



2019 BUILDING ENERGY EFFICIENCY STANDARDS FOR SINGLE FAMILY STANDARD BUILDING DESIGN

Prescriptive Component Package¹ for Climate Zone 10

COMPONENT			ADDITION FLOOR AREA (SQFT)			
			≤ 400	> 400 and ≤ 700	> 700	
Building Envelope Insulation	-ROOFS / CEILINGS		R-30 (R-22 for Rafter roof)	R-30 (R-22 for Rafter roof)	Option B or C (see Table 9-3 on page 2).	
	-RADIANT BARRIER²		REQ	REQ	REQ for option C, NOT REQ for option B	
	-WALLS	Above grade	Framed ³	U = 0.048	U = 0.048	U = 0.048
			Mass wall interior ⁴	U = 0.077 / R-13	U = 0.077 / R-13	U = 0.077 / R-13
			Mass wall exterior ⁵	U = 0.125 / R-8.0	U = 0.125 / R-8.0	U = 0.125 / R-8.0
		Below grade	Below grade interior ⁶	U = 0.077 / R-13	U = 0.077 / R-13	U = 0.077 / R-13
		Below grade exterior ⁷	U = 0.200 / R-5.0	U = 0.200 / R-5.0	U = 0.200 / R-5.0	
-FLOORS	Slab perimeter		NR	NR	NR	
	Raised		U = 0.037 / R-19	U = 0.037 / R-19	U = 0.037 / R-19	
	Concrete raised		U = 0.269 / R-0	U = 0.269 / R-0	U = 0.269 / R-0	
Quality Insulation Installation (QII)			NR	NR	REQ ⁸	
Building Envelope	ROOFING PRODUCTS⁹	Low Sloped (< 2:12)	Aged Solar Reflectance	NR	NR	NR
			Thermal Emittance	NR	NR	NR
		Steep Sloped (≥ 2:12):	Aged Solar Reflectance	0.20	0.20	0.20
			Thermal Emittance	0.75	0.75	0.75
	FENESTRATION¹⁰	Max. U-factor		0.30	0.30	0.30
Max. SHGC		0.23	0.23	0.23		
Max. Total Area (whichever is greater)		75 ft ² or 30% of CFA	120 ft ² or 25% of CFA	175 ft ² or 20% of CFA		
Max. West Facing area ¹¹ (whichever is greater)		60 ft ²	60 ft ²	70 ft ² or 5% of CFA		
DOORS¹²	Max. U-factor		0.20	0.20	0.20	
HVAC System	Electric-Resistant Allowed		No	No	No	
	SPACE HEATING¹³	If Gas Central Furnace <225,000 Btuh	Weatherized unit, min. AFUE =	81%	81%	81%
			Non-weatherized unit, min. AFUE =	80%	80%	80%
		If Heat Pump, single phase air source <65,000 Btuh	Single Package System, min. HSPF =	8.0	8.0	8.0
			Split System, min. HSPF =	8.2	8.2	8.2
	SPACE COOLING	Central Air Conditioner ¹⁴ :	Split System <45,000 Btuh	14.0 SEER / 12.2 EER	14.0 SEER / 12.2 EER	14.0 SEER / 12.2 EER
			Split System ≥45,000 and <65,000 Btuh	14.0 SEER / 11.7 EER	14.0 SEER / 11.7 EER	14.0 SEER / 11.7 EER
			Single Package System <65,000 Btuh	14.0 SEER / 11.0 EER	14.0 SEER / 11.0 EER	14.0 SEER / 11.0 EER
		Refrigerant Charge Verification or Fault Indicator Display ¹⁵		REQ	REQ	REQ
	Whole House Fan ¹⁶		NR	NR	NR	
CENTRAL SYSTEM AIR HANDLERS	Central Fan Integrated Ventilation System Fan Efficacy ¹⁷		REQ	REQ	REQ	
DUCTS¹⁸	Roof/ceiling options B	Duct insulation	R-8	R-8	R-8	
		§150.1(c)9A	NR	NR	NR	
	Roof/ceiling options C	Duct insulation	R-6	R-6	R-6	
		§150.1(c)9B	REQ	REQ	REQ	
WATER HEATER²²	Existing water heater		N/A	N/A	N/A	
	New water heater ¹⁹		See footnote 19	See footnote 19	See footnote 19	
	A second water heater installed as part of the addition ²⁰		See footnote 20	See footnote 20	See footnote 20	
	Altered or replacement water heater ²¹		See footnote 21	See footnote 21	See footnote 21	

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

	Option B (meets §150.1(c)9A)	Option C (meets §150.1(c)9B)
Roof Deck Insulation	Below deck insulation ¹ R-19	None required.
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
- HERS = Home Energy Rating System
- Min. = Minimum
- N/A = Not Applicable
- NR = Not Required
- REQ = Required
- SEER = Air Conditioner Seasonal Energy Efficiency Ratio
- 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.
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. 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. 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. If existing roof sheathing over an attic space is being replaced, a continuous radiant barrier must be installed. To meet prescriptive requirement, provide a minimum free ventilation area of 1 ft² of vent area for each 150 ft² of attic floor area. A minimum 1” air space must be provided between the insulation and the roof sheathing and at the location of vents.
3. Use 2019 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 Gypsum board interior:

Framing	Stud Spacing	Cavity Insulation	Cavity Insulation Type	Exterior continuous Insulation ¹	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.

- **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.
4. Mass wall has a thermal heat capacity ≥ 7.0 Btu/h-ft². “Interior” denotes insulation installed on the inside surface of the wall.
 5. Mass wall has a thermal heat capacity ≥ 7.0 Btu/h-ft². “Exterior” denotes insulation installed on the exterior surface of the wall.
 6. Below grade “interior” denotes insulation installed on the inside surface of the wall.
 7. Below grade “exterior” denotes insulation installed on the outside surface of the wall.
 8. For **additions > 700 sqft** 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.
 9. For **addition ≤ 300 ft²** cool roof compliance is not required. Roofing Product’s thermal emittance and 3-year aged solar reflectance shall be labeled and certified by the Cool Roof Rating Council (CRRC).
 - **For new roofing:** must meet Prescriptive Component Package.
 - **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:
 - a) **For low-sloped roof (< 2:12):** Cool Roof is not required for climate zone 10.
 - b) **For steep sloped roof ($\geq 2:12$):** Minimum aged solar reflectance = 0.20 and minimum thermal emittance = 0.75, or minimum Solar Reflectance Index (SRI) = 16.

Alternatives:

 - a) Air-space of 1.0 inch (25 mm) is provided between the top of the roof deck to the bottom of the roofing product; or
 - b) The installed roofing product has a profile ratio of rise to width of 1 to 5 for 50% or greater of the width of the roofing product; or
 - c) Existing ducts in the attic are insulated and sealed according to Energy Standards Section 150.1(c)9; or
 - d) Buildings with at least R-38 ceiling insulation; or
 - e) Buildings with a radiant barrier in the attic meeting the requirements of Energy Standards Section 150.1(c)2; or
 - f) Buildings that have no ducts in the attic; or
 - g) R-2 or greater insulation above the roof deck.
 10. 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.
 - up to 3 sqft of new tubular skylights area with dual-pane diffusers do not have to meet the U-factor and SHGC.
 - up to 16 sqft of new skylight area with maximum U-factor = 0.55 and SHGC = 0.30.
 - up to 30 sqft of dual-glazed greenhouse or garden windows is exempt from the maximum U-factor requirements.
 - **For alteration fenestration:**
 - a) **For replacement fenestration:**
 - Vertical fenestration replacement up to 75 sqft with maximum U-factor = 0.40 and SHGC = 0.35.
 - Skylight replacement with maximum U-factor = 0.55 and SHGC = 0.30.
 - b) **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.
 - **Up to 75 sqft:** Must meet Prescriptive Component Package and not required to meet the total fenestration area and west facing fenestration area.
 - **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.
- **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.
11. West-facing fenestration area includes skylights tilted to the west or tilted in any direction when the pitch is less than 1:12.
 12. Installed swinging door separating conditioned space from outside or adjacent unconditioned space shall have max. U-factor 0.20 (R-5 insulated door). It does not apply to doors from house to garage. When a door has less than 25% glazing material, it is considered as an opaque door and is subject to door U-factor requirements. When 25% or more of the door opening is glazed, the door is treated as fenestration and must meet fenestration U-factor = 0.30 and SHGC = 0.23 requirements.
 13. 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. 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.
 14. For information about other system types efficiency requirements refer to Table 4-6 of the 2019 Residential Compliance Manual.
 15. Air-cooled air conditioners and air-source heat pumps (including but not limited to ducted split systems, ducted packaged systems, and mini-split system) requires the installation of Measurement Access Holes (MAH), Refrigeration Charge Verification (RCV), and minimum system airflow verification. 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.
 16. Whole House Fan (WHF) is required only in **new buildings**, in buildings with **additions > 1,000 ft²**, and **new dwelling units** that are additions to existing building including Accessory Dwelling Units (ADU). Whole House Fan must capable of minimum total airflow 1.5 cfm/ft² of conditioned floor area and have at least 1 sqft of attic vent free area for each 750 CFM air flow OR as per manufacturer's specifications. Only WHFs that are listed in the Appliance Efficiency Directory may be installed. Field verification and diagnostic testing of airflow performance by a HERS rater is required. A central fan-integrated system may be used instead of WHF to meet the night ventilation cooling requirements.
 17. Gas furnace air-handling units shall have airflow ≥ 350 CFM /ton of nominal cooling capacity and fan watt draw ≤ 0.45 watt/cfm; AND have a hole for placement of a static pressure probe (HSPP) or a permanently installed static pressure probe (PSPP). The airflow and watt draw must be field verified and diagnostic tested by a HERS rater.
 18. For duct and air handler location: REQ denotes location 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.

- **For an entirely new or complete replacement space-conditioning systems:** duct sealing and HERS verification is required.
- **For alterations:**
 - Alterations including the installation or replacement of an air handler, a cooling or heating coil, a furnace heat exchanger, or an outdoor condensing unit of a split system air conditioner or heat pump requires duct sealing and verification by HERS rater. Refrigerant charge measurement or Fault Indicator Display installation is required for installation or replacement of ducted split systems, ducted package systems, and mini split systems and must be verified by HERS rater. The replacement unit must meet or exceed appliance efficiency standards.
 - When more than 40 feet of new or replacement ducts are installed in unconditioned space, the duct sealing and HERS verification is required.

Exceptions: Duct sealing is not required when the existing duct system is documented to have been previously sealed and verified, duct system with less than 40 linear feet in unconditioned spaces, or existing duct systems constructed, insulated or sealed with asbestos.

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

If the existing duct system remain unaltered (see “alteration” above) and the new extension ducts less 40 linear feet HERS verification is not required ; however, the mandatory measures including the R-6 duct insulation requirement apply.

19. There are 5 options to comply with the prescriptive water heating requirements for **new system** serving individual dwelling units:
- a) Install one or more gas or propane instantaneous water heater with an input rating < 200,000 BTUH and no storage tank.
 - b) Install a single gas or propane storage-type water heater ≤ 55 gallons and an input rating ≤ 75,000 BTUH. The dwelling unit shall have installed fenestration products with a weighted average U-factor no greater than 0.24, AND in addition one of the following shall be installed:
 1. Use a compact hot water distribution design with HERS verification, OR
 2. A drain water heat recovery system with HERS verification.
 - c) Install a single gas or propane storage-type water heater > 55 gallons and an input rating ≤ 75,000 BTUH.
 - d) Install a single heat pump water heater located indoor, AND in addition one of the following:
 1. Use a compact hot water distribution design and a drain water heat recovery system with HERS verification.
 2. For Climate Zone 10, a photovoltaic system capacity of 0.3 kWdc larger than the requirement specified in 2019 California Energy Code Section 150.1(c)14.
 - e) Install a single heat pump water heater Tier III NEEA rated for Climate Zone 10.
20. When a **second water heater** is installed as part of the addition, one of the following types of water heater shall be installed:
- a) A water-heating system that meet the requirements of footnote 18; OR
 - b) A water-heating system determined by the executive director to use no more energy than the one specified in item a.
21. For **altered or replacement water heater** shall meet one of the following:
- a) A natural gas or propane unit.
 - b) For Climate Zone 10, a single heat pump water heater located indoor, placed on an incompressible rigid R-10 insulated surface, and meet the applicable demand responsive control requirements.
 - c) For Climate Zone 10, a single heat pump water heater Tier III NEEA rated.
 - d) A consumer electric water heater if no gas is connected to the existing water heater location.
22. Water heaters shall meet the minimum Uniform Energy Efficiency (UEF) requirements. See the following Water Heater Efficiency Guide by California Energy Commission for some of the most common type and sizes of water heaters.

CALIFORNIA ENERGY COMMISSION | EFFICIENCY DIVISION



Water Heater Efficiency Guide

These tables list the minimum uniform energy factors required by federal regulations for some of the most common types and sizes of water heaters.

Consumer Gas-Fired Instantaneous (> 50,000 Btu/h, ≤ 200,000 Btu/h) - Minimum UEF

Volume (gallons)	Max Rating 0 ≤ GPM < 1.7	Max Rating 1.7 ≤ GPM < 2.8	Max Rating 2.8 ≤ GPM < 4.0	Max Rating GPM ≥ 4.0
≤ 2	0.80	0.81	0.81	0.81

Consumer Gas-Fired Storage (≤ 75,000 Btu/h) - Minimum UEF

Volume (gallons)	0 ≤ FHR < 18	18 ≤ FHR < 51	51 ≤ FHR < 75	FHR ≥ 75
30	0.29	0.54	0.60	0.65
40	0.27	0.52	0.58	0.64
50	0.25	0.50	0.56	0.63
55	0.24	0.49	0.55	0.62
60	0.61	0.74	0.77	0.79
75	0.60	0.73	0.76	0.78
80	0.60	0.73	0.76	0.78

Residential-Duty Commercial Gas-Fired Storage (> 75,000 Btu/h, ≤ 105,000 Btu/h) - Minimum UEF

Volume (gallons)	0 ≤ FHR < 18	18 ≤ FHR < 51	51 ≤ FHR < 75	FHR ≥ 75
50	0.22	0.48	0.55	0.61
60	0.21	0.46	0.53	0.61
75	0.2	0.45	0.52	0.59
80	0.2	0.44	0.51	0.59

Consumer Electric Instantaneous (≤ 12 kW) - Minimum UEF

Volume (gallons)	Max Rating 0 ≤ GPM < 1.7	Max Rating 1.7 ≤ GPM < 2.8	Max Rating 2.8 ≤ GPM < 4.0	Max Rating GPM ≥ 4.0
≤ 2	0.91	0.91	0.91	0.92

Residential-Duty Commercial Electric Instantaneous (> 12 kW, ≤ 58.6 kW) - Minimum UEF

Volume (gallons)	Max Rating 0 ≤ GPM < 1.7	Max Rating 1.7 ≤ GPM < 2.8	Max Rating 2.8 ≤ GPM < 4.0	Max Rating GPM ≥ 4.0
≤ 2	0.80	0.80	0.80	0.80

Btu/h	kW	GPM	FHR	UEF
British thermal units per hour	Kilowatt	Gallons Per Minute	First Hour Rating	Uniform Energy Factor

Consumer Electric Storage - Minimum UEF

Volume (gallons)	0 ≤ FHR < 18	18 ≤ FHR < 51	51 ≤ FHR < 75	FHR ≥ 75
30	0.86	0.92	0.92	0.93
40	0.85	0.91	0.92	0.93
50	0.84	0.91	0.92	0.93
55	0.84	0.91	0.92	0.93
60	1.86	1.98	2.05	2.18
75	1.84	1.96	2.03	2.16
80	1.84	1.96	2.03	2.15

Tabletop - Minimum UEF

Volume (gallons)	Max Rating 0 ≤ GPM < 1.7	Max Rating 1.7 ≤ GPM < 2.8	Max Rating 2.8 ≤ GPM < 4.0	Max Rating GPM ≥ 4.0
30	0.46	0.83	0.89	0.94
40	0.40	0.79	0.87	0.92

Heat pump water heaters that meet the UEFs listed in the Water Heater Replacements table may be used to replace existing water heaters. This applies only to prescriptive alterations to single dwelling units. The UEF depends on the climate zone where the water heater will be installed. The water heater being replaced can be of any fuel type – natural gas, propane, or electric.

Northwest Energy Efficiency Alliance (NEEA) Tier 3 or higher heat pump water heaters may be installed as described above in climate zones 1-15. If these water heaters are installed in climate zone 16, the solar water heating requirements described in the table must be met.

Per **Section 150.2(b)1Giid**, the California Energy Commission used the performance compliance approach to determine the minimum UEF needed to be able to prescriptively replace an existing water heater with a heat pump water heater. These heat pump water heaters have been precalculated to comply with the prescriptive water heating alteration requirements when serving a single dwelling unit, with or without natural gas connection. These are only a few of many possible combinations that will comply using the performance compliance approach.

**Water Heater Replacements
(New Heat Pump Water Heater)**

Climate Zone	Minimum UEF
1	2.82
2	2.82
3	2.82
4	2.87
5	2.82
6	2.47
7	2.61
8	2.47
9	2.47
10	2.47
11	2.61
12	2.87
13	2.61
14	2.61
15	2.47
16	≥ 3, plus a solar water heating system with solar saving fraction ≥ 0.4

Can't find your water heater type or volume?

Contact the Energy Standards Hotline at:

(800) 772-3300 (inside California)
 (916) 654-5106 (outside California)
title24@energy.ca.gov

October 2017
 CEC-400-2017-012