



ENERGY STAR® Program Requirements for Roof Products

Partner Commitments

Following are the terms of the ENERGY STAR Partnership Agreement as it pertains to the manufacture and labeling of ENERGY STAR qualified products. The ENERGY STAR Partner must adhere to the following partner commitments:

Qualifying Products

1. Comply with current ENERGY STAR Eligibility Criteria, which define performance requirements and test procedures for roof products. A list of eligible products and their corresponding Eligibility Criteria can be found at www.energystar.gov/specifications.
2. **Prior to associating the ENERGY STAR name or mark with any product**, obtain written certification of ENERGY STAR qualification from a Certification Body recognized by EPA for roof products. As part of this certification process, products must be tested in a laboratory recognized by EPA to perform roof product testing. A list of EPA-recognized laboratories and Certification Bodies can be found at www.energystar.gov/testingandverification.

Using the ENERGY STAR Name and Marks

3. Comply with current ENERGY STAR Identity Guidelines, which define how the ENERGY STAR name and marks may be used. Partner is responsible for adhering to these guidelines and ensuring that its authorized representatives, such as advertising agencies, dealers, and distributors, are also in compliance. The ENERGY STAR Identity Guidelines are available at www.energystar.gov/logouse.
4. Use the ENERGY STAR name and marks only in association with qualified products. Partner may not refer to itself as an ENERGY STAR Partner unless at least one product is qualified and offered for sale in the U.S. and/or ENERGY STAR partner countries.
5. Provide clear and consistent labeling of ENERGY STAR qualified roof products.
 - 5.1. The ENERGY STAR mark must be clearly displayed in product literature (i.e., user manuals, spec sheets, etc.) and on the manufacturer's Internet site where information about ENERGY STAR qualified models is displayed.
 - 5.2. It is also recommended that the mark appear on the product packaging.

Verifying Ongoing Product Qualification

6. Participate in third-party verification testing through a Certification Body recognized by EPA for roof products, providing full cooperation and timely responses. EPA/DOE may also, at its discretion, conduct tests on products that are referred to as ENERGY STAR qualified. These products may be obtained on the open market, or voluntarily supplied by Partner at the government's request.

Providing Information to EPA

7. Provide unit shipment data or other market indicators to EPA annually to assist with creation of ENERGY STAR market penetration estimates, as follows:

- 7.1. Partner must submit the total number of ENERGY STAR qualified roof products shipped in the calendar year or an equivalent measurement as agreed to in advance by EPA and Partner. Partner shall exclude shipments to organizations that rebrand and resell the shipments (unaffiliated private labelers).
- 7.2. Partner must provide unit shipment data segmented by meaningful product characteristics (e.g., type, capacity, presence of additional functions) as prescribed by EPA.
- 7.3. Partner must submit unit shipment data for each calendar year to EPA or an EPA-authorized third party, preferably in electronic format, no later than March 1 of the following year.

Submitted unit shipment data will be used by EPA only for program evaluation purposes and will be closely controlled. If requested under the Freedom of Information Act (FOIA), EPA will argue that the data is exempt. Any information used will be masked by EPA so as to protect the confidentiality of the Partner.

8. Report to EPA any attempts by recognized laboratories or Certification Bodies (CBs) to influence testing or certification results or to engage in discriminatory practices.
9. Notify EPA of a change in the designated responsible party or contacts within 30 days using the My ENERGY STAR Account tool (MESA) available at www.energystar.gov/mesa.

Training and Consumer Education

10. Partner shall comply with the following, product-specific requirements concerning training and education:
 - 10.1. Through product literature, provide the following information to end users:
 - 10.1.1. A description of the variables that influence the amount of energy savings that can be realized when an ENERGY STAR qualified roof product is installed on a home or building,
 - 10.1.2. An acknowledgement that the solar reflectance of any roof products over time may increase or decrease, depending on the product make-up, due to aging and dirt and microbial accumulation, and
 - 10.1.3. A description of the proper maintenance procedures required to maximize solar reflectance over the longest period of time possible (e.g., rinsing or power washing each spring or recoating every five years).
 - 10.2. Partner may continue to use the following statement to meet the above requirement: "When installed properly, this product will help reduce energy costs. Actual savings will vary based on geographic location and individual building characteristics. Consult your product manufacturer, roofing contractor, or call 1-888-STAR-YES (1-888-782-7937) for more information." This statement must be placed in close proximity to the ENERGY STAR mark wherever it is included in product literature and on the manufacturer's Internet site.

Performance for Special Distinction

In order to receive additional recognition and/or support from EPA for its efforts within the Partnership, the ENERGY STAR Partner may consider the following voluntary measures, and should keep EPA informed on the progress of these efforts:

- Provide quarterly, written updates to EPA as to the efforts undertaken by Partner to increase availability of ENERGY STAR qualified products, and to promote awareness of ENERGY STAR and its message.
- Consider energy efficiency improvements in company facilities and pursue benchmarking buildings through the ENERGY STAR Buildings program.
- Purchase ENERGY STAR qualified products. Revise the company purchasing or procurement specifications to include ENERGY STAR. Provide procurement officials' contact information to EPA for

periodic updates and coordination. Circulate general ENERGY STAR qualified product information to employees for use when purchasing products for their homes.

- Feature the ENERGY STAR mark(s) on Partner website and other promotional materials. If information concerning ENERGY STAR is provided on the Partner website as specified by the ENERGY STAR Web Linking Policy (available in the Partner Resources section of the ENERGY STAR website), EPA may provide links where appropriate to the Partner website.
- Ensure the power management feature is enabled on all ENERGY STAR qualified displays and computers in use in company facilities, particularly upon installation and after service is performed.
- Provide general information about the ENERGY STAR program to employees whose jobs are relevant to the development, marketing, sales, and service of current ENERGY STAR qualified products.
- Provide a simple plan to EPA outlining specific measures Partner plans to undertake beyond the program requirements listed above. By doing so, EPA may be able to coordinate, and communicate Partner's activities, provide an EPA representative, or include news about the event in the ENERGY STAR newsletter, on the ENERGY STAR website, etc. The plan may be as simple as providing a list of planned activities or milestones of which Partner would like EPA to be aware. For example, activities may include: (1) increasing the availability of ENERGY STAR qualified products by converting the entire product line within two years to meet ENERGY STAR guidelines; (2) demonstrating the economic and environmental benefits of energy efficiency through special in-store displays twice a year; (3) providing information to users (via the website and user's manual) about energy-saving features and operating characteristics of ENERGY STAR qualified products; and (4) building awareness of the ENERGY STAR Partnership and brand identity by collaborating with EPA on one print advertorial and one live press event.
- Join EPA's SmartWay Transport Partnership to improve the environmental performance of the company's shipping operations. The SmartWay Transport Partnership works with freight carriers, shippers, and other stakeholders in the goods movement industry to reduce fuel consumption, greenhouse gases, and air pollution. For more information on SmartWay, visit www.epa.gov/smartway.
- Join EPA's Green Power Partnership. EPA's Green Power Partnership encourages organizations to buy green power as a way to reduce the environmental impacts associated with traditional fossil fuel-based electricity use. The partnership includes a diverse set of organizations including Fortune 500 companies, small and medium businesses, government institutions as well as a growing number of colleges and universities. For more information on Green Power, visit www.epa.gov/greenpower.



ENERGY STAR® Program Requirements Product Specification for Roof Products

Eligibility Criteria Version 2.3

Following is the ENERGY STAR **Version 2.3** 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.¹
- 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.²
- 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.³
- 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

¹ As defined in ASTM Standard E 1918-06.

² National Roofing Contractors Association Commercial Low-Slope Roofing Materials Guide 1998.

³ 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.⁴
- 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.⁵
- 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.⁶
- 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).⁷

⁴ National Roofing Contractors Association Commercial Low-Slope Roofing Materials Guide 1998.

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

⁶ As defined in Cool Roof Rating Council, Product Rating Program, CRRC-1.

⁷ 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 seventeen 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.⁸

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:

2.1.1 Tested through the Cool Roof Rating Council (CRRC) Product Rating Program, including Color Family Groups and Compound Product Ratings, or⁹

2.1.2 Evaluated using the test methods referenced in Table 3 in Section 4, below.

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

⁸ As defined in Cool Roof Rating Council, Product Rating Program, CRRC-1.

⁹ Information on the Cool Roof Rating Council Product Rating Program can be found at www.coolroofs.org

3. Qualification Criteria

3.1 Significant Digits and Rounding

- 3.1.1. All calculations shall be carried out with actual measured (unrounded) values. Only the final result of a calculation shall be rounded.
- 3.1.2. Unless otherwise specified, compliance with specification limits shall be evaluated using exact values without any benefit from rounding.
- 3.1.3. Directly measured or calculated values that are submitted for reporting on the ENERGY STAR website shall be rounded to the nearest significant digit as expressed in the corresponding specification limit.

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.

Table 1 – Specifications for Low-Slope Roof Products	
Characteristic	Performance Specification
Solar Reflectance	
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.
Reliability	
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.

Table 2 – Specifications for Steep-Slope Roof Products	
Characteristic	Performance Specification
Energy Efficiency Levels	
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.
Reliability	
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*.¹⁰
- 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.¹¹

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

¹⁰ As found in Cool Roof Rating Council’s [Product Rating Program Manual CRRC-1](#).

¹¹ As found in Cool Roof Rating Council’s [Product Rating Program Manual CRRC-1](#).

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

Table 3: Test Methods for ENERGY STAR Qualification	
ENERGY STAR Requirement	Test Method Reference
Initial Solar Reflectance	ASTM E903-96 - <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), or ASTM C1549-09 - <i>Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer</i> Variegated roof products may be tested according to the <i>CRRC-1 Test Method #1</i> .
Maintenance of Solar Reflectance*	ENERGY STAR Test Method for Roof Products: Maintenance of Solar Reflectance, October 2010 (relevant ASTM standard references are included in this document)
Emissivity	ASTM C1371-04a(2010)e1 - <i>Standard Test Method for Determination of Emittance of Materials Near Room Temperature using Portable Emittance Meters</i>

***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" x 3" 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.

For existing products qualified under previous versions of this roof products specification, retesting aged solar reflectance on uncleaned samples is not required. These products will be denoted in some manner on the ENERGY STAR qualifying product list as having been tested on clean samples.

5. Effective Date

The ENERGY STAR Roof Products Specification shall take effect on **July 1, 2012**. 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.

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.



ENERGY STAR® Program Requirements Product Specification for Roof Products

Test Method: Maintenance of Solar Reflectance

1) OVERVIEW

The following test method shall be used for determining product compliance with maintenance of solar reflectance requirements in the ENERGY STAR Product Specification for Roof Products.

2) APPLICABILITY

This test protocol is applicable for evaluation to the ENERGY STAR Roof Products Eligibility Criteria.

3) DEFINITIONS

Unless otherwise specified, all terms used in this document are consistent with the definitions contained in the ENERGY STAR Product Specification for Roof Products.

4) TEST SETUP

Test setup and instrumentation shall be in accordance with applicable test standards, as referenced herein, unless otherwise noted in this document. In the event of conflicting requirements, this test procedure shall take precedence.

5) PREPARATION OF PRODUCT UNDER TEST

The test surface of each sample shall not be washed, cleaned, or wiped in any fashion. 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.

6) TEST METHODS

Maintenance of Solar Reflectance shall be measured using test method A, B, **or** C:

A. Field measurement of Solar Reflectance for roof products and coatings installed at least 3-years prior

Low Sloped Roof Products – Applicable Test Standards

Test setup and instrumentation shall be in accordance with applicable test standards, as referenced herein:

- a) ASTM E 1918-06: *Standard Test Method for Measuring Solar Reflectance of Horizontal and Low-Sloped Surfaces in the Field*, **or**
- b) ASTM C 1549-09: *Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer*

Low Sloped Roof Products – Test Procedure

- a) Identify three (3) existing roofs on which the same product was installed a minimum of three years prior. At least one of these existing roofs shall be located within a major metropolitan area such as Atlanta, Boston, Chicago, Dallas, Houston, Los Angeles, Miami, Minneapolis, New York, Philadelphia, San Francisco, St. Louis, Washington D.C., etc. The roof product need not have been installed at the same time on the three buildings; however, the roofs shall each be at least three years old.
- b) Divide the roof into at least ten (10) equal sections.
- c) Perform measurements in the center of each area.
- d) At least three (3) repetitions shall be made of each measurement (the exact same area). Note that if a pond or birdbath occurs in the center of the area to be measured, offset the measurement location so that it is outside of the pond or birdbath.
- e) If testing is performed to ASTM E 1918-06, measurements shall be taken on a clear day (no clouds) between 10:00 AM and 2:00 PM when the sun is high in the sky and there can be no obstruction in the field of view.

Steep Sloped Roof Products – Applicable Test Standard

Test setup and instrumentation shall be in accordance with ASTM C 1549-09: *Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer*.

Steep Sloped Roof Products – Test Procedure

- a) Identify three (3) existing roofs on which the same product was installed a minimum of three years prior. At least one of these existing roofs shall be located within a major metropolitan area such as Atlanta, Boston, Chicago, Dallas, Houston, Los Angeles, Miami, Minneapolis, New York, Philadelphia, San Francisco, St. Louis, Washington D.C., etc. The roof product need not have been installed at the same time on the three buildings; however, the roofs shall each be at least three years old.
- b) Divide the roof into at least ten (10) equal sections.
- c) Perform measurements in the center of each area.
- d) Make at least three (3) repetitions of each measurement (the exact same area). Note that if a pond or birdbath occurs in the center of the area to be measured, offset the measurement location so that it is outside of the pond or birdbath.

- B. Test Lab measurement of roof products and coating samples taken from roofs installed at least 3-years prior

Applicable Test Standards

Test setup and instrumentation shall be in accordance with applicable test standards, as referenced herein:

- a) ASTM E 903-96: *Standard Test Method for Solar Absorptance, Reflectance, and Transmission of Materials Using Integrating Spheres, or*
- b) ASTM C 1549-09: *Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer*

Test Procedure

- a) Identify three (3) existing roofs on which the same product was installed a minimum of three years prior. At least one of these existing roofs shall be located within a major metropolitan area such as Atlanta, Boston, Chicago, Dallas, Houston, Los Angeles,

Miami, Minneapolis, New York, Philadelphia, San Francisco, St. Louis, Washington D.C., etc. The roof product need not have been installed at the same time on the three buildings; however, the roofs shall each be at least three years old.

- b) Take a minimum of three (3) samples from the each of the existing roofs as identified above.
 - c) Make at least three (3) measurements of solar reflectance from different areas on each sample.
 - d) Ensure that the roof from which samples were taken is properly repaired so as to resume watertight integrity.
- C. Test Lab measurement of roof products and coating samples exposed for three years in accordance with ASTM G 7-05: *Standard Practice for Atmospheric Environmental Exposure Testing of Nonmetallic Materials* on commercial or private weathering farms

Applicable Test Standards

Test setup and instrumentation shall be in accordance with applicable test standards, as referenced herein:

- a) ASTM G 7-05: *Standard Practice for Atmospheric Environmental Exposure Testing of Nonmetallic Materials*
- b) ASTM E 903-96: *Standard Test Method for Solar Absorptance, Reflectance, and Transmission of Materials Using Integrating Spheres, or*
- c) ASTM C 1549-09: *Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer*

Test Procedure

- a) Expose panels outdoors on commercial or private weathering farms that are accredited to ISO/IEC 17025:1999 *General Requirements for the Competence of Testing and Calibration Laboratories*.
- b) Prepare panels such that the surface to receive solar radiation goes over the intended substrate¹.
- c) At least three (3) panels with the identical formulation as those that were tested for initial solar reflectance shall be exposed for three years in accordance with ASTM G 7-05.
- d) Each exposure panel shall be at least 24 square inches (155 square centimeters) in size, e.g. 4" x 6" or 3" x 8", and shall be mounted so that there is no run off from one panel to another.
- e) To further avoid runoff onto samples, where possible, the exposure panel shall be mounted near the top of the test rack.
- f) For low-slope roof products and coatings and for product that can be applied to either low-slope or steep-slope roofs, test samples shall be exposed at a slope of 2:12 or less (1/4:12 is recommended) and facing south.
- g) For steep-slope roof products and coatings, test samples shall be exposed at a slope between 2:12 and 12:12 (4:12 is recommended) and facing south.
- h) Make at least three (3) measurements of solar reflectance from different areas on each sample.

¹ For example, if a coating is intended for BUR, the specimen set needs to be prepared using BUR. If the coating is to be used over Modified Bitumen, a specimen set needs to be prepared using Modified Bitumen.