

## **CALBO Cool Roofs Cool Roofs in Title 24 For Energy Documentation Authors**

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### **Cool Roofs in Title 24**

Building professionals responsible for submitting plans for building department review must be familiar with the Cool Roof documentation requirements for Title 24 compliance. Documentation requirements are fairly straightforward, but there are a number of options that can be used to show compliance.

### **Cool Roof Basics**

Cool Roof products, typically light in color, must have both a high surface reflectivity and a high emissivity to qualify for Title 24 compliance. Solar reflectivity is the percentage of solar energy that reflects off the roof surface. A roof surface cannot reflect all of the solar energy; some is absorbed. The percentage of energy that the roof is able to radiate away once it is absorbed is called thermal emissivity. A roof with low reflectivity will absorb more heat. If the roof also has low emissivity, the building will have a higher heat gain.

Title 24 requires that at least 70% of the solar energy on a Cool Roof be reflected, and that 75% or more of the solar energy must be radiated away from the roof surface before it is absorbed. Compliance focuses on properties of the roofing surface, and not on the roof's insulating properties.

Cool Roofs provide numerous benefits:

- Reduce the amount of heat gain in the building, thereby reducing air conditioning costs
- Reduce required air conditioning system tonnage, lowering first cost for the building
- Improve comfort for building occupants
- Reduce air conditioning and roofing maintenance costs
- Extend the life of the roof
- Qualify for incentives from electrical utilities
- Qualify for green building credits, such as LEED (Leadership in Energy and Environmental Design)


Several types of products meet Title 24 criteria for Cool Roof technology on low-slope commercial roofs:

- Single-ply roof membranes, which come in a roll, are rolled out on the roof and then installed with adhesives, mechanical fasteners or seams which are heat welded.
- A roofer may apply a fluid coating or a cap sheet over the top of a conventional built-up roof. This option works for both new and existing roof surfaces.

- A third option is spray polyurethane foam. The roofer then applies a protective, reflective coating over the top of the foam which provides the Cool Roof properties required for Title 24.
- A fourth product option is a fluid-applied membrane or coating.
- Other materials may also be used as Cool Roof products, including coated metal roofing products.

## Cool Roof Labeling Requirements

In order to comply with Title 24 requirements for Cool Roofs, the project must use a labeled product, which lists solar reflectivity and emissivity values for the roof surface. This label must be issued from the Cool Roof Rating Council (CRRC; [www.coolroofs.org](http://www.coolroofs.org)). If you choose not to take any Title 24 credit for the roofing, the project does not need to use a labeled product.

	<b>Initial</b>	<b>Weathered</b>	
	<b>Solar Reflectance</b>	<b>0.00</b>	<b>Pending</b>
	<b>Thermal Emittance</b>	<b>0.00</b>	<b>Pending</b>
	Rated Product ID Number	-----	
Licensed Seller ID Number	-----		
Classification	Production Line		
<small>Cool Roof Rating Council ratings are determined for a fixed set of conditions, and may not be appropriate for determining seasonal energy performance. The actual effect of solar reflectance and thermal emittance on building performance may vary.</small>			
<small>Manufacturer of product stipulates that these ratings were determined in accordance with the applicable Cool Roof Rating Council procedures.</small>			

## Cool Roof Criteria

In new construction, buildings that meet the following criteria require a Cool Roof:

- Non-residential building (includes office, retail, light manufacturing and others but excluding hotels and motels)
- Low slope roof, with a pitch of 2:12 or less
- Only that portion of the roof that is directly over conditioned space is required to have a Cool Roof

If the roof is a replacement roof, Cool Roof requirements include the same criteria above. In addition, Cool Roofs are required *only* when at least 50% of the roof, or at least 2,000 square feet of roof area is being replaced. Plus, if a Cool Roof is required in a replacement scenario, Title 24 requires that the Cool Roof be applied *only* on that portion which is being replaced.

There are a few exceptions in which you are *not* required to add a Cool Roof in a replacement situation (all criteria must be met for this exemption):

- The existing roof has a rock or gravel surface
- The new roof has a rock or gravel surface
- The contractor is not removing any existing layers of the roofing

- Less than 50% or less than 2,000 square feet of the roof surface is being replaced
- There is no planned recoating with a liquid-applied coating
- The roofer will not install a recover board or rigid insulation

## Cool Roof Compliance Methods

There are three ways to demonstrate compliance with Title 24 requirements.

1. Prescriptive Component method
  - Simple, straightforward checklist to show compliance
  - Requires form ENV-2-C
  - Use of a qualifying Cool Roof product is required, and the Cool Roof product used must be labeled and certified by CRRC
  - Submission notes must show specific adherence to the Cool Roof requirements in terms of reflectivity and emissivity
    - One option allows a tradeoff between solar reflectivity and emissivity; if reflectivity is higher than 70%, the emissivity can be lower than 75% according to a formula that determines specific requirements  
( $\text{Reflectivity} = 0.70 + 0.34 \times (0.75 - \text{Emissivity})$ )
2. Prescriptive Overall Envelope method
  - More complicated approach, but allows for more flexibility
  - Requires form ENV-3-C
  - Use of Cool Roof product is optional
    - If a Cool Roof is used, you must use a CRRC-labeled Cool Roof product
    - If a Cool Roof is not used, you may use CEC default numbers instead in your calculations
  - This methodology allows you to trade off Cool Roof reflectivity and emissivity requirements via a formula that considers other energy efficiency measures used in the building envelope, such as insulation or energy efficient windows
3. Performance method
  - Provides you with a great deal of flexibility, allowing you to combine elements of the other two methodologies
  - Requires form PERF-1
  - Use of Cool Roof product is optional
    - If a Cool Roof is used, you must use a CRRC-labeled Cool Roof product
    - If a Cool Roof is not used, you may use CEC default numbers in your calculations
  - Establishes a Title 24 'energy budget' for the building, and the total energy use of the proposed building must meet or come in below this budget
  - Allows you to trade off Cool Roof reflectivity and emissivity requirements via a formula that considers the total energy usage of the building, including mechanical systems, lighting systems and others

## Code Compliance

There are two options in terms of compliance:

- One is to use a Cool Roof on the building and use the CRRC's rated values for roof performance. According to Title 24, if you choose to take credit for the Cool Roof, you must get the product information from CRRC.
  - Note that not every product listed on CRRC's website ([www.coolroofs.org](http://www.coolroofs.org)) qualifies as a Cool Roof. Title 24 requires a 70% reflectivity and 75% emissivity rating.
  - When using values from CRRC's website, choose the number identified as the initial rating. While weathered (three-year) values are provided, you must only use the initial values in forms and calculations.
- Or, you can use Title 24 default values. These values, however, are quite low and therefore punitive, making it difficult for the building to comply with Title 24 requirements unless other energy efficiency measures are taken.

## Documentation

You must provide specific documentation to the building department to demonstrate compliance with Title 24 requirements. You must always submit form ENV-1-C, the Envelope Certificate of Compliance. This form includes basic building information, including roof area, insulation R-value, and other facts, but does *not* address information regarding roof surface performance.

Other documentation required depends on the compliance method you used.

- Prescriptive Envelope Component method:
  - Requires form ENV-2-C
  - Two options for submittal:
    - Option One shows a straightforward and simple compliance method, documenting the roof surface's actual labeled reflectivity and emissivity ratings, and showing conformance to Title 24's required reflectivity of 70% and emissivity of 75% or more. Simply check 'Option One' on the form and verify Cool Roof values using CRRC's website.

**ENVELOPE COMPONENT METHOD (Part 2 of 2) ENV-2-C**

PROJECT NAME: Large Retail Space DATE: 1/16/07

COOL ROOFS - LOW SLOPED - See Section 3.4 in the NRM and §118(i)(3) and §143(a)(1) in the Energy Standards for further description about exterior roofs and mandatory requirements for Cool Roofs.

**APPLICABLE BOXES**

**Option 1 - Tested - Initial Thermal Emittance  $\geq 0.75$  and Initial Solar Reflectance  $\geq 0.70$**

Emittance and reflectance must be  $\geq$  the standard when tested with CRRC-1.

	Proposed	Standard	
1. Enter proposed initial thermal emittance, $\epsilon_{initial}$	0.85	$\geq 0.75$	If proposed $\geq$ to the Standard then it complies.
2. Enter the proposed initial solar reflectance, $\rho_{initial}$	0.79	$\geq 0.70$	If proposed $\geq$ to the Standard then it complies.

3. When applying Liquid Field Applied Coatings, the coating must be applied with a minimum dry mil thickness of 20 mils across the entire roof surface and meet minimum performance requirements listed in §118(i)(3) and Table 118-C. Select the applicable coating:

Aluminum-Pigmented Asphalt Roof Coating  Cement-Based Roof Coating  Other \_\_\_\_\_

**Option 2 - CRRC-1 Tested - Initial Thermal Emittance  $< 0.75$**

Proposed initial thermal emittance  $< 0.75$  when tested with CRRC-1

	Proposed	Standard	
1. Enter proposed initial thermal emittance, $\epsilon_{initial}$		$< 0.75$	Go to line 2. Insert $\epsilon_{initial}$ value in calculation.
2. Enter the initial solar reflectance, $\rho_{initial}$	$0.70 + [0.34 \times (0.75 - \epsilon_{initial})]$	Standard	Standard $\rho_{initial} =$

3. To apply Liquid Field Applied Coatings, the coating must be applied with a minimum dry mil thickness of 20 mils across the entire roof surface and meet minimum performance requirements listed in §118(i)(3) and Table 118-C. Select the applicable coating:

Aluminum-Pigmented Asphalt Roof Coating  Cement-Based Roof Coating  Other \_\_\_\_\_

**CRRC-1 Label Attached to Submittal**

**When CRRC-1 label is available, this compliance method can not be used.**

ASSEMBLY NAME (e.g. Roof-1, Wall-1, Floor, Soffit, etc.)	TYPE (e.g. Roof, Wall, Floor, demising, etc.)	HEAT CAPACITY	INSULATION R-VALUE*		ASSEMBLY U-FACTOR*	
			PROPOSED	MINIMUM ALLOWED	PROPOSED	MAXIMUM ALLOWED
R-10 Roof over Metal Deck	Roof	0.0	19	19	0.0453	0.051

\* For each assembly type, meet the minimum insulation R-value or the maximum assembly U-factor.

WINDOW NAME (e.g., Window-1, Window-2)	ORIENTATION			Fenestration		# OF PANES	Fen. SHGC*	PROPOSED RSHG			PROP RSHG	ALLOWED RSHG
	N	E	S	U-FACTOR	PROP.			ALLOW.	H	V		
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>									
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>									
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>									
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>									

\* From Fenestration Surfaces ENV-1-C, Part 2, Column G, or when Column H has a "C" identifier, calculate using the center of glass value SHGC: in SHGC<sub>req</sub> = .08 + (.88 x SHGC) and enter value.

- Option two allows you to trade higher reflectivity for lower allowable emissivity using product data from the CRRC website and a formula provided in which you calculate the required solar reflectivity based on your proposed thermal emissivity. Then, simply choose a roofing product that meets or exceeds this value.



