TESTING APPLICATION STANDARD (TAS) 143-95

STANDARD REQUIREMENTS FOR WHITE ELASTOMERIC ROOF COATINGS USED FOR COATING BUILT UP ROOFS AND METAL ROOFING SYSTEMS

1. Scope:

1.1 This Protocol covers white elastomeric roof coatings, suitable for roller, brush or spray application as a reflective and protective coating for built up and metal roof surfaces that are sloped for positive drainage.

1.2 The property requirements used to characterize this product are minimum performance values intended to ensure that the product is fit for its intended use.

1.3 This Protocol specifically addresses laboratory testing of these coatings and does not provide guidance for actual field application.

1.4 All testing shall be conducted by an approved testing agency and all test reports shall be signed by an authorized signer of the testing agency and/or professional engineer.

2. Referenced Documents:

2.1 *ASTM Standards*

C 661 Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer

C 794 Standard Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants

D 412 Standard Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers - Tension

D 471 Test Method for Rubber-Effects of Liquids

D 562 Standard Test Method for Consistency of Paints Using the Stormer Viscometer

D 1079 Standard Definitions of Terms Relating to Roofing, Waterproofing, and Bituminous Materials

D 2196 Standard Test Methods for Rheological Properties of Non-Newtonian Material by Rotational (Brookfield) Viscometer

D 2697 Test Methods for Volume Nonvolatile Matter in Clear or Pigmented Coatings

D 2824 Standard Specification for Aluminum-Pigmented Asphalt Roof Coatings

E 96 Standard Test Methods for Water Vapor Transmission of Materials

E 380 Excerpts from Standard Practice for Use of the International System of Units (SI) (the Modernized Metric System)

G 21 Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi

G 26 Standard Practice for Operating Light-Exposure Apparatus (Xenon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials

2.2 *The Florida Building Code, Building*

2.3 *Roof Consultants Institute*
Glossary of Terms

3. Terminology & Units:

3.1 Definitions - For definitions of terms used in this Protocol, refer to ASTM D 16; and/or ASTM D 1079; and/or Chapter 2 of the *Florida Building Code, Building* and/or The RCI Glossary of Terms. Defi-

nitions from the *Florida Building Code, Building* shall take precedence.

3.2 Units - For conversion of U.S. customary units to SI units, refer to ASTM E 380.

4. Limitations and Precautions:

4.1 This Protocol may involve hazardous materials, operations and equipment. This Protocol does not purport to address all of the safety problems associated with its use. It is the responsibility of whomever uses this Protocol to consult and establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

5. Materials and Manufacture:

5.1 *Composition* - The product, as manufactured, shall be a one component, water based, white elastomeric coating, suitable for application by roller, brush or spray equipment without heating or thinning.

5.2 The coating shall be suitable for the application intended and bond well to clean, dry, properly prepared, built-up roofing materials, metal, poured-in-place concrete, asphalt shingles, modified bitumen, masonry, clay tile and wood surfaces, using a primer when necessary.

5.3 The coating shall be suitable for application where sunlight and surface and ambient temperatures of 50° ± 2°F (10° ± 1.1°C) or above, are maintained long enough for the coating to dry.

6. Performance Requirements:

6.1 Although the product is supplied as a liquid, its performance is based on the functional properties of the cured material in membrane form. The coating is formed into a fully adhered sheet adhered to the roofing substrate.

6.2 Physical Properties (Liquid Form) - The white elastomeric roof coating product, in its liquid form, shall conform to physical property requirements as follows:

Physical Property	Test Standard	Requirement
Viscosity	D 562	85-141 KU
Viscosity	D 2196 See Section 7.2	12,000-85,000
Volume, Solids %	D 2697	>45%

6.3 *Physical Properties (Membrane Form)* - The white elastomeric roof coating product, in its membrane form, shall conform to physical property requirements as follows.

7. Test Methods:

7.1 *Preparation of Coating Specimens* - unless otherwise noted, test specimens shall be prepared as follows.

7.1.1 Test specimens shall be prepared by applying two coats to release paper to give a total dry film thickness of 20 mils.

7.1.2 The test specimen shall be allowed to cure at 77°F (25°C) and 50% relative humidity for 14 days.

7.1.3 The test specimen shall be flipped over after 7 days.

7.2 *Viscosity* - Test Method D 2196

7.2.1 Brookfield viscometer, #6 20 RPM RTV Viscometer

7.3 *Elongation* - Test Method D 412 (Instron or equivalent), except as noted below.

7.3.1 Prepare test specimens as noted in Section 7.1, herein.

7.3.2 Cut specimen in a dumbbell shape measuring 3 in. long by $^3/_4$ in. wide and having a neck width of $^1/_4$ in.

7.3.3 Test type of functional equivalent:

Cross head speed	0.2 in. per min.
Chart speed	0.2 in. per min.
Gauge length	0.5 in. opening
Calibration	according to compound
Integrator	automatic

Physical Property	Reference Section	Requirements
Percent Elongation *(After 50 Hours Weather-Ometer)*	See Section 7.3	min. 200% @ 107°F (42°C) min. 100% @ 30°F (−1°C)
Percent Elongation *(After 3000 Hours Weather-Ometer)*	See Section 7.3	min. 160% @ 107°F (42°C) min. 80% @ 30°F (−1°C)
Recovery *(After 50 Hours Weather-Ometer)*	See Section 7.4	min. 50% @ 107°F (42°C) min. 50% @ 30°F (−1°C)
Recovery *(After 3000 Hours Weather-Ometer)*	See Section 7.4	min. 40% @ 107°F (42°C) min. 40% @ 30°F (−1°C)
Tensile Strength *(After 14 Days Aging)*	See Section 7.6	min. 180 @ 107°F (42°C) min. 180 @ 30°F (−1°C)
Hardness	See Section 7.7	min. 55 @ 77°F (25°C)
Water Vapor Transmission	See Section 7.9	max. 20 perms
Water Swelling	See Section 7.10	max. 20%
Accelerated Weathering	See Section 7.11	No cracking or checking
Adhesion	See Section 7.12	min. 4lb/in-width (dry) min. 2 lb/in-width (wet)
Low Temperature Flexibility	See Section 7.5	Pass 30°F (-1°C) ($^1/_2$ in. Mandrel)
Fungi Resistance	See Section 7.13	28 days, 0-1 rating, max. growth 10%
Reflectance	See Section 7.8	>85%
Reflectance *(After Dirt Pickup)*	See Section 7.8	>76%

7.3.4 Calculate percent elongation (E) in compliance with the following equation:

$$E = \left(\frac{L - L_0}{L_0} \right) \times 100$$

where,

E = percent elongation (%);

L = sample length at break (in.); and

L_o = gage length (in.).

7.3.5 For low temperature testing, the specimen shall be kept in a cold box at the appropriate low temperature for not less than 1 hour, then tested immediately.

7.3.6 A Xenon-Arc Weather-Ometer shall be used. See Section 7.12, herein.

7.4 *Recovery* - Test Method D 412, except as noted below.

7.4.1 Prepare test specimens as noted in Section 7.1, herein.

7.4.2 Cut specimen in a dumbbell shape measuring 3 in. long by $^3/_4$ in. wide and having a neck width of $^1/_4$ in.

7.4.3 25% extension, immediate recovery.

7.4.4 For low temperature testing, the specimen is to be kept in a cold box at the appropriate low temperature for at least 1 hour, then tested immediately.

7.4.5 A Xenon-Arc Weather-Ometer shall be used for exposure prior to elongation testing. Refer to Section 7.11, herein.

7.5 *Low Temperature Flexibility* - Test Method C 734, except as noted below.

7.5.1 Prepare test specimen as in Section 7.1, herein.

7.5.2 For low temperature testing, the specimen shall be kept in a cold box at the appropriate low temperature for not less than 1 hour, then tested immediately.

7.5.3 Bend specimen 180° over a $^1/_2$ in. diameter mandrel.

7.5.5 A Xenon-Arc Weather-Ometer shall be used. See Section 7.11, herein.

7.6 *Tensile Strength* - Test Method D 412, except as noted below.

7.6.1 Prepare test specimen as in Section 7.1, herein.

7.6.2 Cut specimen in a dumbbell shape measuring 3 in. long by $^3/_4$ in. wide and having a neck width of $^1/_4$ in.

7.6.3 Test type of functional equivalent:

Cross head speed	0.2 in. per min.
Chart speed	0.2 in. per min.
Gauge length	0.5 in. opening
Calibration	according to compound
Integrator	automatic

7.6.4 Tensile strength in pounds/inch^2 = $\frac{f}{tw}$

where:

f = the force at break in pounds;

w = the sample width in inches (0.25 in.); and

t = the sample thickness in inches.

7.6.5 For low temperature testing, the specimen shall be kept in a cold box at the appropriate low temperature for not less than 1 hour, then tested immediately.

7.7 *Shore A Hardness* - Test Method C 661, except as noted below.

7.7.1 Prepare test specimen as in Section 7.1, herein.

7.7.2 Cut specimen in a dumbbell shape measuring 3 in. long by $^3/_4$ in. wide and having a neck width of $^1/_4$ in.

7.7.3 Test with a Shore "A" Durometer, taking readings by the instantaneous method using 1-kilogram pressure.

7.7.4 The final result shall be the average of six readings.

7.8 *Reflectance* - Test Method D 2824, Section 8.6, except as noted below.

7.8.1 Coating test specimens are cast at 40 wet mils on 6 in. x 3 in. aluminum panels (suitable to fit QUV).

7.8.2 Test specimens shall be dried at ambient conditions 24 hours prior to testing.

7.8.3 Test specimens shall be placed in the QUV Cabinet for 4 hours UV radiation. The CPR QUV shall be equipped with UV-A bulbs (less severe than UV-B bulbs) and shall operate with no humidity cycle.

7.8.4 Allow test specimens to equilibrate 2 hours.

7.8.5 Iron oxide slurry shall be brushed on one half of each panel, then dried one hour at room temperature.

Note: Brown iron oxide slurry is 56% iron oxide mechanically mixed until smooth in DI water.

7.8.6 Test specimens shall be washed under running luke warm tap water. Use moderate pressure with a cheese cloth pad to wipe off all excess iron oxide. Use a fresh cheese cloth pad for each sample.

7.8.7 Allow panels to dry two hours, then measure % reflectance on tested and non-tested portions using Gardner Colorgard II Reflectometer.

Note: Colorgard II Reflectometer 45° head Gardner Neotec Division, Pacific Scientific.

7.8.8 Report % reflectance; retained.

7.9 *Water Vapor Transmission* - Test Method E 96-80 BW (3.2, 12.4) "The Water Method," except as noted below.

7.9.1 To prepare test specimens, a 20 mil wet drawdown of coating is allowed to cure for 4 hours. A Gardner knife is subsequently adjusted to 30 mils and a second drawdown is placed on top of the partially cured 20 mil coating. The test specimens are allowed to cure at 77°F (25°C) and 50% relative humidity for seven days and then flipped over and cured an additional seven days (total cure time 14 days).

7.9.2 Fill an ASTM perm cup with 20 mil of distilled water and invert it so that the water is in physical contact with the coating film.

7.9.3 Place the perm cup over an open grid rack and maintain at a constant 50% relative humidity.

7.9.4 Plot the weight loss against time until a nominal steady state exists. The slope of the straight line is the rate of water vapor transmission.

7.9.5 Calculate the water vapor transmission (WVT) and permeance (P) in metric units using the following equations.

Water Vapor Transmission:

$$WVT = \frac{G}{T \times A}$$

where,

WVT = rate of water vapor transmission, g/h-m^2;

G = weight change, g (from the straight line);

T = time corresponding to weight change, hours; and

A = test area (per cup mouth area), m^2.

Notes:
1. For cup radius of 0.028 m, A = 0.00246 m^2

Permeance:

$$P = \frac{WVT}{S \times (R_1 - R_2)}$$

where,

P = permeance (g/Pa-s-m^2);

WVT = rate of water vapor transmission, g/h-m^2;

S = saturation vapor pressure at test temperature, mm Hg

R_1 = relative humidity at source expressed as fraction; and,

R_2 = relative humidity at the vapor sink expressed as fraction

Notes:
1. 1 mm Hg = 133 Pa
2. R1 = 1.00 in the perm cup for the water method.
3. For constant temperature room (CTR), relative humidity expressed as decimal fraction (0.50).
4. Permeance values expressed as ng/Pa-s-m^2 are equivalent to 1 perm.

7.10 *Swelling* - Test Method D 471, Section 9, except as noted below.

7.10.1 Prepare test specimen as in Section 7.9.1, herein.

7.10.2 A 20 mm disc is cut out of the cured test specimen using a No. 15 cork borer.

7.10.3 Weigh each disk.

7.10.4 Immerse the disk specimen in tap water. Periodically remove the disk from the water (i.e., 2, 4, 6, 8, 10, etc.hours), dry the surface with filter paper, and reweigh.

7.10.5 The swell ratio (weight of coating plus water divided by initial coating weight) is calculated and plotted as a function of time.

This procedure is continued until an equilibrium swell ratio is obtained.

7.11 *Accelerated Weathering* - Test Method G 26, except as noted below.

7.11.1 To prepare test specimens, the coating is cast on a $2^{5}/_{8}$ in. x $5\ ^{3}/_{4}$ in. plate of $^{1}/_{32}$ in. thick aluminum, at 20 mils dry film thickness, and allowed to cure at 77°F (25°C) and 50% relative humidity for 3 days. Two such specimens are prepared.

7.11.2 After curing, one test specimen is placed in a Xenon-Arc Weatherometer for 3000 hours of accelerated weathering. The second test specimen is air cured at 77°F (25°C) and 50% relative humidity for the duration of this exposure.

7.11.3 When 3000 hours have elapsed, the original specimen is removed from the weatherometer and allowed to cool at 77°F (25°C) and 50% relative humidity for 2 hours.

7.11.4 The two specimens are then compared for appearance differences (color, cracking, adhesion loss, etc.).

7.12 *Adhesion* - Test Method C 794, except as noted below.

7.12.1 Test specimens are prepared by applying two coats to clean, fine spangle galvanized metal Q-Panels, to give a total dry film thickness of 20 mils. The coating is allowed to cure at 77°F (25°C) and 50% relative humidity for 14 days.

7.12.2 Crosshead speed shall be 2 inches per minute.

7.13 *Fungi Resistance* - Test Method G 21.

8. Packaged Material

8.1 Packaged material shall be certified by the manufacturer to be in compliance with this specification and shall be labeled in compliance with Section 1517 of the *Florida Building Code, Building*. Product Approval documents shall be provided to the purchaser or end user upon request.

8.2 Shipping containers shall be marked with the name of the material, stock number, lot number, year of issue and quantity therein and the name of the manufacturer or supplier.

9. Rejection and Reinspection

9.1 The Authority Having Jurisdiction may periodically purchase commercial quantities of the approved product for testing at Approved Testing Agencies to confirm compliance with the provisions of this Protocol. Failure to meet the minimum requirements set forth in Sections 5 and 6 shall constitute grounds for rejection of the lots and suspension of the Product Approval. In cases of rejection the Authority Having Jurisdiction shall request removal of the rejected lot number(s) from commercial sale.

9.2 The Authority Having Jurisdiction may, after rejection of one or more lots, require third party quality control inspection as a provision to lifting of Approval suspension.

9.3 Shipping containers shall be marked with the name of the material, the stock number, lot number, quantity therein, and the name of the manufacturer or supplier.