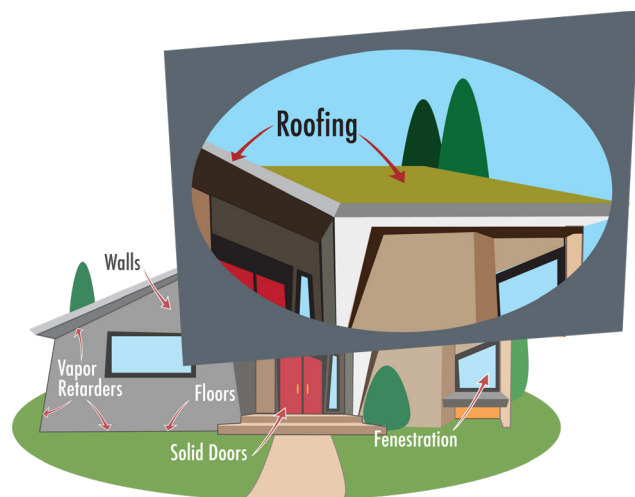


## Roofs

**Why Is Compliance Required for Roofs?** Roofs have a high potential for solar gains and losses, so increasing insulation levels in these areas can provide significant reductions in heating and cooling loads in buildings. Adding continuous rigid insulation above the roof deck can reduce conductive heat transfer through framing members. Adding rated “cool roof” roofing material can reduce the conductive heat flow through the roof, increasing the efficiency of the roof assembly.



**Figure 2.** Roofing Material on a Single-family Building

### Key Terms

**Attic Roof** is an enclosed space directly below the roof deck and above the ceiling beams.

**Rafter Roof** can be either flat or in a sloped application with insulation typically installed between the rafters. With this construction, the insulation is in contact with the ceiling and there is typically a one-inch air gap above the insulation so that moisture can be vented. Whether there is an air space above the insulation depends on local climate conditions and may not be required in some building permit jurisdictions. Filling the entire cavity of framed rafter assemblies with loose-fill mineral fiber, wool, cellulose, or low-density open cell spray polyurethane foam (ocSPF) requires prior approval by the local building official.

**Rated Cool Roof Material** is a roofing product with high solar reflectance and thermal emittance properties, which help reduce cooling loads by lowering interstitial space (attic) temperatures on hot, sunny days. Solar reflectance and thermal emittance are properties of the roofing material.

- ✦ **Aged Solar Reflectance** is the solar reflectance of the surface after three years, which typically is lower than the initial reflectance value. The higher the solar reflectance, the better (i.e., the more heat is reflected from the roofing material).
- ✦ **Thermal Emittance** provides a means of quantifying how much of the absorbed heat is rejected for a given material. The higher the thermal emittance value, the better (i.e., the more heat the roofing material emits back to the atmosphere).
- ✦ **Solar Reflectance Index (SRI)** is a measure of the roof’s ability to reject solar heat which includes both reflectance and emittance.

**Roof** is the outside cover of a building or structure including the structural supports, decking and top layer that is exposed to the outside with a slope less than 60° from the horizontal.

**Roof, Low Sloped** is a roof that has a ratio of rise to run of less than 2:12 (9.5° from the horizontal).

**Roof, Steep Sloped** is a roof that has a ratio of rise to run greater than or equal to 2:12 (9.5° from the horizontal).

**R-value** is the measure of the thermal resistance of insulation or any material or building component expressed in ft<sup>2</sup>-hr-°F/Btu. All insulation must be certified by the Department of Consumer Affairs, Bureau of Household Goods and Services that the insulation conductive thermal performance is approved pursuant to the California Code of Regulations, Title 24, Part 12, Chapters 12-13, Article 3, “Standards for Insulating Material.”

**U-factor** is the overall coefficient of thermal transmittance of a fenestration, wall, floor or roof/ceiling component, in Btu/(hr × ft<sup>2</sup> × °F), including air film resistance at both surfaces.

**Wet Insulation Requirements:** There are Mandatory requirements in [§110.8\(h\)](#) that dictate how to determine designed U-factor performance when using the Prescriptive Method to show compliance when wet insulation is used above the roofing membrane or layer to seal the roof from water penetration. Water can penetrate this insulation material and affect the energy performance of the roofing assembly in wet and cool climates. In Climate Zones 1 and 16, the insulating R-value of continuous insulation materials installed above the waterproof membrane of the roof must be multiplied by 0.8, and installers must use the result value in choosing the table column in [Joint Reference Appendix JA4](#) for determining assembly U-factor (when using the JA4 table to comply). See the footnotes for [Tables 4.2.1 through 4.2.7](#) in the Joint Reference Appendix JA4.



## New Construction and Additions

When associated with conditioned spaces, New Construction and Additions must meet Energy Code requirements for roofing materials. See Figure 3 and Table 5 for the corresponding Mandatory and Prescriptive Energy Code sections.

Prescriptive Single-family New Construction and Addition Roofing Requirements Associated with Conditioned Spaces			
New Construction and Additions Project Scope Examples	Roof Type	Climate Zone	Rated "Cool Roof" Roofing Material
			<i>When associated with conditioned spaces</i>
			<a href="#">§§110.8(i); 150.1(c)11; 150.2(a)</a>
New Building	Low-sloped	13, 15	Yes
		1-12, 14, 16	No
	Steep-sloped	10-15	Yes
		1-9, 16	No
Addition > 300 ft <sup>2</sup> with Roof	Low-sloped	13, 15	Yes
		1-12, 14, 16	No
	Steep-sloped	10-15	Yes
		1-9, 16	No
Addition ≤ 300 ft <sup>2</sup> with Roof	Low- or Steep-sloped	1-16	No

**CZ** = Climate Zone.

**Table 3.** Prescriptive Single-family New Construction and Addition Roofing Requirements Associated with Conditioned Spaces



### WHAT'S NEW

For New Construction projects with vented roofs in Climate Zone 4 or 8-16, when the air handler and ductwork are in the attic, there is new Mandatory maximum U-factor 0.184. Additions ≤ 700 ft<sup>2</sup> have revised insulation requirements.

## Rated Cool Roof Material

To qualify as a "cool roof" under the Energy Code, roofing material must have a Cool Roof Rating Council (CRRC) rating and meet the specified value for reflectance and emittance, or SRI value, specified in Certificate of Compliance (CF1R).

Refer to Table 4 for the roof material requirements and exceptions for Single-family New Construction and Additions.

Prescriptive Cool Roof Requirements for Single-family Buildings by Roof Slope and Climate Zone				
Roof Style	Climate Zone	Either		Or
		3-year Aged Solar Reflectance	Thermal Emittance	SRI
Low-sloped	13, 15	≥ 0.63	≥ 0.75	≥ 75
	All others	NR	NR	NR
Steep-sloped	10-15	≥ 0.20	≥ 0.75	≥ 16
	All others	NR	NR	NR

**Low-sloped** = rise-to-run ratio of < 2:12 (lower than 9.5 degrees); **steep-sloped** = rise-to-run ratio ≥ 2:12 (9.5 degrees or more); **SRI** = solar reflectance index.

**\*Exceptions for single-family low-sloped roofs:**

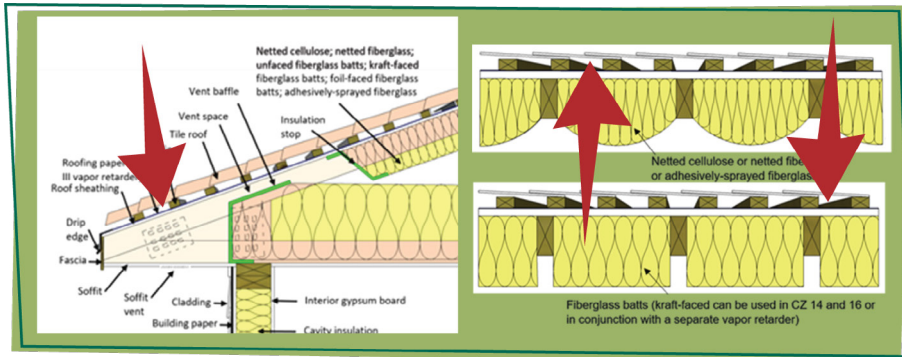
- ✦ Roof constructions with a weight of at least 25 lb/ft<sup>2</sup> over the roof membrane
- ✦ Any roof area covered by building integrated photovoltaic panels or integrated solar thermal panels

**Table 4.** Prescriptive Cool Roof Requirements for Single-family Buildings by Roof Slope and Climate Zone



### Prescriptive Option B Air Space Below Roofing Material

For Prescriptive Option B compliance of a vented attic, a one-inch air space is required between the roof deck and the roofing material (see Figure 3 and Table 5 on this page). This air space is typical with a tile roof application. If an air space is not provided, the Performance Approach must be used to determine if compliance can be achieved.



**Figure 3.** Prescriptive Option B Air Space Below Roofing Material for Single-family Buildings

### Prescriptive Requirements for Roof and Ceiling Insulation

The Prescriptive insulation requirements for ceilings and roofs depend not only upon Climate Zone, HVAC ducting location and scope of work but also upon the roof assembly type specific to attic roofs (§§150.1(c)1A, 150.2(a)1).

When a project does not have a vented attic or is unable to meet the insulation, roofing air space or duct location requirements in Table 5, the Performance Approach must be used to determine if compliance can be achieved.

### Prescriptive Radiant Barrier Requirements for New Construction and Additions

A 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. For Prescriptive compliance, radiant barriers must be installed in vented attics that do not require insulation below the roof deck, except for buildings in Climate Zones 1 and 16 (§150.1(c)2). Radiant barriers must meet the Mandatory requirements of §110.8(j). If a residence does not meet the Prescriptive radiant barrier requirements, the Performance Approach must be used.

Prescriptive Roof and Ceiling Insulation Requirements for Single-family New Construction and Additions						
Project Scope	Roof Type	HVAC Duct and Air Handler Location	Climate Zone	Insulation		
				Ceiling Insulation Between Attic and Conditioned Space	Below-Roof Deck Insulation	Air Space Between Roofing and Roof Deck
				<b>§§150.0(a), 150.1(c)1A, 150.2(a)1</b>		
New Building	Vented Attic	Option B: In Attic	1-2	R-38	None	Yes
			3, 5-7	R-30	None	Yes
			4, 8-16	R-38	R-19*	Yes
		Option C: Conditioned Space	1, 11-16	R-38	None	No
	2-10		R-30	None	No	
Unvented or Rafter	Performance Approach Required					
Addition > 700 ft²	Vented Attic	Option B: In Attic	1-2	R-38	None	Yes
			3, 5-7	R-30	None	Yes
			4, 8-16	R-38	R-19	Yes
		Option C: Conditioned Space	1, 11-16	R-38	None	No
	2-10		R-30	None	No	
Unvented or Rafter	Performance Approach Required					
Addition ≤ 700 ft²	Vented Attic	N/A	1-2, 4, 8-16	R-38 (or U-factor ≤ 0.025)	None	No
			3, 5-7	R-30 (or U-factor ≤ 0.031)	None	No
	Unvented or Rafter	Performance Approach Required				

\* Note that for New Construction, Option B roof decks in Climate Zones 4 and 8-16 have a Mandatory U-factor ≤ 0.184. Some below-roof deck insulation will be required to meet U-factor ≤ 0.184 even when using the Performance Approach. This does not apply to Additions or Alterations.

**Table 5.** Prescriptive Roof and Ceiling Insulation Requirements for Single-family New Construction and Additions



## Alterations

### Key Terms

**Roof Recover** is the process of installing an additional roof covering over a prepared existing roof covering without removing the existing roof covering.

**Roof Recover Board** is a rigid type board, installed directly below a low-sloped roof membrane, with or without above deck thermal insulation, to: (a) improve a roof system's compressive strength, (b) physically separate the roof membrane from the thermal insulation, or (c) physically separate a new roof covering from an underlying roof membrane as part of a roof overlay project.

**Roof Replacement** is the process of removing the existing roof covering, repairing any damaged substrate and installing a new roof covering.

### WHAT'S NEW

Additional Climate Zones are subject to the rated Cool Roof roofing material requirements and the revisions to the exceptions associated with these requirements.

Altered vented attic roofs have new insulation and air sealing requirements.

## Mandatory and Prescriptive Roofing Material and Insulation Requirements for Single-family Building Alterations Associated with Conditioned Spaces

Altered Roof Project Scope Examples		Rated Cool Roof Material Requirements Applicable to Any Roof Type	Insulation Requirements			Air Sealing
			Roof	Ceiling	Above Recessed Downlight Luminaire	
		<i>When associated with conditioned spaces</i>				
		§§110.8(i); 150.2(b)1I	§§110.8(a)-(c); 150.0(a); 150.2(b)1I and J			§150.2(b)1Jii
<b>Steep-sloped Roof Alteration</b>	Replacing or recovering > 50% in CZ 4, 8-15	Yes	No	No	No	No
	Replacing or recovering ≤ 50% in CZ 4, 8-15	No	No	No	No	No
	Replacing or recovering in CZ 1-3, 5-7, 16	No	No	No	No	No
<b>Low-sloped Roof Alteration</b>	Replacing or recovering > 50% in CZ 4, 8-15	Yes	Yes	No	No	No
	Replacing or recovering > 50% in CZ 6-7	Yes	No	No	No	No
	Replacing or recovering > 50% in CZ 1-2, 16	No	Yes	No	No	No
	Replacing or recovering ≤ 50% in CZ 1-2, 4, 6-16	No	No	No	No	No
	Replacing or recovering in CZ 3, 5	No	No	No	No	No
<b>Vented Attic Alterations</b>	Altering ceiling in CZ 2, 4, 8-16	No	No	Yes per §150.2(b)1J	Yes	Yes
	Altering ceiling in CZ 1, 3	No	No	Yes per §150.2(b)1J	Yes	No
	Altering ceiling in CZ 6	No	No	Yes per §150.2(b)1J	No	No
	Altering ceiling in CZ 5, 7	No	No	Yes per §150.0(a)	No	No
<b>Other</b>	Altering non attic or non-vented attic roof (e.g., rafter roof)	No	No	Yes per §150.0(a)	No	No

**Low-sloped** = rise-to-run ratio of < 2:12 (lower than 9.5 degrees); **steep-sloped** = rise-to-run ratio ≥ 2:12 (9.5 degrees or more).

**Table 6.** Roofing Material and Insulation Requirements for Single-family Building Alterations Associated with Conditioned Spaces



## Altered Roof Rated “Cool Roof” Material

See New Construction and Additions for criteria for rated Cool Roof materials.

Refer to Table 7 to determine the roofing material requirements for your project based on roof slope, building type and Climate Zone.

Prescriptive Roofing Material Requirements for Single-family Building Alterations				
Roof Style	Climate Zone	Either		Or
		3-year Aged Solar Reflectance	Thermal Emittance	SRI
Low-sloped	4, 6-15	≥ 0.63*	≥ 0.75	≥ 75
	All others	NR	NR	NR
Steep-sloped	4, 8-15	≥ 0.20**	≥ 0.75	≥ 16
	All others	NR	NR	NR

**Low-sloped** = rise-to-run ratio of < 2:12 (lower than 9.5 degrees); **steep-sloped** = rise-to-run ratio ≥ 2:12 (9.5 degrees or more); **SRI** = solar reflectance index.

**\*Exceptions for low-sloped roofs:**

- ✦ Roof constructions with a weight of at least 25 lb/ft<sup>2</sup> over the roof membrane
- ✦ Any roof area covered by building integrated photovoltaic panels or integrated solar thermal panels
- ✦ Altered roof/ceiling tradeoff for aged solar reflectance (See options in Table 8.)

**\*\*Exceptions for steep-sloped roofs:**

- ✦ Roof constructions with a weight of at least 25 lb/ft<sup>2</sup> over the roof membrane
- ✦ Any roof area covered by building integrated photovoltaic panels or integrated solar thermal panels
- ✦ When ceiling assembly U-factor is ≤ 0.025 (or ≥ R-38 ceiling insulation)
- ✦ When radiant barrier is installed (not including when installed above spaced sheathing) meeting install requirements of §150.1(c)2
- ✦ When in CZs 2, 4, 9, 10, 12 and 14 and no ducts are in the attic
- ✦ When there is ≥ R-2 continuous insulation above or below the roof deck

**Table 7.** Prescriptive Roofing Material Requirements for Single-family Building Alterations

## Tradeoffs Allowed in Alterations to Low-sloped Roofs

In an exception to the roofing material requirements, Alterations to low-sloped roofs may lower the required minimum aged solar reflectance by increasing the roof deck insulation R-value. See Table 8 for the tradeoff options by Climate Zone.

Prescriptive Tradeoffs Allowed in Alterations to Low-sloped Roofs of Single-family Buildings		
Minimum Aged Solar Reflectance	Roof Deck Continuous Insulation Tradeoff R-Value	
	Climate Zone 6 - 7	Climate Zone 2, 4, 8-15
0.60	R-2	R-16
0.55	R-4	R-18
0.50	R-6	R-20
0.45	R-8	R-22
No Requirement	R-10	R-24

**Table 8.** Prescriptive Tradeoffs Allowed in Alterations to Low-sloped Roofs of Single-family Buildings (adapted from Table 150.2-B)

## Rated Cool Roof Material

For key terms related to roofing, see page 4.

To qualify as a Cool Roof under the Energy Code, roofing material must have a Cool Roof Rating Council (CRRC) rating and meet the specified value for reflectance and emittance, or solar reflectance index (SRI) value, specified in the Certificate of Compliance (CF1R) form. For the CRRC list of Rated Roof Products, see <https://coolroofs.org/directory/roof>.



## Prescriptive Insulation Requirements for Altered Roofs

Insulation requirements apply when altering existing roofs and ceilings and when an altered low-sloped roof is recovered or replaced in some Climate Zones. Luminaires not rated for insulation contact must be replaced or retrofitted with a fire-proof cover that allows insulation to be installed directly over the cover. Attic ventilation requirements of California Building Code also apply. See Table 9 for new insulation requirements and exceptions to those requirements based on existing roof or ceiling insulation.

Altered Roof Type	Climate Zone	Prescriptive and Mandatory Insulation Requirements for Altered Roofs	
		New Insulation Requirement	Compliance Exceptions Based on Existing Insulation
Low-sloped*	1, 2, 4, 8-16	Continuous $\geq$ R-14 insulation (or U-factor $\leq$ 0.039)	
	3, 5-7	No	
Ceiling to Vented Attic**	11-16	$\geq$ R-49 (or U-factor $\leq$ 0.020)	Maintain Insulation depth above recessed downlight luminaires***
	2, 4, 8-10	$\geq$ R-49 (or U-factor $\leq$ 0.020)	
	1, 3, 6	$\geq$ R-49 (or U-factor $\leq$ 0.020)	
	5, 7	$\geq$ R-22 between wood framing (or U-factor $\leq$ 0.043)	
All Other Roof Types	Any	Non-rafter: $\geq$ R-22 between wood framing (or U-factor $\leq$ 0.043) Rafter: $\geq$ R-19 between wood framing (or U-factor $\leq$ 0.054)	No

**\*Insulation installation exceptions for low-sloped roofs:**

- ✦ The continuous insulation may be reduced to R-4 when continuous  $\geq$  R-14 insulation would reduce the height from the roof surface to the top of the base flashing to less than that set forth in the manufacturer's installation instructions as per the California Residential Code §R900 when:
  - ◊ Mechanical equipment is located on the roof and **will not** be temporarily disconnected and lifted as part of the roof replacement; and/or
  - ◊ Existing sidewall or parapet walls are finished with an exterior cladding material other than the roof covering membrane material; and the exterior cladding material must be removed to install the new roof covering membrane to maintain the minimum base flashing height; and the ratio of the replaced roof area to the linear dimension of affected sidewall or parapet walls is  $<$  25 ft<sup>2</sup> per linear foot.
- ✦ The continuous insulation requirements may be reduced where increasing the thickness of 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 a registered design professional's approved flashing design, as per the California Residential Code §R703.4 or by California Residential Code §R905.2.8.3.
- ✦ 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 exceeds the required value.

**\*\*Insulation installation exceptions for vented attics:**

- ✦ The Alteration would directly cause the disturbance of asbestos.
- ✦ Knob and tube wiring is located in the vented attic.
- ✦ When the accessible space in the attic is not large enough to accommodate the required R-value, the entire accessible space must be filled with insulation provided such installation does not violate §806.3 of Title 24, Part 2.5.
- ✦ If an altered dwelling unit shares attic space with unaltered dwelling units, the unaltered dwelling units do not require ceiling insulation.

**\*\*\* Insulation above recessed downlights is required in CZ 1-4 and 8-16, but with an exception for homes in CZ 1-4 and 8-10 with  $\geq$  R-19 existing ceiling insulation.**

**Table 9.** Prescriptive and Mandatory Insulation Requirements for Altered Roofs of Single-family Buildings



## Altered Vented Attic Air Sealing Requirements

Air sealing is required in Climate Zones 2, 4 and 8-16 when altering the ceiling to a vented attic. All accessible areas of the ceiling plane between the altered attic and the conditioned space must meet the air leakage limitation requirements of [§110.7](#). All joints, penetrations and other openings in the building envelope that are potential sources of air leakage must be caulked, gasketed, weather stripped or otherwise sealed to limit infiltration and exfiltration. This is not a requirement verified by a HERS Rater.

Prescriptive Air Sealing Requirements for Altered Vented Attic Ceiling by Climate Zone	
Climate Zone	Air Sealing Requirements <a href="#">§150.2(b)1Jii</a>
2, 4, 8-16	Yes*
1, 3, 5-7	No

**CZ = Climate Zone**

**\*Exceptions to air sealing requirements:**

- ✦ *There is existing  $\geq R-19$  insulation at the ceiling level.*
- ✦ *When atmospherically vented space-heating or water-heating combustion appliances are located inside the pressure boundary of the dwelling unit.*

**Table 10.** Prescriptive Air Sealing Requirements for Altered Vented Attic Ceiling by Climate Zone



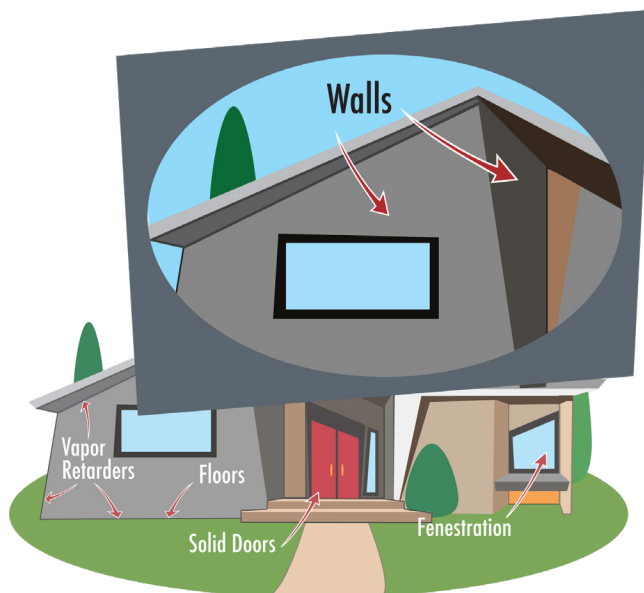
## Walls

**Why is compliance required for walls?** Walls are important because heat travels through a building's envelope (roofs, walls, floors, windows) and tends to travel from higher temperatures to lower temperatures by conduction, convection or radiation. The greater the temperature difference, the greater the rate of heat transfer. Therefore, heat gain in a building occurs when the outdoor temperature is greater than the indoor temperature. Heat gain in buildings also can come from people, lights and appliances. Similarly, heat loss occurs when the indoor temperature is greater than the outdoor temperature.

Insulation is one of the most important components for reducing heat gain and loss through opaque construction assemblies. Insulation comes in many different types, forms and applications. Its effectiveness is measured in R-value, which is the measure of resistance to heat flow. The higher the R-value, the greater the insulation provided.

When choosing insulation, it is important to consider where the material will be installed in the building envelope assembly and how much insulation is necessary to meet or exceed the Energy Code. Opaque construction assemblies often consist of one or more types of insulation in different locations for cavity insulation and continuous insulation. In many cases, determining the best strategy for insulating depends on the building design and overall project budget.

Another consideration for selecting insulation is its environmental impact. Many of the newer insulation materials are far more "green" than previously available products, including formaldehyde-free and recycled-content insulation.



**Figure 4.** Exterior Walls of a Single-family Building

## Key Terms

**R-value** is the measure of the thermal resistance of insulation or any material or building component expressed in  $\text{ft}^2\text{-hr-}^\circ\text{F}/\text{Btu}$ . All insulation must be certified by the Department of Consumer Affairs, Bureau of Household Goods and Services (BHGS) that the insulation conductive thermal performance is approved pursuant to the California Code of Regulations, Title 24, Part 12, Chapters 12-13, Article 3, "Standards for Insulating Material."

**U-factor** is the overall coefficient of thermal transmittance of a fenestration, wall, floor or roof/ceiling component, in  $\text{Btu}/(\text{hr} \times \text{ft}^2 \times ^\circ\text{F})$ , including air film resistance at both surfaces.






## New Construction and Additions

When associated with conditioned spaces, New Construction and Additions must meet Energy Code insulation requirements for exterior walls and demising walls. They must always meet applicable Mandatory Measures, while also complying with either the Prescriptive or Performance Approach. See Table 11 for the applicable Mandatory and Prescriptive Energy Code sections.

Mandatory and Prescriptive Single-family New Construction and Addition Wall Requirements Associated with Conditioned Spaces			
Project Scope	Exterior Wall Insulation Requirements	Demising Wall Insulation Requirements	Interior Wall Requirements*
	<i>When associated with conditioned spaces</i>		
	<a href="#">§§110.8(a)-(c), 150.1(c)1B, 150.2(a)1A-B</a>	<a href="#">§§110.8(a)-(c), 150.0(c)</a>	
<b>New Construction: new building</b>	<b>Yes</b>	<b>Yes</b>	N/A
<b>Addition</b>	<b>Yes</b>	<b>Yes</b>	N/A
<b>Conditioning an existing building for the first time</b>	<b>Yes</b>	<b>Yes</b>	N/A

\* Interior walls are the walls that separate conditioned spaces from other enclosed conditioned spaces.

**Table 11.** Mandatory and Prescriptive Single-family New Construction and Addition Wall Requirements Associated with Conditioned Spaces



### WHAT'S NEW

There are no changes in the 2022 Energy Code for walls in New Construction or Additions to single-family buildings.



## Wall Insulation Requirements

U-factors for common construction assemblies can be determined based on framing type, spacing, cavity insulation and various thicknesses of continuous insulation.

Determining proposed assembly U-factor can be done by either using the tables under [Joint Reference Appendix JA4.3 Walls](#) or the layers method in [CEC-certified software](#).

Compliance for New Construction can use an area-weighted average calculation, although metal-framed walls may not be combined with any other wall type. Wood-framed walls can be combined with structurally insulated wall panels (SIPs), spandrel or curtain, metal panel or straw bale wall types. Mass walls can be combined with concrete sandwich panel, log and insulated concrete form walls. Area-weighted average calculations are not allowed for Alterations.

For Prescriptive compliance, exterior framed walls must have an overall assembly U-factor no greater than the applicable value in [Table 150.1-A](#) (Prescriptive Component Package for Single-family Standard Building Design). Above or below grade mass walls can comply Prescriptively by either installing continuous insulation that meets the R-values from Table 150.1-A or by having an overall assembly U-factor no greater than the value from Table 150.1-A. Buildings with exterior walls that do not meet the Prescriptive requirements must show compliance using the Performance Approach. Demising walls must meet the [§150.0\(c\)](#) Mandatory maximum U-factor requirements of  $\leq 0.102$  for framed 2 x 4 walls and  $\leq 0.071$  for framed 2 x 6 walls. This is equivalent to installing R-13 in 2 x 4 wood framing or R-20 in 2 x 6 wood framing. Metal-framed walls would need additional insulation to comply with the Mandatory maximum U-factors. Other demising wall types are supported in §150.0(c). Because the demising wall requirements are Mandatory, the Performance Approach does not allow for a greater U-factor allowance.

Prescriptive Requirements for Wall Insulation in Single-family Building New Construction and Additions				
Wall Type	Insulation	Climate Zone	New Construction and Addition Requirements	
			Minimum R-value****	Maximum U-factor
Framed Walls*		1-5, 8-16	See U-factor	$\leq 0.048$
		6-7	See U-factor	$\leq 0.065$
Above Grade Mass Walls**	Interior Insulation	1-15	R-13	$\leq 0.077$
		16	R-17	$\leq 0.059$
	Exterior Insulation	1-15	R-8	$\leq 0.125$
		16	R-13	$\leq 0.077$
Below Grade Mass Walls***	Interior Insulation	1-15	R-13	$\leq 0.077$
		16	R-15	$\leq 0.067$
	Exterior Insulation	1-13	R-5	$\leq 0.200$
		14-15	R-10	$\leq 0.100$
		16	R-19	$\leq 0.053$

\* Assembly U-factors for exterior framed walls can be met with cavity insulation alone or with continuous insulation alone, or with both cavity and continuous insulation that results in an assembly U-factor equal to or less than the U-factor shown. Use [Joint Reference Appendix JA4 Table 4.3.1](#), [4.3.1\(a\)](#), or [Table 4.3.4](#) to determine whether framed wall assemblies with alternative insulation products are less than or equal to the required maximum U-factor.

\*\* Mass wall has a heat capacity  $\geq 7.0$  Btu/h-ft<sup>2</sup>. "Interior" denotes insulation installed on the inside surface of the wall. "Exterior" denotes insulation installed on the exterior surface of the wall.

\*\*\* Below grade "interior" denotes insulation installed on the inside surface of the wall, and below grade "exterior" denotes insulation installed on the outside surface of the wall.

\*\*\*\* Prescriptive minimum R-values for mass walls are for continuous insulation, not for insulation installed between framing attached to mass walls. Mass walls with insulation penetrated by framing could comply by meeting the Prescriptive maximum U-factor.

**Table 12.** Prescriptive Requirements for Wall Insulation in Single-family Building New Construction and Additions

