

AAMA 2603-02

**Voluntary Specification,
Performance Requirements
and Test Procedures For
Pigmented Organic Coatings
on Aluminum Extrusions
and Panels**





TABLE OF CONTENTS

Preface.....	1
1.0 Scope.....	1
2.0 Purpose.....	1
3.0 Definitions.....	1
4.0 General	1
5.0 Test Specimens.....	2
6.0 Tests.....	2
7.0 Test Reports.....	5
8.0 Referenced Standards	5



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Publish Date: 2002 Reprint Date: 12/2002

PREFACE

For years, the architectural community has recognized AAMA 603 and AAMA 605 as the standards for testing and performance of organic coatings on architectural aluminum extrusions and panels. Significant advances have been made in technology which have created the need to revise these specifications.

AAMA 2603, "Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels;"

AAMA 2604, "Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels;"

AAMA 2605, "Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels"

SUPERCEED

AAMA 603, "Voluntary Performance Requirements and Test Procedures for Pigmented Organic Coatings on Extruded Aluminum;" and

AAMA 605, "Voluntary Specification for High Performance Organic Coatings on Architectural Extrusions and Panels;" as well as all revisions to these documents.

AAMA 2603 involves editorial changes only. The performance criteria is equal to AAMA 603.

1.0 SCOPE

1.1 This specification describes test procedures and performance requirements for pigmented organic coatings applied to aluminum extrusions and panels.

1.2 This specification covers factory-applied spray coatings only.

1.3 The primary units of measure in this document are metric. The values stated in SI units are to be regarded as the standard. The values given in parentheses are for reference only.

2.0 PURPOSE

The specification will assist the architect, owner and contractor to specify and obtain factory-applied organic coatings which will provide a good level of performance in terms of film integrity, exterior weatherability and general appearance over a period of many years.

3.0 DEFINITIONS

3.1 The terms "film" and "coating" are used interchangeably in this specification and are defined as meaning the layer of pigmented organic material applied to the surface of the aluminum.

3.2 Exposed surfaces are those surfaces which are visible when the coated product is installed. These may include both closed and open positions of operating sash, ventilators, doors or panels.

3.3 Spray Coating: The process of applying a resinous coating by atomizing it into a spray or mist, and curing it into a continuous film.

4.0 GENERAL

4.1 To qualify as meeting this specification, products tested shall meet all requirements as specified herein.

4.2 Coatings shall be visibly free from flow lines, streaks, blisters or other surface imperfections in the dry-film state on exposed surfaces when observed at a distance of 3 m (10 ft) from the metal surface and inspected at an angle of 90 degrees to the surface.

4.3 The total dry-film thickness utilizing the ASTM D 1400 method shall be calculated to be a minimum of 20 microns (0.8 mil) on significant exposed surfaces. Eighty percent of the measurements shall meet or exceed 20 microns (0.8 mil) total film thickness. In no case shall measurements be below 17 microns (0.68 mil) or 85% of the film thickness specified. Film thickness specified may be increased to be consistent with color selection and type of coating as recommended by the coating manufacturer.

NOTE: Due to the complexities of extrusion dies and limitations of application equipment, it may not be possible to achieve minimum recommended dry film thickness on all areas of an extrusion, such as inside corners and channels. For details of these affected areas, contact the coating applicator prior to painting.

4.4 A multi-stage cleaning and pre-treatment system is required to remove organic and inorganic surface soils, remove residual oxides, and apply a chemical conversion coating to which organic coatings will firmly adhere.

The pre-treatment when used in conjunction with a baked organic coating shall produce a total finishing system capable of meeting impact, adhesion, detergent, humidity and salt spray performance as specified in the appropriate test method.

4.5 Minor scratches and blemishes shall be repairable with the coating manufacturer's recommended product or system. Such repairs shall match the original finish for color and gloss and shall adhere to the original finish when tested as outlined in Section 6.4.1.1, Dry Adhesion. After application, allow repair coating to dry for 72 hours at 18°C to 27°C (65°F to 80°F), before conducting the film adhesion test.

NOTE: The size and number of touch-up repairs should be kept to a minimum.

4.6 Sealant used in contact with an organic coating shall be compatible with the organic coating and meet the performance requirements of AAMA 800 sealant specification. There shall be no evidence of deleterious effects in the organic coating such as staining, coating separation, lifting, discoloration or loss of adhesion of the coating from the substrate.

NOTE: It is strongly recommended that the fabricator of the finished products consult with the sealant manufacturer in the selection of the appropriate sealant. Pell adhesion testing as described in AAMA 800 is suggested. It is important to understand that the AAMA 800 sealant specification does not ensure adhesion to a specific coating. The best way to ensure adhesion is to submit panel specimens of the specific coating to the sealant manufacturer or an AAMA accredited independent laboratory for tests and recommendations.

5.0 TEST SPECIMENS

5.1 Test specimens shall consist of finished panels or extrusions representative of the production coated aluminum. A sufficient number of specimens on which to conduct instrument measurements with flat coated surfaces of at least 150 mm (6 in) long and 75 mm (3 in) wide, shall be submitted to the testing laboratory. The coating applicator or fabricator shall indicate exposed surfaces or submit drawings. Tests shall be performed on exposed areas as indicated on drawings or as marked on test specimens.

6.0 TESTS

6.1 COLOR UNIFORMITY

6.1.1 Procedure

Check random samples visually under a uniform light source such as a Macbeth Daylight lamp or the North daylight sky. Samples must have a dry film thickness within specified range.

6.1.2 Performance

Color uniformity shall be consistent with the color range or numerical value as established between the approval source and the applicator.

NOTE: Color and finish appearance may vary upon factory application due to differences in spray equipment, line conditions or day-to-day process variations. It is strongly recommended that final color approval limits be made with actual production line samples or mock-ups, not laboratory prepared color panels. Since flake orientation contributes to color uniformity, pearlescent, mica and metallic flake colors do present the need for more stringent control in application and consideration during project design and installation.

6.2 SPECULAR GLOSS

6.2.1 Procedure

Measure in accordance with the latest issue of ASTM D 523 using a 60 degree gloss Meter. Samples must meet minimum dry film thickness requirements.

6.2.2 Performance

Gloss values shall be within ± 5 units of the manufacturer's specification.

NOTE: Standard Gloss Range Reference Values are:

Gloss Colors	Specular Gloss Value
High	80-Over
Medium	20-79
Low	19 or less

6.3 DRY FILM HARDNESS

6.3.1 Procedure

Strip the wood from a Berol Eagle Turquoise Pencil or equivalent, grade H minimum hardness leaving a full diameter of lead exposed to a length of 6 mm minimum to 10 mm maximum (1/4 in minimum to 3/8 in maximum). Flatten the end of the lead 90 degrees to the pencil axis using fine-grit sand or emery paper. Hold the pencil at a 45 degree angle to film surface and push forward about 6 mm (1/4 in) using as much downward pressure as can be applied without breaking lead. Reference ASTM D 3363.

6.3.2 Performance

No rupture of film per ASTM D 3363.

6.4 FILM ADHESION

6.4.1 Procedure

6.4.1.1 Dry Adhesion

Make 11 parallel cuts, 1 mm (1/16 in) apart through the film. Make 11 similar cuts at 90 degrees to and crossing the

first 11 cuts. Apply tape (Permacel 99 or equivalent) 20 mm (3/4 in) wide over area of cuts by pressing down firmly against coating to eliminate voids and air pockets. Sharply pull tape off at a right angle to the plane of the surface being tested. Test pieces should be at ambient temperature [approximately 18°C to 27°C (65°F to 80°F)].

6.4.1.2 Wet Adhesion

Make cuts as outlined in Section 6.4.1.1. Immerse the sample in distilled or deionized water at 38 °C (100 °F) for 24 hours. Remove and wipe the sample dry. Repeat the test specified in Section 6.4.1.1 within five minutes.

6.4.2 Performance

No removal of film under the tape within or outside of the cross-hatched area or blistering anywhere on test specimen. Report loss of adhesion as a percentage of squares affected, (i.e., 10 squares lifted is 10% failure).

6.5 IMPACT RESISTANCE

6.5.1 Procedure

Using a 16 mm (5/8 in) diameter round-nosed impact tester, 18 N-m (160 in-lb) range, such as a Gardner impact tester, apply a load directly to the coated surface of sufficient force to deform the test sample a minimum of 3 mm ± 0.3 mm (0.10 in ± 0.01 in). Apply tape (Permacel 99 or equivalent) 20 mm (3/4 in) wide over area of deformation by pressing down firmly against coating to eliminate voids and air pockets. Sharply pull tape off at a right angle to the plane of the surface being tested. Test pieces should be at ambient temperature approximately 18°C to 27°C (65°F to 80°F).

6.5.2 Performance

No removal of film from substrate.

NOTE: Minute cracking at perimeter of concave area of test panel is permissible, but no coating pick-off should be apparent.

6.6 CHEMICAL RESISTANCE

6.6.1 Muriatic Acid Resistance

(15-Minute Spot Test)

6.6.1.1 Procedure

Apply 10 drops of 10% (by volume) solution of muriatic acid (37% commercial grade hydrochloric acid) in tap water and cover it with a watch glass, convex side up. The acid solution and test shall be conducted at 18°C to 27°C (65°F to 80°F). After a 15-minute exposure, wash off running tap water.

6.6.1.2 Performance

No blistering and no visual change in appearance when examined by the unaided eye.

6.6.2 Mortar Resistance

(24-Hour Pat Test)

6.6.2.1 Procedure

Prepare mortar by mixing 75 g (2.6 oz) of building lime (conforming to ASTM C 207) and 225 g (7.9 oz) of dry sand, both passing through a 10-mesh wire screen with sufficient water, approximately 100 g (3.5 oz), to make a soft paste. Immediately apply wet pats of mortar about 1300 sq. mm (2 sq. in) in area and 12 mm (1/2 in) in thickness to coated aluminum specimens which have been aged at least 24 hours after coating. Immediately expose test sections for 24 hours to 100% relative humidity at 38°C (100°F).

6.6.2.2 Performance

Mortar shall dislodge easily from the painted surface, and any residue shall be removable with a damp cloth. Any lime residue should be easily removed with the 10% muriatic acid solution described in Section 6.6.1.1. There shall be no loss of film adhesion or visual change in appearance when examined by the unaided eye.

NOTE: A slight staining or discoloration may be apparent on orange, yellow or metallic coatings. This should be discussed with the specifying source prior to selection of color.

6.6.3 Detergent Resistance

6.6.3.1 Procedure

Prepare a 3% (by weight) solution of detergent as prescribed in ASTM D 2248, and distilled water. Immerse at least two test specimens in the detergent solution at 38°C (100°F) for 72 hours. Remove and wipe the samples dry. Immediately apply tape (Permacel 99 or equivalent) 20 mm (3/4 in) wide by pressing down firmly against the coating to eliminate voids and air pockets. Place the tape longitudinally along the entire length of the test specimen. If blisters are visible, then the blistered area must be taped and rated. Sharply pull off at a right angle to the plane of the surface being tested per ASTM D 3359. A typical solid detergent composition is as follows:

	Parts by Weight
Tetrasodium pyrophosphate (Na ₄ P ₂ O ₇) anhydrous	53.0
Sodium sulfate (Na ₂ SO ₄), anhydrous	19.0
Sodium metasilicate (Na ₂ SiO ₃), anhydrous	7.0
Sodium carbonate (Na ₂ CO ₃), anhydrous	1.0
Sodium salt of a linear alkylarylsulfonate (90% flake grade)	20.0
Total	100.0

6.6.3.2 Performance

No loss of adhesion of the film to the metal. No blistering and no significant visual change in appearance when examined by the unaided eye.

6.7 CORROSION RESISTANCE

6.7.1 Humidity Resistance

6.7.1.1 Procedure

Expose the sample in a controlled heat-and-humidity cabinet for 1,500 hours at 38°C (100°F) and 100% RH with the cabinet operated in accordance with ASTM D 2247 or ASTM D 4585.

6.7.1.2 Performance

No formation of blisters to extent greater than "Few" blisters Size No. 8, as shown in Figure No. 4, ASTM D 714.

6.7.2 Salt Spray Resistance

6.7.2.1 Procedure

Score the film sufficiently deep to expose the base metal using a sharp knife or blade instrument. Expose the sample for 1,500 hours according to ASTM B 117 using a 5% salt solution. Remove and wipe sample dry. Immediately apply tape (Permacel 99 or equivalent) 20 mm (3/4 in) wide over scored area by pressing down firmly against coating to eliminate void and air pockets. Sharply pull tape off at a right angle to plane of the surface being tested.

6.7.2.2 Performance

Minimum rating of seven on scribe or cut edges and a minimum blister rating of eight within the test specimen field, in accordance with the following Table 1 and Table 2 (Reference ASTM D 1654).

Representative Mean Creepage from Scribe		
Millimeters	Inches (Approx.)	Rating Number
Zero	0	10
Over 0 to 0.5	0 to 1/64	9
Over 0.5 to 1.0	1/64 to 1/32	8
Over 1.0 to 2.0	1/32 to 1/16	7
Over 2.0 to 3.0	1/16 to 1/8	6
Over 3.0 to 5.0	1/8 to 3/16	5
Over 5.0 to 7.0	3/16 to 1/4	4
Over 7.0 to 10.0	1/4 to 3/8	3
Over 10.0 to 13.0	3/8 to 1/2	2
Over 13.0 to 16.0	1/2 to 5/8	1
Over 16.0	Over 5/8	0

TABLE 2 - Rating of Unscribed Areas (Procedure B)

Area Failed	Rating Number
No Failure	10
0 to 1	9
2 to 3	8
4 to 6	7
7 to 10	6
11 to 20	5
21 to 30	4
31 to 40	3
41 to 55	2
56 to 75	1
Over 75	0

NOTE: The use of a ruled plastic grid is recommended as an aid in evaluating this type of failure. A 6 mm (1/4 in) grid is suggested as most practical for the usual specimen. In using the grid, the number of squares in which one or more points of failure are found is related to the total number of squares covering the significant area of the specimen to get a percentage figure as used in the tabulation. In some instances, the rating numbers may be used as factors with exposure time intervals related thereto, to produce a performance index number which very accurately indicates relative quality.

6.8 WEATHER EXPOSURE

6.8.1 Outdoor Exposure

6.8.1.1 Procedure

Expose six samples representing typical products on an exposure rack for one year in Southern Florida at a 45 degree angle facing South. Exposure site should be inland at least 3.2 km (2 miles).

6.8.1.2 Performance

No checking, crazing or loss of adhesion after taping and only a slight chalking and slight fading.

NOTE: Film approval is not dependent on Outdoor Exposure Test, but failure of a color should be reported to the coating supplier and a revision of the coating process requested prior to additional shipments.

7.0 TEST REPORTS

7.1 Test reports on file with the applicator shall include the following information:

7.1.1 Date when tests were performed and date of issue of report.

7.1.2 Identification of organic coating and/or coating system tested, including production date, batch or lot number, cure conditions, pretreatment data, manufacturer's name and name of company submitting coated samples used in test.

7.1.3 Copy of drawings submitted showing exposed surfaces.

7.1.4 Test results.

7.1.5 A statement indicating that the organic coating and/or coating system tested passed all tests or failed one or more.

7.1.6 In the case of a failure, which test(s) and a description of the failure(s).

7.1.7 Statement that all tests were conducted in accordance with this standard.

7.1.8 Name and address of the laboratory which conducted tests and issued the report.

8.0 REFERENCED STANDARDS

References to the standards listed below shall be to the edition indicated. Any undated reference to a code or standard appearing in the requirements of this standard shall be interpreted as referring to the latest edition of that code or standard.

AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

AAMA 800-92, Voluntary Specifications and Test Methods for Sealants

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM B 117-95, Standard Practice for Operating Salt Spray (Fog) Apparatus

ASTM C 207-91 (1992), Specification for Hydrated Lime for Masonry Purposes

ASTM D 523-89 (1994), Standard Test Method for Specular Gloss

ASTM D 714-87 (1994), Standard Test Method for Evaluating Degree of Blistering of Paints

ASTM D 822-89, Practice for Conducting Tests on Paint and Related Coatings and Materials using Filtered Open-Flame Carbon-Arc Light and Water Exposure Apparatus

ASTM D 1400-94, Standard Test Method for Nondestructive Measurement of Dry Film Thickness of Nonconductive Coatings Applied to a Nonferrous Metal Base

ASTM D 1654-92, Standard Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments

ASTM D 2247-94, Standard Practice for Testing Water Resistance of Coatings in 100% Relative Humidity

ASTM D 2248-93, Standard Practice for Detergent Resistance of Organic Finishes

ASTM D 3359-95a, Standard Test Methods for Measuring Adhesion by Tape Test

ASTM D 3363-92a, Standard Test Method for Film Hardness by Pencil Test

ASTM D 4585-92, Standard Practice for Testing the Water Resistance of Coatings Using Controlled Condensation



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