2022 BUILDING ENERGY EFFICIENCY STANDARDS

 FOR SINGLE FAMILY STANDARD BUILDING DESIGN

*Prescriptive Component Package1 for Climate Zone 10, effective Jan 1, 2023*

| **COMPONENT** | **ADDITION FLOOR AREA (SQFT)** | **NEWLY CONSTRUCTED BUILDINGS**  |
| --- | --- | --- |
| **≤ 400** | **> 400 and ≤ 700** | **> 700** |
| **Building Envelope Insulation** | **ROOFS / CEILINGS**  | U = 0.025 / R-38(R-22 for Rafter roof) | U= 0.025 / R-38(R-22 for Rafter roof) | Option **B** or **C**(See Table 9-3 on page 2) | Option **B** or **C**(See Table 9-3 on page 2) |
| **RADIANT BARRIER**2 | REQ | REQ | NOT REQ for option **B**, REQ for option **C**, | NOT REQ for option **B**, REQ for option **C**, |
| **WALLS** | Above grade | Framed3 | U = 0.048 U = 0.077 / R-13U = 0.125 / R-8.0 | U = 0.048U = 0.077 / R-13U = 0.125 / R-8.0 | U = 0.048U = 0.077 / R-13U = 0.125 / R-8.0 | U = 0.048U = 0.077 / R-13U = 0.125 / R-8.0 |
| Mass wall interior4 |
| Mass wall exterior5 |
| Below grade  | Below grade interior6  | U = 0.077 / R-13U = 0.200 / R-5.0 | U = 0.077 / R-13U = 0.200 / R-5.0 | U = 0.077 / R-13U = 0.200 / R-5.0 | U = 0.077 / R-13U = 0.200 / R-5.0 |
| Below grade exterior7 |
| **FLOORS** | Slab perimeter | NRU = 0.037 / R-19U = 0.269 / R-0 | NRU = 0.037 / R-19U = 0.269 / R-0 | NRU = 0.037 / R-19U = 0.269 / R-0 | NRU = 0.037 / R-19U = 0.269 / R-0 |
| Raised |
| Concrete raised |
| **Quality Insulation Installation (QII)** | NR | NR | REQ8 | REQ |
| **Building Envelope** | **ROOFING PRODUCTS**9**(COOL ROOF)** | Low Sloped (< 2:12) | Aged Solar Reflectance, Min. | NRNRNR0.200.7516 | NRNRNR0.200.7516 | NRNRNR0.200.7516 | NRNRNR0.200.7516 |
| Thermal Emittance, Min. |
| Solar Reflectance Index (SRI) |
| Steep Sloped (≥ 2:12): | Aged Solar Reflectance, Min. |
| Thermal Emittance, Min. |
|  | Solar Reflectance Index (SRI) |
| **FENESTRATION**10 | Max. U-factor | 0.300.2375 ft2 or 30% of CFA 60 ft2  | 0.300.23120 ft2 or 25% of CFA60 ft2  | 0.300.23175 ft2 or 20% of CFA70 ft2 or 5% of CFA | 0.300.2320% of CFA5% of CFA |
| Max. SHGC |
| Max. Total Area (whichever is greater) |
| Max. West Facing area11 (whichever is greater) |
| **DOORS**12 | Max. U-factor | 0.20 | 0.20 | 0.20 | 0.20 |
| **HVAC System** | **SPACE HEATING**13 | Electric-Resistance allowed13 | Not Allowed Min.14Min.14 | Not AllowedMin.14Min.14 | Not AllowedMin.14Min. 14 | Not AllowedNot AllowedMin. 14 |
| If Gas, AFUE |
| If Heat Pump, HSPF / HSPF2  |
| **SPACE COOLING**15 | SEER / SEER2  | Min. 14REQNR17 | Min. 14REQNR17 | Min. 14REQNR17 | Min. 14REQREQ17 |
| Refrigerant Charge Verification or Fault Indicator Display16 |
| Whole House Fan17 |
| **CENTRAL SYSTEM AIR HANDLERS** |  Central Fan Integrated Ventilation System Fan Efficacy18 | REQ | REQ | REQ | REQ |
|  **DUCTS**19 | Roof/ceiling options **B** | Duct insulation | R-8NRR-6REQ | R-8NRR-6REQ | R-8NRR-6REQ | R-8NRR-6REQ |
| §150.1(c)9A |
| Roof/ceiling options **C** | Duct insulation |
| §150.1(c)9B |
| **WATER HEATER**20 | Existing water heater  | N/ASee footnote 21See footnote 22See footnote 23 | N/ASee footnote 21See footnote 22See footnote 23 | N/ASee footnote 21See footnote 22See footnote 23 | N/ASee footnote 21N/AN/A |
| New water heater21 |
| A second water heater installed as part of the addition22 |
| Altered or replacement water heater23 |

**Table 9-3: Roof and Ceiling Requirements for Prescriptive Approach Climate Zone 10**

|  |  |  |
| --- | --- | --- |
| **Component** | **Option B** (meets §150.1(c)9A) | **Option C** (meets §150.1(c)9B) |
| Roof Deck Insulation | Below deck insulation1 R-19 | NR |
| Radiant Barrier | NR | REQ |
| Roofing | Tile roof or other product with an air space | Tile roof or other product with an air space |
| Ceiling Insulation  | R-38  | R-30 |
| Duct and Air Handler Location  | Attic  | Conditioned space |
| Notes:1. Below deck insulation are for wood-frame construction with insulation installed in the cavities between the roof framing members.  |

**ABBREVIATIONS:**

AFUE = Furnace Annual Fuel Utilization Efficiency

CFA = Conditioned Floor Area

EF = Energy Factor

HSPF = Heating Seasonal Performance Factor

HSPF2 = Heating Seasonal Performance Factor 2 effective January 1, 2023

HERS = Home Energy Rating System

Max. = Maximum

MIN = Minimum

N/A = Not Applicable

NR = No Requirement

REQ = Required

SEER = Seasonal Energy Efficiency Ratio

SEER2 = Seasonal Energy Efficiency Ratio 2 effective January 1, 2023

SHGC = Solar Heat Gain Coefficient

 **FOOTNOTES:**

1. To comply with Prescriptive Component Package, low-rise residential buildings shall be designed, constructed, and equipped to meet all the requirements of Component Package [per § 150.1(c)].
2. **RADIANT BARRIER** is a highly reflective, low emitting material installed at the underside surface of the roof deck and the inside surface of gable ends or other exterior vertical surfaces in attics to reduce solar heat gain [per § 100.1]. A radiant barrier shall have an emittance of 0.05 or less, tested in accordance with ASTM C1371 or ASTM E408, and shall be certified to the Department of Consumer Affairs [per § 110.8(j)]. The radiant barrier requirement only applies to the new addition roof area. It is not necessary to retrofit a radiant barrier in the existing attic. To meet prescriptive requirement, provide a minimum free ventilation area of 1 ft2 of vent area for each 300 ft2 of attic floor area [RA4.2.1.1].
3. Use 2022 Reference Joint Appendix JA4 Tables 4.3.1 for any wall assembly constructions. The following are typical examples of wood-framed wall assemblies and U-factor that equal to or less than 0.048, assuming ½” Gypsum board interior:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Framing | Stud Spacing | Cavity Insulation | Cavity Insulation Type | Exterior continuous Insulation1 | U-factor |
| 2x4 | 16” OC | R-15 | High density batt | R-10 (2”) | 0.045 |
| 2x6 | 16” OC | R-19 | Low density fiberglass batt | R-7 (1.5”) | 0.046 |
| 2x6 | 16” OC | R-21 | High density batt | R-5 (1”) | 0.048 |
| 2x6 | 24” OC | R-19 | Low density fiberglass batt | R-6 (1.25”) | 0.048 |
| Notes:1. The continuous insulation is typically a rigid polystyrene or polysocyanurate foam insulation. Continuous insulation may be installed on either the inside or the exterior of the wall, or both. |

* **For extension of existing wood-framed walls** may retain the dimensions of the existing walls and shall install cavity insulation of R-15 in a 2x4 framing and R-21 in a 2x6 framing [per § 150.2(a)1.A.iii, § 150.2(a)1.B.iii].
* **When existing siding of a wood-frame wall is not being removed or replaced,** cavity insulation of R-15 in a 2x4 framing and R-21 in a 2x6 framing shall be installed and continuous insulation is not required [per § 150.2(a)1.A.i, § 150.2(a)1.B.vi].

1. Mass wall has a thermal heat capacity ≥ 7.0 Btu/h-ft2. “Interior” denotes insulation installed on the inside surface of the wall.
2. Mass wall has a thermal heat capacity ≥ 7.0 Btu/h-ft2. “Exterior” denotes insulation installed on the exterior surface of the wall.
3. Below grade “interior” denotes insulation installed on the inside surface of the wall.
4. Below grade “exterior” denotes insulation installed on the outside surface of the wall.
5. **Quality Insulation Installation (QII) Requirements:**

For **additions > 700 ft2** that consist of the conversion of existing unconditioned spaces to conditioned space do not require to perform the following as part of QII: existing window and door headers are not required to be insulated and air sealing is not required when existing air barrier is not removed or replaced [per § 150.2 (a) Exception 7 item 1.A.iv].

1. **Cool Roof** **Requirements:**

Roofing Product’s thermal emittance and 3-year aged solar reflectance shall be labeled and certified by the Cool Roof Rating Council (CRRC) [Per § 110.8(i)1.

* For **addition ≤ 300 ft2** cool roof compliance is not required [Per § 150.2(a) Exception 1].
* For **new roofing:** must meet Prescriptive Component Package [per § 150.1(c)11].
* For **alteration to existing roofing (reroofing):** Replacement of existing roofing, including adding a new surface layer on top of existing roofing more than 50% of the roof, the following is required [Per § 150.2(b)1.I]:
1. **For steep-sloped roofs (≥ 2:12):**

Minimum aged solar reflectance = 0.20 and minimum thermal emittance = 0.75, or minimum Solar Reflectance Index (SRI) = 16. [Per § 150.2(b)1.I.i]

*Exceptions:*

1. Buildings with ceiling assembly U-factor ≤ 0.025 or at least R-38 ceiling insulation; or
2. Buildings with a radiant barrier in the attic, where the radiant barrier is not installed directly above space sheathing, meeting the requirements of Energy Standards Section 150.1(c)2; or
3. Buildings that have no ducts in the attic; or
4. Building with R-2 or greater continuous insulation above or below the roof deck; or
5. Roof area covered by building integrated photovoltaic panels or solar thermal panels; or
6. Roof constructions with a weight of at least 25 lbs/ft2.
7. **For low-sloped roofs (< 2:12):**
8. Minimum aged solar reflectance = 0.63 and minimum thermal emittance = 0.75, or minimum Solar Reflectance Index (SRI) = 75 [per § 150.2(b)1.I.ii(a)].

*Exceptions:*

1. The aged solar reflectance can be met using R-16 roof deck continuous insulation for climate zone 10 per in Table 150.2-B, or
2. Roof area covered by building integrated photovoltaic panels or solar thermal panels; or
3. Roof constructions with a weight of at least 25 lbs/ft2.
4. Roofs shall be insulated with R-14 continuous insulation above roof deck or roof assembly U-Factor = 0.039 (R-11 cavity insulation below the roof deck, wood framing at 24” o.c.). [Per § 150.2(b)I.ii.b & Table 150.2-C].

*Exceptions:*

* 1. Existing roofs with R-10 or greater continuous insulation above or below the roof deck; or
	2. Existing roofs with an assembly U-Factor ≤ 0.056 or insulated with R-19 min. insulation between the roof rafters and in contact with the roof deck.
	3. The R-14 continuous insulation may be reduced to R-4 where the following conditions are met:

Mechanical equipment is located on the roof and will not be temporarily disconnected and lifted as part of the roof replacement and the addition of insulation would not reduce the height from the roof surface to top of the base flashing to less than the manufacturer’s installation instruction.

Replace roofing abuts sidewall or parapet walls and the addition of insulation would not reduce the height from the roof surface to top of the base flashing to less than the manufacturer’s installation instruction, provided that the following conditions apply:

* + - 1. The sidewall or parapet walls are finished with an exterior cladding material other than the roof covering membrane material; and
			2. The sidewall or parapet walls have exterior cladding material that must be removed to install the new roof covering membrane to maintain the minimum base flashing height; and
			3. The ratio of the replaced roof area to the linear dimension of affected sidewall or parapet walls is less than 25 sqft/ft; or
	1. The R-14 continuous insulation may be reduced where increasing the thickness above deck insulation would reduce the flashing around an existing exterior wall opening below what is permitted by the fenestration or door manufacturer’s installation instructions or register design professional’s approved flashing design.
	2. Tapered insulation with thermal resistance less than prescribed at the drains and other low points may be used provided that the thickness of insulation is increased at the high points of the roof so that the average thermal resistance equals or exceed the required value.
1. **Fenestration products** (e.g., windows, glazed doors, and skylights) shall be labeled and certified for the U-factor and Solar Heat Gain coefficient (SHGC).
* **For new fenestration:** Must meet Prescriptive Component Package, exceptions:
* Up to 3 sqft of new glazing area installed in doors do not have to meet the U-factor and SHGC [per § 150.1(c)3A exception 1].
* Up to 3 sqft of new tubular skylights area with dual-pane diffusers do not have to meet the U-factor and SHGC [per § 150.1(c)3A exception 1].
* Up to 16 sqft of new skylight area with maximum U-factor = 0.55 and SHGC = 0.30 [per § 150.1(c)3A exception 2].
* Up to 30 sqft of dual-glazed greenhouse or garden windows is exempt from the maximum U-factor requirements [per § 150.(q)1 exception 2].
* **For alteration fenestration:**
1. **For replacement fenestration:**
* Vertical fenestration replacement up to 75 sqft with maximum U-factor = 0.40 and SHGC = 0.35 [per § 150.2(b)1B exception 1].
* Skylight replacement with maximum U-factor = 0.55 and SHGC = 0.30 [per § 150.2(b)1B exception 2].
1. **For alterations that add vertical fenestration & skylight:**
* **Over 75 sqft:** Must meet Prescriptive Component Package and required to meet the total fenestration area and west facing fenestration area [per § 150.2(b)1].
* **Up to 75 sqft:** Must meet Prescriptive Component Package and not required to meet the total fenestration area and west facing fenestration area [per § 150.2(b)1A exception 1].
* **Up to 16 sqft skylight:** With maximum U-factor = 0.55 and SHGC = 0.30 and not required to meet the total fenestration area and west facing fenestration area [per § 150.2(b)1A exception 2].
* **For repair fenestration:** Glass replaced in an existing sash and frame are considered repairs. The replacement is at least equivalent to the original in performance [per § 150.2(b)1B note].
1. West-facing fenestration area includes skylights tilted to the west or tilted in any direction when the pitch is less than 1:12 [per § 150.1(c)3B & C].
2. Installed swinging door separating conditioned space from outside or adjacent unconditioned space shall have max. U-factor 0.20 (R-5 insulated door) [per § 150.1(c)5]. Glazed doors are an exterior door having a glazed area ≥ 25% of the area of the door, treated the same as windows and must meet the U-factor and SHGC requirements for windows. When doors have < 25 % glazing material, it is considered an opaque door and is subject to the door U- requirements [per § 100.1]. Swinging doors between the garage and conditioned space that are required to have fire protection are not required to meet the prescriptive U-factor requirement of 0.20 [per § 150.1(c)5 exception].
3. **Space-heating requirements:**

Setback thermostats must be installed with all unitary heating or cooling system that allows to program the temperature set points for at least four periods within 24 hours except for gravity gas wall heaters, gravity floor heaters, gravity room heaters, room air conditioners, and air conditioner heat pump [per § 110.2(c)1]. The heating system capacity must be adequate to meet the minimum requirements of CRC 303.9. **A supplemental heating unit** may be installed in a space served directly or indirectly by a primary heating system, provided that the unit thermal capacity does not exceed 2 kW or 7,000 Btu/hr and is controlled by a time-limiting device not exceeding 30 minutes [per § 150.1(c)6 exception].

* **For a new or replacement space-heating system serving an addition** may be a heat pump or gas heating system [per § 150.2(a) exception 7].
* **For altered or replacement space-heating systems** shall not use electric resistance as the primary heat source [per § 150.2(b)1G], exceptions:
1. When replacing a ducted electric resistance space-heating system, electric resistance is NOT allowed, but a non-ducted electric resistance space-heating system is allowed as an exception.
2. When replacing a ducted electric resistance space-heating system, if the existing space-heating system is electric resistance and a ducted space-cooling system is not being replaced or installed, an electric resistance space-heating system is allowed.
3. Space heating and space cooling equipment shall comply with minimum appliance efficiency regulations [per § 150.1(c)7]. See attachment Quick Reference by Energy Code Ace *“Residential Space Heating/Cooling and Water Heating Equipment Minimum Efficiencies”*.
4. Ducted forced air systems must comply with the minimum system airflow rate of ≥ 350 CFM/ton, or ≥ 250 CFM/ton for small duct high velocity system when performing the refrigerant charge verification (RCV). [per § 150.1(c)7A.i.b]
5. **Space-cooling requirements:**

Setback thermostats must be installed with all unitary heating or cooling system that allows to program the temperature set points for at least four periods within 24 hours except for gravity gas wall heaters, gravity floor heaters, gravity room heaters, room air conditioners, and air conditioner heat pump [per § 110.2(c)1].

* **For altered space-conditioning system-mechanical cooling:** Air-cooled air conditioners and air-source heat pumps (including but not limited to ducted split systems, ducted packaged systems, small duct high-velocity, and mini-split systems) requires the installation of Measurement Access Holes (MAH) [per § 150.1(c)7A.i.a], Refrigeration Charge Verification (RCV), and minimum system airflow verification [per § 150.2(b)1F]. The minimum system airflow installation and RCV must be performed by the installer and/or HERS Rater. The alternative to RCV by a HERS Rater is the installation of a refrigerant Fault Indicator Display (FID). When installing a FID, the installer must still performed a RCV. Packaged systems for which the manufacturer has verified correct system refrigerant charge prior to shipment from the factory are not required to confirm refrigerant charge through field verification and diagnostic testing [per § 150.2(b)1.F.ii.b].
1. **Ventilation cooling requirements:**

**Whole House Fan (WHF)** is required for new single-family homeswhen using prescriptive compliance [per § 150.1(c)12] and **new dwelling units that are additions to existing building** including Accessory Dwelling Units (**ADU**) [per 150.2(a)1C]. New dwelling units ≤ 500 ft2 shall not be required to comply with WHF requirements [per § 150.1(c)12 exception]. Additions ≤ 1,000 ft2are exempt from the ventilation cooling (WHF) requirements [per § 150.2(a) exception 5]. Junior accessory dwelling unit (**JADU**) that are additions to an existing building are also exempt [per 150.2(a)1C]. Whole House Fan must be capable of minimum total airflow 1.5 cfm/ft2 of conditioned floor area and have at least 1 ft2 of attic vent free area for each 750 CFM air flow OR as per manufacturer’s specifications except WHF’s that are directly vented to the outside [per § 150.1(c)12B]. Only WHFs that are listed in the Home Ventilating Institute (HVI) Certified Products Directory may be installed [per § 150.1(c)12A]. Field verification and diagnostic testing of airflow performance by a HERS rater is required.

1. **Central Fan Integrated (CFI) Ventilation** **Systems requirements:**

Gas furnace air-handling units shall have fan efficacy ≤ 0.45 watt/cfm, air-handling units that are not gas furnaces shall have fan efficacy ≤ 0.58 watt/cfm, and small-duct high velocity air-handling units shall have fan efficacy ≤ 0.62 watt/cfm [per § 150.1(c)10]. The airflow and watt draw must be field verified and diagnostic tested by a HERS rater [per § 150.1(c)10].

1. **Duct system requirements:**

REQ denotes location of duct and air handler in conditioned space and HERS verification is required.

Duct sealing must be field verified by HERS rater and diagnostic tested for duct leakage. If a house has no air distribution ducts, then Sealed Duct System testing is not required. The system shall be provided with 2” minimum MERV-13 air filter [per § 150.0(m)12C].

* **For an entirely new or complete replacement duct systems:** duct sealing and HERS verification is required [per § 150.2(b)1C].
* **For altered duct systems:**
* Alterations including the installation or replacement of air handler, outdoor condensing unit of a split system air conditioner or heat pump, or cooling or heating coil, the duct system shall be sealed and verified by HERS rater [per § 150.2(b)1E]. Refrigerant charge measurement or Fault Indicator Display installation is required for installation or replacement of ducted split systems, ducted package systems, small duct high velocity air systems, and mini split systems and must be verified by HERS rater [per § 150.2(b)1Fii]. The replacement unit must meet or exceed appliance efficiency standards.
* When more than 25 feet of new or replacement ducts, the duct sealing and HERS verification is required [per § 150.2(b)1D].

*Exceptions:* Duct sealing is not required for duct system with less than 40 linear feet, or existing duct systems constructed, insulated, or sealed with asbestos [per § 150.2(b)1E exceptions 2 & 3].

* **For extension of existing duct system:**

If the new ducts are extension of an existing ducts system, the combined new and existing duct shall meet HERS duct testing leakage rate of 10% or 7% for HERS duct leakage to outside [per § 150.2(b)1D.ii.b].

1. Water heaters shall meet the minimum Uniform Energy Efficiency (UEF) requirements [per § 110.3(b), § 110.1]. See attachment Quick Reference by Energy Code Ace *“Residential Space Heating/Cooling and Water Heating Equipment Minimum Efficiencies”*.
2. **Prescriptive Water Heating Requirements** for newly constructed single dwelling units [per § 150.1(c)8]:
3. A single 240 volt heat pump water heater (HPWH) with storage tank located in the garage or conditioned space; or
4. A single 240 volt heat pump water heater (HPWH) that meet the requirements of NEEA Advanced Water Heater Specification Tier III or higher; or
5. A solar water-heating system with electric battery backup and a minimum 0.7 Solar Saving Fraction (SSF).

*Exceptions:*

1. New dwelling units ≤ 500 ft2 CFA with point of use distribution may have instantaneous electric water heater; or
2. New dwelling units with 1 bedroom or less may use 120 volt heat pump water heater (HPWP).
3. **When a second water heater is installed as part of the addition,** one of the following types of water heaters shall be installed [per § 150.2(a)1D]:
4. A single heat pump water heater (HPWH). The storage tank shall not be located outdoors and shall be place on an incompressible, rigid insulated surface with a minimum thermal resistance of R-10, and meet the applicable demand responsive control requirements; or
5. A single 240 volt heat pump water heater (HPWH) that meet the requirements of NEEA Advanced Water Heater Specification Tier III or higher; or
6. A gas or propane instantaneous water heater with an input of 200,000 Btu per hour or less and no storage tank; or
7. An instantaneous electric water heater with point of use distribution for additions ≤ 500 ft2; or
8. A water-heating system determined by the executive director to use no more energy than the one specified in items a – d above.
9. **For** **altered or replacement water heater** shall meet one of the following [per § 150.2(b)1.H.iii]:
10. A natural gas or propane water-heating system; or
11. A single heat pump water heater (HPWH). The storage tank shall not be located outdoors and placed on an incompressible, rigid insulated surface with a minimum thermal resistance of R-10, and meet the applicable demand responsive control requirements; or
12. A single 240 volt heat pump water heater (HPWH) that meet the requirements of NEEA Advanced Water Heater Specification Tier III or higher; or
13. A consumer electric water heater if the existing water heater is an electric resistance water heater; or
14. A water-heating system determined by Executive Director to use no more energy than the one specified in item b or d above.