Nonresidential Roofing:

Guide to 2019 Energy Code Requirements

What is the energy code and why does it matter?

California's energy code, the **Building Energy Efficiency Standards** (Title 24, Part 6; the Standards), outlines the energy efficiency requirements for newly constructed buildings and additions and alterations to existing buildings. Energy efficiency reduces energy costs and wasteful consumption, improves building comfort, and reduces environmental impacts of energy use. The Standards ensure that builders use technologies and practices that are energy efficient and *cost effective* for building owners.

What are the roofing requirements?

The Standards require permits when replacing a roof and require roof replacements to meet certain energy specifications. This document is intended to provide guidance on meeting compliance using a **prescriptive approach**, meaning that each component of a proposed project must meet a prescribed minimum energy requirement. The prescriptive requirements call for roofing products to meet the **thermal emittance** (the relative ability of the roof surface to radiate absorbed heat) and the three-year aged (or "weathered") **solar reflectance** (the fraction of solar energy that is reflected by the roof after three years) in both low-sloped and steep-sloped roof applications. An alternative to using the aged solar reflectance and thermal emittance required values is the **Solar Reflectance Index** (SRI) (a measure of the constructed surface's ability to stay cool in the sun by reflecting solar radiation and emitting thermal radiation). An SRI calculator can be used to determine the value by inputting the three-year aged solar reflectance and thermal emittance of the desired roofing material. Roofing products (tile, asphalt, shingles, etc.) with high solar reflectance and thermal emittance properties are called "**cool roofs**."

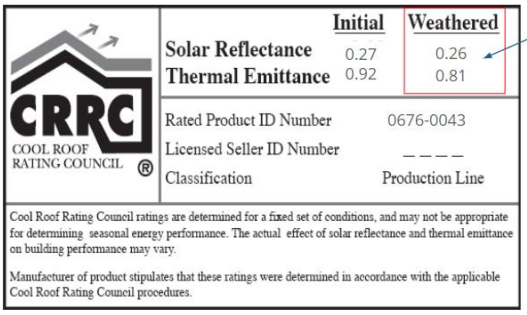

Figure 1: Sample CRRC Product Label and Information. *Image Source: CEC*

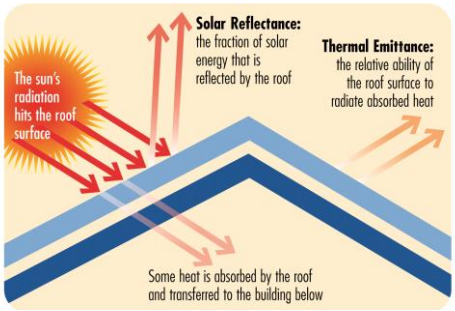

Figure 2: Solar Reflectance and Thermal Emittance. *Image Source: CRRC*

Cool Roof Specifications

Certified cool roofing product manufacturers are required to test aged solar reflectance and thermal emittance and are listed in the **Cool Roof Rating Council's (CRRC)** Rated Product Directory. Cool roofing products must be certified by the CRRC per §10-113 and §110.8(i) and must have an official CRRC package label indicating compliance. Figure 1 shows a sample of an approved CRRC product label. Cool roofing *requirements are triggered when 50% or more of the roof is being replaced*. Any areas of roof covered by building integrated photovoltaic panels and solar thermal panels are exempt. However, the area of roof not covered by photovoltaic panels is still required to meet any applicable cool roof requirements. To apply Liquid Field Applied Coatings, the coating must be applied across the entire roof surface and meet the dry mil thickness or coverage recommended by the coatings manufacturer and meet minimum performance requirements list in Section 110.8(i)4 of the 2019 Building Energy Efficiency Standards.

(Step-by-step permit requirement guide on page 2)

Required 2019 compliance documents can be found at:

https://ww2.energy.ca.gov/title24/2019standards/2019_compliance_documents/Nonresidential_Documents/NRCC

For more information on 2019 Title 24 Part 6 requirements:

- Visit **http://www.energy.ca.gov/title24/2019standards/**
- Contact the Energy Standards Hotline at (800) 772-3300 or email: **title24@energy.state.ca.us**
- Contact the BayREN Codes & Standards Program by email: **codes@bayren.org**

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COOL ROOF (only applies to roof area directly above conditioned or indirectly conditioned space, and not covered by solar PV panels)

IS *NOT* REQUIRED if **ANY of the boxes below are checked:**

Cool Roof Exemptions: Check any that are true statements about project. Do not include roof area over unconditioned space (e.g. warehouse) or process space (e.g. manufacturing) in formulas.

☐ Roof area to be replaced is less than 50% of total roof area AND less than 2000 ft^2

A. Area to be re-roofed = _____ ft^2

B. Total roof area = _____ ft^2

C. (A / B) x 100 = _____% *Check box if A is less than 2000 ft^2 AND C is less than 50%.*

☐ Project is in climate zone[1] 3 or 5 ***AND*** the roof is wood-framed with a U-factor (thermal performance data) ≤ 0.034 (See Reference Appendix JA4 for example U-factors)

☐ The roof construction is covered by thermal mass (e.g. gravel, concrete pavers, stone) with a weight ≥ 25 lb/ft^2

☐ The building is a hotel, motel, or high-rise residential building, and the roof is low-sloped (pitch ≤ 2:12)

IS REQUIRED **if NONE of the boxes above are checked:**

Install roofing that meets the requirements outlined in Appendices A and B (Tables 140.3-B and C in Chapter 3: Building Envelope of the *2019 Nonresidential Compliance Manual)*.

ROOF INSULATION (only applies to roof area directly above conditioned or indirectly conditioned space, and not covered by solar PV panels)

IS *NOT* REQUIRED **if ANY of the following criteria are met:**

☐ The roof deck or roof recover boards of a low-sloped roof are not exposed during reroof.

☐ Existing roof is already insulated to at least R-7 or has an assembly U-factor less than 0.089

☐ Mechanical equipment is permanently located on the roof and will not be removed or lifted during roof replacement (for insulation requirements for this case, see Appendix E (*EXCEPTION to Section 141.0(b)2Biiib* of the *2019 Building Energy Efficiency Standards for Residential and Nonresidential Buildings)*.

☐ Added insulation will reduce the base flashing height to less than 8 inches (203 mm) at penthouse or parapet walls (for insulation requirements for this case, see Appendix E (*EXCEPTION to Section 141.0(b)2Biiic* of the *2019 Building Energy Efficiency Standards for Residential and Nonresidential Buildings))*.

IS REQUIRED **if NONE of the boxes above are checked:**

Install roof insulation that meets the applicable requirement in Appendix C (Table 141.0-C *of* in *Section 141.0(b)2Biiid the 2019 Building Energy Efficiency Standards for Residential and Nonresidential Buildings)***.** NOTE: Tapered insulation may be used which has a thermal resistance less than that prescribed in Table 141.0-C at the drains and other low points, 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 value that is specified in Table 141.0-C.

Requirement Tradeoffs

The lower Aged Solar Reflectance value is permitted with increased roof/ceiling insulation. Use the values in Appendix D (Table 141.0-B of the *2019 Building Energy Efficiency Standards for Residential and Nonresidential Buildings)* as a guide.

References:

2019 Building Energy Efficiency Standards for Residential and Nonresidential Buildings. PDF File. December 20, 2019. https://ww2.energy.ca.gov/2018publications/CEC-400-2018-020/CEC-400-2018-020-CMF.pdf

2019 Nonresidential Compliance Manual. PDF File. December 20, 2019. https://ww2.energy.ca.gov/2018publications/CEC-400-2018-018/Compliance_Manual-Complete_without_forms.pdf

[1] California Building Climate Zone Areas: https://ww2.energy.ca.gov/maps/renewable/building_climate_zones.html

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Appendices

Appendix A

Table 3-2: Prescriptive Criteria for Roofing Products for Nonresidential Buildings

			Climate Zones															
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Roofing Products	Low-sloped	Aged Reflectance	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63
		Emittance	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
		SRI	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75
	Steep-Sloped	Aged Reflectance	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
		Emittance	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
		SRI	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16

Energy Standards Table 140.3-B

Appendix B

Table 3-3: Prescriptive Criteria for Roofing Products for High-Rise Residential Buildings and Guest Rooms of Hotel/Motel Buildings

			Climate Zones															
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Roofing Products	Low-sloped	Aged Reflectance	NR	NR	NR	NR	NR	NR	NR	NR	0.55	0.55	0.55	NR	0.55	0.55	0.55	NR
		Emittance	NR	NR	NR	NR	NR	NR	NR	NR	0.75	0.75	0.75	NR	0.75	0.75	0.75	NR
		SRI	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64
	Steep-Sloped	Aged Reflectance	NR	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	NR
		Emittance	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
		SRI	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16

Energy Standards Table 140.3-C

Appendix C

Table 3-22: Insulation Requirements for Roof Alterations

	Nonresidential		High-Rise Residential and Guest Rooms of Hotel/Motel Buildings	
Climate Zone	Continuous Insulation R-value	U-Factor	Continuous Insulation R-Value	U-Factor
1	R-8	0.082	R-14	0.055
2	R-14	0.055	R-14	0.055
3-9	R-8	0.082	R-14	0.055
10-16	R-14	0.055	R-14	0.055

Energy Standards Table 141.0-C

Appendix D

Table 3-23: Roof/Ceiling Insulation Trade-Off for Aged Solar Reflectance

Aged Solar Reflectance	Climate Zone 1, 3-9 U-factor	Climate Zone 2, 10-16 U-factor
0.62 - 0.60	0.075	0.052
0.59 - 0.55	0.066	0.048
0.54 - 0.50	0.060	0.044
0.49 - 0.45	0.055	0.041
0.44 - 0.40	0.051	0.039
0.39 - 0.35	0.047	0.037
0.34 - 0.30	0.044	0.035
0.29 - 0.25	0.042	0.034

Energy Standards Table 141.0-B

Appendix E

Exceptions to 141.0(b)2Biii:

- No additional insulation is required if the roof is already insulated to a minimum level of R-7.
- If mechanical equipment is located on the roof will not be disconnected and lifted as part of the roof replacement, insulation added may be limited to the maximum insulation thickness that will allow a height of 8 inches (203 mm) from the roof membrane surface to the top of the base flashing.
- If adding the required insulation will reduce the base flashing height to less than 8 inches at penthouse or parapet walls, the insulation added may be limited to the maximum insulation thickness that will allow a height of 8 inches from the roof membrane surface to the top of the base flashing. These conditions must be met:
  - The penthouse or parapet walls are finished with an exterior cladding material other than the roofing covering membrane material.
  - The penthouse or parapet walls have exterior cladding material that must be removed to install the new roof covering membrane to maintain a base flashing height of 8 inches.
  - For nonresidential buildings, the ratio of the replaced roof area to the linear dimension of affected penthouse or parapet walls shall be less than 25 square feet per linear foot for Climate Zones 2 and 10 through 16, and less than 100 square feet per linear foot for Climate Zones 1 and 3 through 9.
  - For high-rise residential buildings, hotels, or motels, the ratio of the replaced roof area to the linear dimension of affected penthouse or parapet walls shall be less than 25 square feet per linear foot for all climate zones.
  - Increasing the elevation of the roof membrane by adding insulation may also affect roof drainage. The Energy Standards allow tapered insulation to be used that has a thermal resistance less than that prescribed in Table 141.0-C at the drains and other low points, 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 value that is specified in Table 141.0-C.