of proposed design must be ≤ standard reference design, plus
  - Install one of the Additional Efficiency Package Options without including such measures in the proposed design, or
  - Energy cost of proposed design ≤ 95% of standard reference design
  - Comply with Table R405.2 listing all requirements from previous sections that must be met
  - The proposed design building envelope must at least meet the efficiency levels of the 2009 IECC as a backstop
- Compliance report is required for permit application – “projected” report
- Compliance report is required for certificate of occupancy – “confirmed report

Total Building Performance

Mandatory Requirements

TABLE R405.2
REQUIREMENTS FOR TOTAL BUILDING PERFORMANCE

SECTION[a]	TITLE
General	
R401.2.5	Additional energy efficiency
R401.3	Certificate
Building Thermal Envelope	
R402.1.1	Vapor retarder
R402.2.3	Eave baffle
R402.2.4.1	Access hatches and doors
R402.2.10.1	Crawl space wall insulation installations
R402.4.1.1	Installation
R402.4.1.2	Testing
R402.5	Maximum fenestration *U*-factor and SHGC
Mechanical	
R403.1	Controls
R403.3, including R403.3.1, except Sections R403.3.2, R403.3.3 and R403.3.6	Ducts
R403.4	Mechanical system piping insulation
R403.5.1	Heated water circulation and temperature maintenance systems
R403.5.3	Drain water heat recovery units
R403.6	Mechanical ventilation
R403.7	Equipment sizing and efficiency rating
R403.8	Systems serving multiple dwelling units
R403.9	Snow melt and ice systems
R403.10	Energy consumption of pools and spas
R403.11	Portable spas
R403.12	Residential pools and permanent residential spas
Electrical Power and Lighting Systems	
R404.1	Lighting equipment
R404.2	Interior lighting controls

R406 Energy Rating Index Option

Energy Rating Index Option

- Uses energy modeling and “rating” by HERS Rater
- Proposed design is compared to a standard reference design built to 2006 IECC
- ERI value ≤ the ERI target specified in Table R406.5, plus
  - The proposed design ERI value must be 5% less to demonstrate additional energy efficiency in accordance with R401.2.5.
  - Comply with Table R406.2 listing all requirements from previous sections that must be met
  - When on-site renewable power is not included, the proposed design ≤ 1.15 x UA of the reference design as a backstop.
  - When on-site renewable power is included, The proposed design building envelope must at least meet the efficiency levels of Table R402.1.2 or table R402.1.4 of the 2018 IECC as a backstop.
- Compliance report is required for permit application – “projected” report
- Compliance report is required for certificate of occupancy – “confirmed” report

Energy Rating Index Option

Buildings complying with ERI path must achieve a 5% lower score than in Table R-406.5

Climate Zone	ERI	Adjusted ERI
1	52	49.4
2	52	49.4
3	51	48.5
4	54	51.3
5	55	52.3
6	54	51.3
7	53	50.4
8	53	50.4

Energy Rating Index

Mandatory Requirements

TABLE R406.2
REQUIREMENTS FOR ENERGY RATING INDEX

SECTION[a]	TITLE
General	
R401.2.5	Additional efficiency packages
R401.3	Certificate
Building Thermal Envelope	
R402.1.1	Vapor retarder
R402.2.3	Eave baffle
R402.2.4.1	Access hatches and doors
R402.2.10.1	Crawl space wall insulation install
R402.4.1.1	Installation
R402.4.1.2	Testing
Mechanical	
R403.1	Controls
R403.3 except Sections R403.3.2, R403.3.3 and R403.3.6	Ducts
R403.4	Mechanical system piping insulation
R403.5.1	Heated water calculation and temperature maintenance systems
R403.5.3	Drain water heat recovery units
R403.6	Mechanical ventilation
R403.7	Equipment sizing and efficiency rating
R403.8	Systems serving multiple dwelling units
R403.9	Snow melt and ice systems
R403.10	Energy consumption of pools and spas
R403.11	Portable spas
R403.12	Residential pools and permanent residential spas
Electrical Power and Lighting Systems	
R404.1	Lighting equipment
R404.2	Interior lighting controls
R406.3	Building thermal envelope

MUBEC adopted above code options

- DOE Zero Ready Homes Option
  - Energy Star SFNH certification
  - Indoor Air Plus certification
  - DOE ZERH certification
  - Compliance documentation can be completed by rater
- Phius or PassiveHouse
  - Energy Star SFNH certification
  - Indoor Air Plus certification
  - DOE ZERH certification
  - Phius Core or Prescriptive certification
  - Compliance documentation from Phius can take several weeks

R408.2
Additional Efficiency Package Options

Choose one:

1. Enhanced envelope performance option
2. More efficient HVAC option
3. Reduce energy use in service water heating option
4. More efficient thermal distribution system option
5. Improved air sealing with HRV/ERV option

Additional Efficiency Package Options

1. Enhance envelope performance option
   - Total building UA ≤ 95% of the standard reference design
   - Area weighted SHGC ≤ 95% of prescriptive SHGC (CZ's 0 – 5 only)
   - Can be calculated on ResCheck – Compliance: 5.0% Better Than Code
   - Can be calculated with Ekotrope or REM/Rate

Additional Efficiency Package Options

2. More efficient HVAC equipment performance option
   - ≥ 95 AFUE gas furnace and 16 SEER AC
   - ≥ 10 HSPF/16 SEER air source Heat pump
   - ≥ 3.5 COP ground source heat pump
   - For multiple systems, all systems must meet the above efficiencies

Additional Efficiency Package Options

3. Reduced energy use in service water heating option
   - ≥ 0.82 EF fossil fuel service water heating system
   - ≥ 2.0 EF electric service water heating system
   - ≥ 0.4 solar fraction water heating system

Additional Efficiency Package Options

4. More efficient thermal distribution system option

- 100% of ducts and air handlers located entirely within the building thermal envelope
- 100% of ductless thermal distribution systems located completely inside the thermal envelope
- 100% of duct thermal distribution systems located in conditioned space as defined by Section R403.3.2

Additional Efficiency Package Options

5. Improved air sealing and efficient ventilation system option
    - Envelope air leakage rate ≤ 3.0 ACH50
    - Install ERV or HRV with
        - ✓ Sensible recovery efficiency ≥ 75%
        - ✓ Fan efficacy ≤ 1.1 W/CFM (changed from 1st Printing)
        - ✓ ERV Latent Recovery/Moisture Transfer (LRMT) ≥ 50%

Appendices (optional)

Appendix RB

Solar-ready Provisions-Detached One- and Two-family Dwellings And Townhouses

+

Section R401.2

Appendix RC

Zero Energy Residential Building Provisions

TABLE RC102.2
MAXIMUM ENERGY RATING INDEX[a]

CLIMATE ZONE	ENERGY RATING INDEX NOT INCLUDING OPP	ENERGY RATING INDEX INCLUDING ADJUSTED OPP (as proposed)
1	43	0
2	45	0
3	47	0
4	47	0
5	47	0
6	46	0
7	46	0
8	46	0

Stretch Code

“The total Building UA for the project, calculated as outlined in R402.1.5, shall exceed the UA requirements by at least 15% over a code compliant project.”