Measure Information Template – Inclusion of Solar Reflectance Index as an Alternative to Reflectance and Thermal Emittance Requirements.

2008 California Building Energy Efficiency Standards

Asphalt Roofing Manufacturers Association

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CONTENTS

Overview

Description	***It is imperative to note that the Asphalt Roofing Manufacturers Association opposes the inclusion of requirements for roof reflectance and emittance that are not cost-effective. Based on research and analyses undertaken by ARMA and our member companies which has been provided to the commission, the proposed requirements are not cost effective. However, we submit this measure in the event that the Commission chooses to move forward with this proposal in spite of this fact.*** This measure is for adding the Solar Reflectance Index (SRI) as an alternative requirement to the reflectance and thermal emittance requirements of the proposed 2008 Title 24, Part 6, "Mandatory Requirements for Insulation, Roof Solar Reflectance and Roof Thermal Emittance".

Type of Change	Mandatory Requirement: This proposal would completely remove and replace the existing text in Section 118(i), "Mandatory Requirements for Roof Solar Reflectance and Thermal Emittance", in the draft *("Proposed Standards Language: Solar Reflectance and Thermal Emittance of Residential and Nonresidential Roofs 2008" in Title 24* – Revised May 17, 2006). This proposal offers an alternative to the reflectance and thermal emittance requirements prescribed in the aforementioned proposal. The proposal would necessitate text changes in Title 24, Part 6 Standards and the Compliance Manual.
Energy Benefits	Energy savings resulting from inclusion of this language would be equal to those proposed in the draft proposed *("Proposed Standards Language: Solar Reflectance and Thermal Emittance of Residential and Nonresidential Roofs 2008" in Title 24* – Revised May 17, 2006).
Non-Energy Benefits	The proposed language simplifies and clarifies for the consumer the specification of cool roofing materials by using a single number (SRI) that properly considers the effects of both reflectance and thermal emittance to comply with the energy goals set forth in Title 24, Part 6.
Environmental Impact	There is no discernable difference in the impact to the environment from the language in the proposed prescriptive requirement *("Proposed Standards Language: Solar Reflectance and Thermal Emittance of Residential and Nonresidential Roofs 2008" in Title 24* – Revised May 17, 2006)
Technology Measures	Measure Availability and Cost: This proposal does not affect measure availability and cost. Useful Life, Persistence and Maintenance: This proposal does not affect useful life, persistence and maintenance.
Performance Verification	No performance verification changes are required by this proposal.
Cost Effectiveness	By properly considering the effects of both reflectance and thermal emittance, this proposal allows manufacturers to optimize the combination of reflectance and thermal emittance while still meeting energy requirements. This can improve cost effectiveness.

Analysis Tools	This measure uses a consensus standard, ASTM E-1980, "Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces", to calculate the SRI. This standard is applicable to roofs with a slope of less than 9.5 degrees (2:12). While a different convective coefficient may be more applicable for steeper slopes, a convective coefficient of 12 W/(m^2K) (medium wind) is used for all calculations. The standard states "for non-metallic surfaces, SRI is insensitive to choice of convective coefficient".
Relationship to Other Measures	This proposal offers an alternative that simplifies and clarifies the draft proposed *("Proposed Standards Language: Solar Reflectance and Thermal Emittance of Residential and Nonresidential Roofs 2008" in Title 24* – Revised May 17, 2006).

Methodology

Using ASTM E-1980, "Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces", with a convective coefficient of 12 W/(m^2K) (medium wind), the SRI's that correspond to the proposed requirements for reflectance and thermal emittance were calculated and included in the proposed language. Since the proposed energy savings are equal and obtained at a potentially reduced cost, no life-cycle cost analysis is required.

Analysis and Results

The analysis provides SRI values corresponding to the proposed reflectance and thermal emittance. Appendix A includes the proposed language for Section 118 (i) and the ACM paragraph 2.3.2.3.

Recommendations

We are proposing to delete all current text contained in Section 118(i), "Mandatory Requirements for Roof Solar Reflectance and Thermal Emittance" and the ACM paragraph 2.3.2.3 in the draft *("Proposed Standards Language: Solar Reflectance and Thermal Emittance of Residential and Nonresidential Roofs 2008" in Title 24* – Revised May 17, 2006), and replace it with the language in Appendix A.

Material for Compliance Manuals

The language in Appendix A would be appropriate for inclusion in the Residential Compliance Manual.

Bibliography and Other Research

ASTM E-1980, "Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces".

Appendices

Appendix A – NEW PROPOSALS for Section 118(i) and the ACM paragraph 2.3.2.3.

NEW Section 118 PROPOSAL

Section 118 – Mandatory Requirements for Insulation, Roof Solar Reflectance Index

(i) Mandatory Requirements for Roof Solar Reflectance Index. A roof shall be certified and labeled according to the requirements of Section 10-113 and meet conditions 1 or 2 and, for liquid applied roofing products, 3 below.

1. For all buildings with low-sloped-roofs: any roofing product shall have a a minimum 3-year-aged solar reflectance of 0.55 and minimum 3-year-aged thermal emittance of 0.75. This requirement is also met with a minimum 3-year aged Solar Reflectance Index of 60 as determined by Section 118 (i) 4.

2. For all buildings with steep-sloped roofs:

a. fiberglass asphalt shingles shall have a minimum 3-year-aged solar reflectance of 0.25 and minimum 3-year-aged thermal emittance of 0.75. This requirement is also met with a minimum 3-year aged Solar Reflectance Index of 18 as determined by Section 118 (i) 4.

b. all other roofing products including but not limited to metal, concrete tile, and clay tile shall have a minimum 3-year-aged solar reflectance of 0.40 and minimum 3-year aged thermal emittance of 0.75. This requirement is also met with a minimum 3-year aged Solar Reflectance Index of 39 as determined by Section 118 (i) 4. .

EXCEPTION to Section 118 (i) 1: For low-rise residential buildings with low-sloped roofs, the prescriptive requirements for solar reflectance and thermal emittance are waived in California Climate Zones 1 through 9 and 12. For low-rise residential buildings with steep-sloped roofs, the prescriptive requirement for solar reflectance and thermal emittance are waived in California Climate Zones 1 through 8.

3. Liquid applied roof coatings **TBD**

4. Three-year-aged value of Solar Reflectance Index is determined as follows.

a. If the product's three-year-aged values of solar reflectance and thermal emittance have been certified and labeled according to CRRC-1, these values may be reported directly or they may be used to calculate the Solar Reflectance Index in accordance with ASTM E-1980, Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces, assuming medium wind.[1]

b. If the product's initial values of solar reflectance and thermal emittance have been certified and labeled according to CRRC-1, but the product's three-year-aged values of solar reflectance and thermal emittance have not been certified and labeled according to CRRC-1, the product's three-year-aged solar reflectance ρ_{aged} and three-year-aged thermal emittance e_{aged} are estimated from its CRRC-1 compliant values of initial solar reflectance $\rho_{initial}$ and initial thermal emittance $e_{initial}$ using the following two formulas:

$$\rho_{aged} = 0.2 + 0.7 * (\rho_{initial} - 0.2)$$
$$e_{aged} = e_{initial}$$

The calculated aged values may be reported directly or they may be used to calculate the Solar Reflectance Index in accordance with ASTM E-1980 assuming medium wind.

c. If neither three-year-aged nor initial values of the product's solar reflectance and thermal emittance have been certified and labeled according to CRRC-1, the product will be assigned a default three-year-aged solar reflectance of 0.10 and a default three-year-aged thermal emittance of 0.75, or a default three-year-aged Solar Reflectance Index of 0.

NEW ACM language PROPOSAL

2.3.2.3 Solar Reflectance and Thermal Emittance

Description

The combination of solar reflectance and thermal emittance are the reflective and radiative properties of exterior surfaces. With the performance method any combination of reflectance and thermal emittance is recognized for credit or penalty. A cool roof, as defined in the Standards,

a. for low-sloped roofs, has a minimum 3-year-aged solar reflectance of 0.55 and minimum 3-year-aged thermal emittance of 0.75. This requirement is also met with a minimum 3-year-aged Solar Reflectance Index (SRI) of 60.

b. for steep-sloped roofs:
1. asphalt shingles: minimum 3-year-aged solar reflectance of 0.25 and minimum 3-year-aged thermal emittance of 0.75. This requirement is also met with a minimum 3-year-aged Solar Reflectance Index of 18.

2. all other roofing products including but not limited to metal, concrete tile, and clay tile: a minimum 3-year-aged solar reflectance of 0.40 and minimum 3-year aged thermal emittance of 0.75. This requirement is also met with minimum 3-year-aged Solar Reflectance Index of 39.