



ENERGY STAR[®] Program Requirements for Roof Products

Eligibility Criteria

Below is the product specification (Version 1.2) for ENERGY STAR qualified roof products. A product must meet all of the identified criteria if it is to be labeled as ENERGY STAR by its manufacturer.

- 1) Definitions: Below is a brief description of roof products and other terms as relevant to ENERGY STAR.
 - 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 inches or less.¹
 - C. Steep-Slope Roofs: Surfaces with a slope greater than 2:12 inches.
 - 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, 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 uppermost surface of the building structure.
 - 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, shakes, architectural profiled metal and individual metal roof components. 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 upper most surface of the building structure.
 - F. 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, or polymer modified. 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.
 - G. 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
 - H. Single-Ply Membrane: Flexible manufactured sheet of compounded synthetic materials. Single-ply membranes include EPDM (ethylene, propylene, diene monomer), Neoprene (chloroprene rubber), PVC (polyvinyl chloride polymers), CSPE (chlorosulfonated polyethylene, also known as Hypalon), CPE (chlorinated polyethylene), PIB (polyisobutylene), NBP (nitrite alloy membranes compounded from butadiene-acrylonitrile copolymers), TPO (thermoplastic polyolefin), and others.
 - I. Modified Bitumen: Roll roofing products consisting of asphalt, reinforcing layers, and in some

¹ As defined in proposed ASTM Standard E 1918-97.

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

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.³

- J. Metal Roof Panel: Metal roofing systems are divided into two categories, architectural and structural. Architectural metal roofs usually require a slope of at least 3:12. Structural metal roofs can be used on roofs with slopes as low as 1/4:12. 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 are also painted to provide additional corrosion protection, as well as color.
 - K. Metal Roof Component: Metal roof product designed to resemble a traditional steep-slope residential product such as shingle, tile, shake, or slate.
 - L. 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, silicon, or urethane elastomers.
 - M. Composite Shingle: Composed of a base material, either organic felt or glass fiber mat; asphalt; and surfacing material, generally in the form of mineral granules.⁴
 - N. Roof Tile: May be composed of clay, concrete, fiber-cement, or synthetic materials. A variety of tile profiles, styles, finishes, and colors are available.
 - O. 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).
 - P. Solar Flux: The direct and diffuse radiation from the sun received at ground level over the solar spectrum expressed in watts per square meter.
 - Q. 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.
- 2) Qualifying Products: Any roof product as defined in Section 1 above, is eligible for the ENERGY STAR label.
- 3) Energy-Efficiency Specifications for Qualifying Products: Only those products listed in Section 2 that meet the criteria below (Tables 1 and 2) may qualify as ENERGY STAR. **For roof products that may be applied to either low-slope or steep-slope roofs, such as roof coatings and single-ply membranes, Table 1 contains the applicable ENERGY STAR specifications.**

³ National Roofing Contractors Association Commercial Low-Slope Roofing Materials Guide 1998.

⁴ Ibid.

Table 1 – Specifications for Low-Slope Roof Products

Characteristic	Performance Specification
Energy Efficiency	
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 reflective roof products must be equal in all material respects to the product warranty offered by the same company for comparable non-reflective roof products. A company that sells only reflective roof products must offer a warranty that is equal in all material respects to the standard industry warranty for comparable non-reflective roof products.

Table 2 – Specifications for Steep-Slope Roof Products

Characteristic	Performance Specification
Energy Efficiency	
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 roof product warranty for reflective roof products must be equal in all material respects to the product warranty offered by the same company for comparable non-reflective roof membrane products. A company that sells only reflective roof products must offer a warranty that is equal in all material respects to the standard industry warranty for comparable non-reflective roof products.

- 4) Test Criteria: Manufacturers are required to perform tests and self-certify product models that meet the ENERGY STAR guidelines. Partner agrees to follow the test methods as outlined below. Alternatively, a Partner already participating in the Cool Roof Rating Council (CRRC) Product Rating Program⁵ may submit solar reflectance product information derived from CRRC certification. Please note, at the time that this document was written, the CRRC Product Rating Program did not include testing for maintenance of solar reflectance. Until this aspect of the CRRC Program is initiated and results are available, Partner shall use one of the test procedure options listed below to derive values for the maintenance of solar reflectance.

Test results must be reported to EPA using the Roof Products Qualifying Product Information (QPI) Form. In addition, documentation of test results, e.g., test reports, in either hard copy or electronic format, must be submitted to EPA along with the QPI Form for each qualifying product.

Initial Solar Reflectance

Product shall be tested using ASTM E 903 - *Standard Test Method for Solar Absorptance, Reflectance, and Transmission of Materials Using Integrating Spheres*. Products need only be tested for solar reflectance (values for solar absorptance and transmission need not be obtained). Manufacturers will submit a 3" X 3" flat sample of each product to a laboratory that has the appropriate equipment. The manufacturer shall request that the test 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.

Product may also be tested using ASTM C 1549 - *Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer*.

⁵ Information on the Cool Roof Rating Council Product Rating Program can be found at www.coolroofs.org

If manufacturer has performed the test for initial solar reflectance on a particular product since 1996, the product need not be retested. The manufacturer must have a record of the test results on file and must submit these results to EPA. Particularly with regard to roof coatings, if Partner has changed a fundamental element of product formulation such as the base latex, Partner must retest for the solar reflectance of the product both initially and according to the Maintenance of Solar Reflectance (see next section). In addition, to ensure other product formulation changes will not affect the solar reflectance of the product, Partner shall certify that the product formulation or recipe has not changed since the solar reflectance testing was performed.

Maintenance of Solar Reflectance

Partner shall use one of the following methods to test the maintenance of solar reflectance of a roof product:

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 must 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 must each be at least three years old.

1) For low-slope roof products and coatings, use either ASTM E 1918 - *Standard Test Method for Measuring Solar Reflectance of Horizontal and Low-Sloped Surfaces in the Field* or ASTM C 1549, to test the solar reflectance of the roof product as installed and weathered for three years. Partner shall divide the roof into at least ten (10) equal sections. Measurements shall be performed in the center of each area. At least three (3) repetitions shall be made of each measurement. Partner shall take the average of all solar reflectance values obtained from the roof to determine if the solar reflectance of the roof product as installed and weathered for three years is greater than or equal to the threshold value in Table 1. If Partner is employing ASTM E 1918, the test must be performed 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.

2) To measure the solar reflectance of steep-slope roofs as installed and weathered for three years, use ASTM C 1549. Partner shall divide the roof into at least ten (10) equal sections. Measurements shall be performed in the center of each area. At least three repetitions shall be made of each measurement. Partner shall take the average of all solar reflectance values obtained from the roof to determine if the solar reflectance of the roof product as installed and weathered for three years is greater than or equal to the threshold value in Table 2.

B) Take a minimum of three (3) samples from the each of the existing roofs as identified above. At least three (3) measurements of solar reflectance are to be taken from different areas on each sample using either ASTM E 903 or ASTM C 1549. Partner shall take the average of all solar reflectance values obtained from the panels to determine if the solar reflectance of the weathered roof product is greater than or equal to the threshold values in Tables 1 and 2. Subsequently, the Partner is responsible for ensuring that the roof from which samples were taken is properly repaired so as to resume watertight integrity.

C) 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*. The panel must be prepared such that the surface to receive solar radiation goes over the intended substrate⁶. At least three (3) panels with the identical formulation as those that were tested for initial solar reflectance must be exposed for three years in accordance with ASTM G 7 - *Standard Practice for Atmospheric Environmental Exposure Testing of Nonmetallic Materials*. Each exposure panel must be at least 24 square inches (155 square centimeters) in size, e.g. 4" x 6" or 3" x 8", and must be mounted so that there is no run off from one panel to another.

At least three (3) measurements of solar reflectance are to be taken from different areas on each

⁶ 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.

weathered panel using either ASTM E 903 or ASTM C 1549. Partner shall take the average of all solar reflectance values obtained from the panels to determine if the solar reflectance of the weathered roof product is greater than or equal to the threshold values in Tables 1 and 2.

1) For low-slope roof products and coatings and for product that can be applied to either low-slope or steep-slope roofs, Partner shall use test samples exposed at a slope of 2:12 inches or less (1/4:12 inches is recommended) and facing south.

2) For steep-slope roof products and coatings, Partner shall use test samples exposed at a slope between 2:12 inches and 12:12 inches (4:12 inches is recommended) and facing south.

For any of the above options, the areas tested may be cleaned according to proper maintenance procedures as recommended by the manufacturer before solar reflectance tests are performed. It must be indicated if samples are cleaned prior to testing. If Partner is using Option A and chooses to clean the tested area, it is strongly recommended that Partner clean the entire roof area.

- 5) Effective Date: The date that manufacturers may begin to qualify products as ENERGY STAR will be defined as the *effective date* of the agreement. The ENERGY STAR Roof Products (Version 1.2 specification is effective immediately.

- 6) Future Specification Revisions: ENERGY STAR 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.