



May 2012

Universal Model Building Code Language for Cool Roofs

Note: italicized text can be adapted to align with the goal and/or scope of a particular standard.

Intent

To reduce building energy use, cool the local and global environment, and mitigate summer urban heat islands.

Definitions

Solar reflectance (“SR”): A measure of the ability of a surface to reflect sunlight. It is the fraction of incident sunlight that is reflected, and is expressed on a scale from 0 to 1 (or 0% to 100%). Solar reflectance is also referred to as albedo.

Solar reflectance index (“SRI”): A metric that indicates the ability of a surface to stay cool in the sun. SRI compares the test surface's temperature to those of standard black and standard white surfaces. It typically ranges from 0 (standard black) to 100 (standard white), but can be less than 0 or greater than 100. SRI is calculated from measured values of solar reflectance and thermal emittance in accordance with ASTM Standard E1980.

Sunlight: Radiation from the sun (spectrum 0.3 – 2.5 μm).

Thermal emittance (“TE”): The ratio of thermal radiation (power) emitted by a sample to that emitted by a black body radiator at the same temperature. Thermal emittance is also referred to as infrared emittance.

Thermal radiation: Radiation emitted from a surface at a temperature near 300 K (spectrum 4 – 80 μm).

Vegetated roof: An engineered green roof assembly that consists of waterproof and root-proof membranes, a drainage layer, a growing media substrate and vegetative plantings.

Requirements

Determination of Radiative Properties (Mandatory Requirement)

The aged solar reflectance and aged thermal emittance of the roofing product shall be measured in accordance with the ANSI/CRRC-1 Standard-2010. Aged solar reflectance index shall be calculated from aged solar reflectance and aged thermal emittance in accordance with ASTM Standard E1980, using a convection coefficient of 2.1 BTU/h-ft² (12 W m⁻² K⁻¹).



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Radiative Property Values (Prescriptive Requirement)

The following applies to buildings in International Energy Conservation Code climate zones 1 - 5.

Non-residential buildings, high-rise residential buildings & hotels/motels. For all new construction and for roof additions/alterations in which at least 2,000 square feet or at least 50 percent of the roof area is being replaced, recovered or recoated, at least 75 percent of the roof's surface shall meet either (a) the solar reflectance and thermal emittance requirements in Table 1, or (b) the solar reflectance index requirement in Table 1.

Low-rise residential buildings. For all new construction and for roof additions/alterations in which at least 1,000 square feet or at least 50 percent of the roof area is being replaced, recovered or recoated, at least 75 percent of the roof's surface shall meet either (a) the solar reflectance and thermal emittance requirements in Table 1, or (b) the solar reflectance index requirement in Table 1.

Exceptions (all buildings)

1. Vegetated roof systems that contain a minimum thickness of 2.5 inches of growing medium and cover at least 75 percent of the roof area with durable plantings are exempt from the radiative property requirements in Table 1.
2. Portions of roof surfaces that are covered by solar thermal collectors, solar photovoltaic systems, roof penetrations and associated equipment, rooftop decks or walkways, or vegetative roofing systems may be deducted from the total roof surface area that is required to comply with the radiative property requirements in Table 1.
3. Portions of roof surfaces that are shaded at solar noon on the summer solstice may be deducted from the total roof surface area that is required to comply with the radiative property requirements in Table 1.



Table 1. Cool roof radiative property requirements for non-residential and residential buildings applicable to (a) building energy efficiency standards and (b) stretch codes or incentive programs.

(a) Requirements for building energy efficiency standards

	Minimum aged solar reflectance index (SRI)	Minimum aged solar reflectance (SR)	Minimum aged thermal emittance (TE)
Low-sloped roof (slope \leq 2:12) ¹	64	0.55	0.75
Steep roof (slope $>$ 2:12) ²	11	0.20	0.75

(b) Requirements for stretch codes or incentive programs

	Minimum aged solar reflectance index (SRI)	Minimum aged solar reflectance (SR)	Minimum aged thermal emittance (TE)
Low-sloped roof (slope \leq 2:12) ³	75	0.65	0.75
Steep roof (slope $>$ 2:12) ⁴	32	0.35	0.75

The proposed radiative property requirements in the tables above are drawn from existing codes and standards as follows:

- 1) ASHRAE 90.1 and IECC 2012
- 2) Proposed updates to California’s Title 24, 2013 Rulemaking
- 3) Proposed updates to California’s Title 24, 2013 Rulemaking
- 4) PG&E Energy-Efficient Cool Roof rebate program, Level 1