



# ENERGY STAR<sup>®</sup> Program Requirements Product Specification for Roof Products

## Eligibility Criteria DRAFT 1: Version 3.0

Following is the ENERGY STAR **Version 3.0** product specification for roof products. A product shall meet all of the identified criteria if it is to earn the ENERGY STAR.

### 1. Definitions

#### 1.1 General

- A. Roof surface: The uppermost part of the roof system that is in direct contact with solar radiation.
- B. Low-Slope Roofs: Surfaces with a slope of 2:12 or less.<sup>1</sup>
- C. Steep-Slope Roofs: Surfaces with a slope greater than 2:12.
- D. Low-Slope Roof Products: Products that are typically installed on low-slope surfaces such as single-ply membranes, built-up-roofs (BUR), modified bitumen, spray polyurethane foam, roof coatings, metal panels, and standing-seam profiled metal. Some products that are typically installed on low-slope roofs may also be installed on steep-slope roofs (e.g., single-ply membranes and roof coatings). For the purposes of this specification, the roof product will constitute the roof surface.
- E. Steep-Slope Roof Products: Products that are typically installed on steep-slope surfaces such as composite shingles, clay, concrete, or fiber-cement tile, slate, metal panels, and metal shingles. Some products that are typically installed on low-slope roofs may also be installed on steep-slope roofs (e.g., single-ply membranes and roof coatings). For the purposes of this specification, the roof product will constitute the roof surface.

#### 1.2 Roof Products

- F. Built-Up-Roof (BUR): Traditional hot asphalt or coal tar built-up roofing membrane assembly consists of alternating layers of felts, fabrics, or mats saturated with bitumen during manufacture, assembled in place, and adhered with applied layers of hot bitumen. Surfacing for the hot BUR can be aggregate embedded in hot asphalt; mineral-surface cap sheets; modified bitumen cap sheets; or smooth-surface applications or coatings.<sup>2</sup>
- G. Asphalt Shingle: Composed of a base material, either organic felt or glass fiber mat; asphalt; and surfacing material, generally in the form of mineral granules.<sup>3</sup>
- H. Metal Roof Component: Metal roof product designed to resemble a traditional steep-slope residential product such as shingle, tile, shake, or slate.
- I. Metal Roof Panel: Roofing systems using metal panels are divided into two categories: architectural and structural. Architectural metal roofs are applied over a substrate while structural metal roofs span between structural supports without the need for a substrate to carry the applied

<sup>1</sup> As defined in ASTM Standard E 1918-06.

<sup>2</sup> National Roofing Contractors Association Commercial Low-Slope Roofing Materials Guide 1998.

<sup>3</sup> Ibid.

loads. Standing seam roofs can be used on roofs with slopes as low as ¼:12. Steel and aluminum sheets are commonly used to fabricate metal roof panels. Steel requires a corrosion resistant metal coating such as zinc, aluminum, alloys of zinc-aluminum, or tin. Metallic coated steel includes galvanized steel, aluminized steel, zinc-aluminum-coated steel and terne-coated steel. Metallic coated steels may also be painted to provide additional corrosion protection, as well as color.

- J. Modified Bitumen: Roll roofing products consisting of asphalt, reinforcing layers, and in some cases, surfacing. During manufacture, a polymer (APP, or atactic polypropylene, and SBS, or styrene butadiene styrene, are the most common) is added to the bitumen while heating, which "modifies," or changes, its properties.<sup>4</sup>
- K. Roof Coating: A material typically applied in the liquid state to the roof surface at the time of construction or at a later time as a retrofit measure. Roof coatings may be bituminous, polymeric, polymer modified, epoxy based, or other formulations. Bituminous roof coatings are formulated using bitumen. Polymeric roof coatings are formulated using a variety of synthetic resins such as acrylic, neoprene, styrene butadiene, urethane, polyvinyl acetate, and others. Polymer modified roof coatings are manufactured by combining a portion of the polymeric technology with bitumen technology.
- L. Roof Tile: May be composed of clay, concrete, fiber-cement, or synthetic materials. A variety of tile profiles, styles, finishes, and colors are available.
- M. Single-Ply Membrane: A term applied to a sheet membrane which is a membrane fabricated in a controlled factory environment. It is waterproof and weather resistant. It may be a laminate of one or more materials and may or may not contain reinforcing fabrics.<sup>5</sup>
- N. Spray Polyurethane Foam Roof System: A fully adhered system that consists of a rigid closed-cell sprayed-in-place polyurethane foam insulation and a protective roof coating. Typical coatings include acrylic, silicone, or urethane elastomers.
- O. Variegated Roof Products: A material with a varied surface color, requiring a larger sample for measurement of Solar Reflectance.<sup>6</sup>
- P. Factory-Applied Roof Product Component: A material or component made by a licensed Original Manufacturer (OM) which is applied to a substrate in a factory or coating facility (i.e. not in the field).

### 1.3 Roof Product Performance

- Q. Solar Flux: The direct and diffuse radiation from the sun received at ground level over the solar spectrum expressed in watts per square meter.
- R. Solar Reflectance: The fraction of solar flux reflected by a surface expressed as a percent or within the range of 0.00 and 1.00.
- S. Solar Spectrum: Radiation originating from the sun, including ultraviolet, visible, and near-infrared radiation. Approximately 99 percent of solar energy lies between wavelengths of 0.3 to 3.5 micrometers (Fm).
- T. Thermal Emittance: The ratio of the radiant heat flux emitted by a sample to that emitted by a blackbody radiator at the same temperature (Total Thermal Emittance).<sup>7</sup>

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<sup>4</sup> National Roofing Contractors Association Commercial Low-Slope Roofing Materials Guide 1998.

<sup>5</sup> As found in Single Ply Roofing Industry's Publication, Flexible Membrane Roofing: Professional's Guide to Specifications, 2003.

<sup>6</sup> As defined in Cool Roof Rating Council, Product Rating Program, CRRC-1, January 8, 2008.

<sup>7</sup> Ibid.

## 1.4 Color Families

- U. Color Family Binder/Resin Technology: General class of factory-applied coatings used in metal roofing products which are defined by the family of related binder/resin chemicals used to formulate such coatings.
- V. Hunter “L,” “a,” “b” Color Values: A numeric measurement of a color’s lightness (L), redness/greenness (a) and yellowness/blueness (b).
- W. Color Family: A CRRC pre-defined range of Hunter “L”, “a”, and “b” color values that establishes the color space for a CRRC predefined set of eighteen colors.
- X. Color Family Group: One or more production line of factory coated metal roofing products that have the same binder/resin technology, color properties, solar reflectance, and thermal emittance values that fall within the ranges established for the respective CRRC Color Family.
- Y. Color Family Element: A uniquely formulated roofing product that is a member of a Color Family Group and is either: (1) a factory-applied roof product component that serves as the top coating on a factory coated metal roofing product or (2) a metal roofing product that has a factory-applied roof product component as its top coating.
- Z. Color Family Representative Element: A Color Family Element that is used to initially establish a Color Family Group.
- AA. Color Family Additional Element: A Color Family Element that is not the Color Family Representative Element.<sup>8</sup>

## 2. Scope

- 2.1. Included Products:** Products that meet the definition of a Roofing Product as specified herein are eligible for ENERGY STAR qualification, with the exception of products listed in Section 2.2. To qualify for ENERGY STAR, roof products shall be:
- a) Tested through the Cool Roof Rating Council (CRRC) Product Rating Program, including Color Family Groups and Compound Product Ratings, or<sup>9</sup>
  - b) Evaluated using the test methods referenced in Table 3 in Section 4, below.

**Note:** EPA would like to clarify Compound Product Ratings, as defined by the Cool Roof Rating Council, are eligible for qualification. Compound Ratings share the same surface formulation and same radiative properties with varying designs or profiles.

- 2.2. Excluded Products:** Roof products intended for use on siding or walls, are not eligible for ENERGY STAR under this product specification.

**Note:** EPA is aware that roof products are often installed for non-roof applications. For example, coatings are often applied to exterior walls. EPA would like to clarify when roof product materials are used for non-roof applications, the product is not considered to be ENERGY STAR qualified and partners shall not imply ENERGY STAR qualification to consumers.

<sup>8</sup> As defined in Cool Roof Rating Council, Product Rating Program, CRRC-1, January 8, 2008.

<sup>9</sup> Information on the Cool Roof Rating Council Product Rating Program can be found at [www.coolroofs.org](http://www.coolroofs.org)

### 3. Qualification Criteria

#### 3.1 Significant Digits and Rounding

- 3.1.1. All calculations shall be carried out with actual measured or observed values. Only the final result of a calculation shall be rounded. Calculated results shall be rounded to the nearest significant digit as expressed in the corresponding specification limit.
- 3.1.2. Unless otherwise specified, compliance with specification limits shall be evaluated using exact values without any benefit from rounding.

#### 3.2 Solar Reflectance and Reliability

- 3.2.1 The average of all solar reflectance values obtained during testing shall be used to meet the limits provided in Table 1 (low-slope) or Table 2 (steep-slope), below.
- 3.2.2 Roof products that may be applied to either low-slope or steep-slope roofs, such as roof coatings and single-ply membranes, shall meet the Table 1 requirements, below.

<b>Table 1 – Specifications for Low-Slope Roof Products</b>	
<b>Characteristic</b>	<b>Performance Specification</b>
<b>Solar Reflectance</b>	
Initial Solar Reflectance	Greater than or equal to 0.65.
Maintenance of Solar Reflectance	Greater than or equal to 0.50 three years after installation under normal conditions.
<b>Reliability</b>	
Manufacturer warranty for defects in materials and manufacturing	Each company’s warranty for ENERGY STAR qualified roof products shall be equal in all material respects to the product warranty offered by the same company for comparable non-ENERGY STAR qualified roof products. A company that sells only ENERGY STAR qualified roof products shall offer a warranty that is equal in all material respects to the standard industry warranty for comparable non-ENERGY STAR qualified roof products.

<b>Table 2 – Specifications for Steep-Slope Roof Products</b>	
<b>Characteristic</b>	<b>Performance Specification</b>
<b>Energy Efficiency Levels</b>	
Initial Solar Reflectance	Greater than or equal to 0.25.
Maintenance of Solar Reflectance	Greater than or equal to 0.15 three years after installation under normal conditions.
<b>Reliability</b>	
Manufacturer warranty for defects in materials and manufacturing	Each company’s warranty for ENERGY STAR qualified roof products shall be equal in all material respects to the product warranty offered by the same company for comparable non-ENERGY STAR qualified roof membrane products. A company that sells only ENERGY STAR qualified roof products shall offer a warranty that is equal in all material respects to the standard industry warranty for comparable non-ENERGY STAR qualified roof products.

## 4. Test Requirements

4.1 Representative Models shall be selected for testing per the following requirements:

- 4.1.1 For qualification of an individual product model, the representative product shall be equivalent to that which is intended to be marketed and labeled as ENERGY STAR.
- 4.1.2 For qualification of a product family, one product shall be designated as the Color Family Representative Element. The Color Family Representative Element shall be tested for initial *and* aged solar reflectance and thermal emittance. Tested initial solar reflectance shall meet or exceed the Color Family Group default solar reflectance value and default thermal emittance value. Additional products to be submitted into an already established Color Family Group are called Color Family Additional Elements. Color Family Additional Elements shall also be tested for initial solar reflectance and thermal emittance, but aged testing is not required. All Color Family Elements shall be tested for Hunter “L”, “a”, “b” values. Color families are defined in *Table 1: CRRC Color Families and Characteristics*.<sup>10</sup>
- 4.1.3 For Color Family Representative Elements, aged reflectance values are subsequently established for the Color Family Group as *either* the measured aged values of the Color Family Representative Element *or* the initial Color Family default values, whichever is lower.
- 4.1.4 After a Color Family Group is established by rating a Color Family Representative Element, additional products of the same binder/resin technology that fall within the specified Hunter “L”, “a”, “b” color range can then be added to the Color Family Group as “Color Family Additional Elements” by testing each Additional Element’s initial solar reflectance and thermal emittance. Reported values shall be no higher than the average of the initial test results of the Color Family Representative Element.

**Note 1:** No aged testing is required for Color Family Additional Elements. The Color Family Additional Element shall qualify using the default solar reflectance value and default thermal emittance value of the Color Family Group and the aged solar reflectance value of the Representative Element of the Color Family Group; either the initial Color Family Group default value or the actual aged rated value of the Representative Element, whichever is lower.<sup>11</sup>

**Note 2:** Variegated roof products using binder/resin technologies encompassing multiple Color Family Groups shall not qualify as Color Family Additional Elements.

**Note:** EPA has clarified that variegated roof products are generally not eligible for qualification as a Color Family Additional Element, consistent with the Cool Roof Rating Council’s product rating program. Variegated roof products may only qualify using Maintenance of Solar Reflectance testing. Should the Cool Roof Rating Council allow variegated roof product certification as Color Family Additional Elements in the future, EPA will reevaluate how variegated roof products shall be qualified.

<sup>10</sup> As found in Cool Roof Rating Council’s [Product Rating Program Manual CRRC-1](#), 2009.

<sup>11</sup> As found in Cool Roof Rating Council’s [Product Rating Program Manual CRRC-1](#), 2009.

4.1.5 When testing roof products, the following test methods shall be used to determine ENERGY STAR qualification:

<b>Table 3: Test Methods for ENERGY STAR Qualification</b>	
<b>ENERGY STAR Requirement</b>	<b>Test Method Reference</b>
Initial Solar Reflectance	ASTM E 903-96 - <i>Standard Test Method for Solar Absorptance, Reflectance, and Transmission of Materials Using Integrating Spheres</i> (solar reflectance only, values for solar absorptance and transmission need not be obtained), <b>or</b>  ASTM C 1549-09 - <i>Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer</i>  <b>Variegated roof products</b> may be tested according to the <i>CRRC Test Method #1</i> .
Maintenance of Solar Reflectance*	ENERGY STAR Test Method for Roof Products: Maintenance of Solar Reflectance, March 2015 (relevant ASTM standard references are included in this document)
Emissivity	ASTM C1371-04a(2010)e1 – Standard Test Method for Determination of Emittance of Materials Near Room Temperature using Portable Emissometers

**Note:** EPA is removing the option to test emissivity using ASTM E408-71(1996) since the test method may provide more favorable test results over ASTM C1371-04a(2010)e1. The specification also references a more recent version of the ENERGY STAR Test Method for Maintenance of Solar Reflectance, which is currently under development.

**\*Note:** Maintenance of Solar Reflectance can also be established using the CRRC Color Family Program as defined in the Product Rating Program Manual (CRRC-1). This program addresses the fact that, with a given binder/resin material technology, the performance of a product will vary little between products of similar, but not identical, color. This program establishes a representative product (i.e., Color Family Representative Element), which will represent a group of similar products throughout the testing process. Please refer to the Color Family Group Requirements and Color Family Additional Element Requirements sections above for additional information.

**4.2 Initial Solar Reflectance:** A 3” x3” flat sample of each product shall be submitted for testing. The test shall be performed using a black background for the sample. Where appropriate, the sample shall be prepared according to manufacturer recommendation for thickness used in the field.

**4.3 Changes to Product Formulation:** If a fundamental element of product formulation occurs, such as the base latex, the product shall be retested for the solar reflectance of both initially and according to the Maintenance of Solar Reflectance Test Method. In addition, to ensure other product formulation changes will not affect the solar reflectance of the product, evidence shall be provided that shows product formulation or recipe has not changed since the solar reflectance testing was performed.

**4.4 Color Family Element Testing:** All Color Family Elements shall be tested for Hunter “L”, “a”, “b” values. Color families are defined in *Table 1: CRRC Color Families and Characteristics* found in the CRRC Product Rating Program Manual (CRRC-1).

**4.5 Emissivity:** Initial emissivity results shall be tested according to the test methods listed in Table 3 of this specification. Roof products are not required to meet minimum emissivity requirements for ENERGY STAR qualification at this time unless the roof product is qualifying using Color Family Groups.

**4.6** As required in the *ENERGY STAR Test Method for Roof Products: Maintenance of Solar Reflectance*, the test surface of each sample shall not be washed, cleaned, or wiped in any fashion prior to testing aged solar reflectance. Loose dirt, embedded dirt, environmental stains, mold, mildew, and any other material that rests on – or has become incorporated into – the surface of the material shall not be altered.

**Note:** EPA requires maintenance of solar reflectance testing on un-cleaned samples. All roof products, including those previously qualified under Version 1.0, must have been tested on un-cleaned samples to remain qualified under this Version 3.0 specification.

## 5. Effective Date

The ENERGY STAR Roof Products Specification shall take effect on **March 1, 2015**. To qualify for ENERGY STAR, a product model shall meet the ENERGY STAR specification in effect on the model's date of manufacture. The date of manufacture is specific to each unit and is the date on which a unit is considered to be completely assembled.

**Note:** In light of the limited set of adequate testing facilities and the particularly long test period for roof products, EPA is proposing a March 1, 2015 effective date for Version 3.0.

## 6. Future Specification Revisions

EPA reserves the right to change the specification should technological and/or market changes affect its usefulness to consumers, industry, or the environment. In keeping with current policy, revisions to the specification are arrived at through industry discussions. In the event of a specification revision, please note that the ENERGY STAR qualification is not automatically granted for the life of a product model.