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Standard Specification for Ornamental Aluminum Fence Systems[1]

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1. Scope

1.1 This specification establishes the minimum requirements for architecturally coated, tubular picket, ornamental aluminum fence systems.

1.2 The values stated in inch-pound units are to be regarded as standard. No other units of measurement are included in this standard.

2. Referenced Documents

2.1 *ASTM Standards:*[2]

B117 Practice for Operating Salt Spray (Fog) Apparatus

D1654 Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments

D714 Test Method for Evaluating Degree of Blistering of Paints

D2244 Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates

D3359 Test Methods for Measuring Adhesion by Tape Test

D523 Test Method for Specular Gloss

D714 Test Method for Evaluating Degree of Blistering of Paints

G154 Practice for Operating Fluorescent Ultraviolet (UV) Lamp Apparatus for Exposure of Nonmetallic Materials

2.2 *AEC (Aluminum Extruders Council) Standards:*[3]

Alloys as specified by AEC

2.3 *AAMA (American Architectural Manufacturers Association) Standards:*[4]

AAMA 2603-02 Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *adhesion*—the bonding integrity of an organic coating to the aluminum substrate.

3.1.2 *corrosion resistance*—the ability of an organic coating to resist attack from manmade and natural elements while maintaining adhesion and protecting the aluminum substrate from corrosion.

3.1.3 *fence panel*—fabricated unit consisting of rails and pickets. Also referred to as a *fence section*.

3.1.4 *impact resistance*—the measure of an organically coated aluminum product to resist indentation; the ability of a coating to resist cracking or loss of adhesion due to reforming the metal during bending or a shape change from abuse.

3.1.5 *ornamental accessory*—any fitting that adds further decoration to an ornamental aluminum fence system including items like finials, caps, picket collars, rings, scrolls, or other ornamental panel inserts.

3.1.6 *post*—vertical fence structural component that supports the fence panel in the ornamental aluminum fence system.

3.1.7 *rail*—horizontal structural component of a fence panel.

3.1.8 *tubular picket*—hollow vertical component of a fence panel.

3.1.9 *weathering resistance*—the ability of an organically coated aluminum fence panel to resist the effects of natural sunlight and humidity measured by loss of gloss and color change (fade) over time.

4. Materials and Manufacture

4.1 Ornamental aluminum fence pickets, rails, and posts shall be manufactured from aluminum. The testing criteria, within this document, will determine the alloy, temper, and thickness of the aluminum.

4.2 *Manufacture:*

4.2.1 Uncoated aluminum extrusion to be protected from outdoor elements prior to coating.

4.2.2 Chemicals used in the manufacture process to be removable by the coating pretreatment process and not affect the weathering or corrosion resistance of the organically coated fence panel.

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[1] This test method is under the jurisdiction of ASTM Committee F14 on Fences and is the direct responsibility of Subcommittee F14.35 on Architectural Metal Fence Systems.

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[3] Available from Aluminum Extruders Council (AEC), 1000 N. Rand Rd. Suite 214 Wauconda, IL 60084, http://www.aec.org

[4] Available from American Architectural Manufacturers Association (AAMA), 1827 Walden Office Square, Suite 550 Schaumburg, Illinois 60173-4268, http://www.aamanet.org

4.3 *Organic Coating Material:*

4.3.1 Organic coating system can be a liquid coat or powder coat process capable of meeting specifications listed in #8 Testing-Surface finish.

4.3.2 Organic coating to be applied and cured to the organic coating manufacturer application and curing specifications.

4.4 Visible fittings, screws/mechanical fasteners, and decorative ornamental accessories shall be manufactured from a substrate that will permit the organic coating to meet the coating specifications listed in #8 Testing-Surface Finish.

4.5 Non-visible screwless fasteners, concealed fasteners, and/or screws to be manufactured from a substrate that will not deteriorate, break down, or corrode over the life of the fence panel.

5. Testing—Structural

5.1 *Structural Test Method A—Vertical Load Assembled Panel Testing:*

5.1.1 *Installation of Test Specimen*—One panel and two posts with mounting hardware will be required.

5.1.2 Posts will be mounted to a stationary object at the manufacturer's on center distance specified for the model to be tested. Allow at least 12 in. of clearance from grade to the bottom of the fence panel to allow for fence panel deformation.

5.1.3 Install the fence panel into or onto the posts using the manufacture specified mounting system for the model being tested.

5.1.4 Distribute weight to the top rail of the panel to be tested at two locations 12 in. on either side of the center point of the panel. Allow fence panel to support the prescribed weight for two minutes.

5.1.5 Remove weight after two minutes and inspect rails for deformation. Panels are to have less than ¼ in. visible deformation after weight is removed.

5.1.6 Weight ratings for various models.

Residential 2 rail	150 pounds
Residential 3-4 rail	225 pounds
Commercial 2 rail	220 pounds
Commercial 3-4 rail	325 pounds
Industrial 2 rail	300 pounds
Industrial 3-4 rail	500 pounds

NOTE 1—Four rail systems are required to meet the same weight specification as a three-rail system.

5.2 *Structural Test Method B Picket Testing:*

5.2.1 Pickets to be inserted in a secured section (in accordance with 6.1.7, 6.2.8, or 6.3.6) with spacing between rails not to exceed 55 inches. Industrial sections over 72 in. and up to 120 in. height to be tested with rail spacing not to exceed 82 inches.

5.2.2 Minimum of three pickets shall be tested using a 12-in. by 12-in. flat surface with testing force pulled horizontally on a vertically installed section.

5.2.3 Apply force centered between posts and rails.

5.2.4 Remove weight after two minutes and inspect rails for deformation. Pickets to have less than ¼ in. visible deformation after weight is removed.

5.2.5 *Weight Ratings for Various Models:*

Residential 55 in. spacing	50 pounds
Commercial 55 in. spacing	80 pounds
Industrial 55 to 82 in. spacing	125 pounds

6. Physical Dimensions

6.1 *Residential Fence Systems:*

6.1.1 Typical minimum post dimension is 2 by 2 in. (0.060-in. wall).

6.1.2 Typical minimum picket dimension is ⅝ by ⅝ in. (0.045-in. wall) or similar dimensions and wall thickness in a round, oval, or rectangular shape to meet specifications listed in 5.2.

6.1.3 Typical minimum rail dimension is 1 by 1 inch. Rails shall have sufficient dimension and wall thickness to meet specifications listed in Section 5.

6.1.4 A residential fence panel can be attached to vertical posts by aluminum or stainless steel brackets, welding, or a notched rail/routed post system. The rail to be inserted inside the routed post and secured with stainless steel screws or the rail can be notched or have a protrusion and inserted inside the routed post.

6.1.5 The opening between rails shall not exceed 55 inches.

6.1.6 Residential fence panels where the picket extends above the top rail shall be no less than 48-in. height if the pickets have sharp pointed ornamental spears.

6.1.7 Picket spacing (open area) shall be less than four inches.

6.1.8 Clearance from grade to the bottom most location of a fence panel shall be less than four inches.

NOTE 2—Fence height is typically the distance from the grade to top of the top rail unless the picket extends through the top rail and the height is the distance from the grade to the top of the picket.

6.2 *Commercial Fence Systems:*

6.2.1 Typical minimum post dimension is 2 by 2 in. (0.060-in. wall) for 72-in. wide panels. 2 ½ by 2 ½ in. (0.065-in. wall) for 96-in. wide panels.

6.2.2 Typical minimum picket dimension is ¾ by ¾ in. (0.050-in. wall) or similar dimensions and wall thickness in a round, oval, or rectangular shape of equal strength to meet specifications listed in 5.2.

6.2.3 Typical minimum rail dimension for a 72-in. wide section is 1 by 1 inch. Minimum rail dimension for a 96-in. wide section 1 by 1 7⁄16 inches. Rails shall have sufficient dimension and wall thickness to meet specifications listed in Section 5.

6.2.4 A commercial fence panel can be attached to vertical posts by; aluminum or stainless steel brackets, welding, or a notched rail/routed post system. The rail to be inserted inside the routed post and secured with stainless steel screws or the rail can be notched or have a protrusion and inserted inside the routed post.

6.2.5 A commercial fence panel shall not exceed a width of 96 in. on center.

6.2.6 The opening between rails shall not exceed 55 inches.

6.2.7 Commercial fence panels where the picket extends above the top rail shall be no less than 48 in. height if the pickets have sharp pointed ornamental spears.

6.2.8 Picket spacing (open area) shall be less than four inches.

6.2.9 Clearance from grade to the bottom most location of a fence panel shall be less than four inches.

NOTE 3—Fence height is typically the distance from the grade to top of the top rail unless the picket extends through the top rail and the height is the distance from the grade to the top of the picket.

6.3 *Industrial Fence Systems:*

6.3.1 Typical minimum post dimension is 2 ½ by 2 ½ in. (0.065-in. wall) for panels up to and including 72 in. tall. Panels over 72 in. tall will have a typical minimum post dimension of 2 ½ by 2 ½ in. (0.075-in. wall). Panels over 96 in. tall will have a typical minimum post dimension of 4 by 4 in. (0.125-in. wall).

6.3.2 Typical minimum picket dimension is 1 by 1 in. (0.060-in. wall) or similar dimensions and wall thickness in a round, oval, or rectangular shape of equal strength to meet specifications listed in Section 5.

6.3.3 Typical minimum rail dimension is 1 ½ by 1 ½ in. for panels up to 96 in. height. Panels over 96 in. height to have a suggested minimum dimension of 1 ¾ by 1 ¾ inches. Rails shall have sufficient dimension and wall thickness to meet specifications listed in 5.1.

6.3.4 An industrial fence panel can be attached to vertical posts by; aluminum or stainless steel brackets, welding, or a notched rail/routed post system. The rail to be inserted inside the routed post and secured with stainless steel screws or the rail can be notched or have a protrusion and inserted inside the routed post.

6.3.5 Industrial fence panels where the picket extends above the top rail shall be no less than 48 in. height if the pickets have sharp pointed ornamental spears.

6.3.6 Picket spacing (open area) shall be less than four inches.

6.3.7 Clearance from grade to the bottom most location of a fence panel shall be less than four inches.

NOTE 4—Fence height is typically the distance from the grade to top of the top rail unless the picket extends through the top rail and the height is the distance from the grade to the top of the picket.

7. Workmanship

7.1 All ornamental aluminum fence system components shall be produced using materials and finishes specified in Section 4. All shall be free from defects in workmanship.

8. Testing—Surface Finish

8.1 *Test Methods:*

8.1.1 *Adhesion Testing*—Adhesion testing shall be in accordance with Test Methods D3359, Method B. The minimum performance requirement is retention of the organic coating film over 100 % of the scribed surface.

8.1.2 *Corrosion/Salt Fog (Spray) Resistance*—Testing shall be conducted in accordance to ASTM D1654. The prepared specimen shall be scribed as directed by Test Method D1654. The minimum performance requirement is less than 1/16 in. creepage from the scribe and less than 6 % organic coating blistering (ASTM D714) after 1500 hours of exposure as specified in AAMA 2603-02, 6.7.2.

8.1.3 *Impact Resistance*—Testing shall be conducted using a 5/8" diameter round-nosed impact tester 18N-m (160 in-lb) range. Apply a load directly to the coated surface of sufficient force to deform the test sample a minimum of 0.10 inch. Apply tape (Permacel 99 or equivalent) ¾ in. wide over the area of deformation by pressing down firmly against coating to eliminate voids and air pockets. Sharply pull the tape off at a right angle to the plane of the surface being tested. Test pieces should be at ambient temperatures of 65 to 80°F. Minimum performance requirement is no removal of film from the substrate as specified by AAMA 2603-02, 6.5.

8.1.4 *Weathering Resistance*—South Florida exposure testing or QUV Accelerated Weathering Testing shall be accepted.

8.1.4.1 *South Florida Exposure*—Test site for on-apparatus testing are acceptable as follows; Florida exposure South of latitude 27 degrees North at 45 degree angle facing South for a minimum of 1 year as specified by AAMA 2603-02, 6.8.

8.1.4.2 *QUV Accelerated Weathering Testing*—QUV Accelerated Weathering Machine (UVA-340 lamp) shall be conducted in accordance to ASTM G154. Time frame is a minimum of 1000 hours.

8.1.4.3 *Weathering Color Retention*—As specified by AAMA 2603-02, 6.8. It is suggested slight fading and chalking be limited to 10 Delta E (Hunter) units in one year South Florida exposure or 1000 hours QUV (UVA-340 lamp) exposure.

8.1.5 *Product Testing*—All products tested must be coated on fence manufacturer's designated coating equipment and processes using standard aluminum extrusions used in the manufacture of fence manufacturer's fence products.

9. Significance and Use

9.1 The purpose of the specification is to define minimum selection criteria and test procedures to ensure product users that an ornamental aluminum fence system has the strength necessary to withstand reasonable loads and forces, and has the appropriate combination of material and organic coating surface protection to withstand the effects of corrosion and weathering for an extended period of time.

10. Certification

10.1 When specified in the purchase order or contract, the purchaser shall be provided with documentation from an independent testing laboratory that a representative sample of the manufacturers fence system of specified material, color, height, span, and component dimension, has been tested in accordance with this specification and the requirements have been met. Ornamental aluminum fence manufacturers may choose to test their fence panels and coatings internally, according to this specification, and the Purchaser may choose to accept or reject internally created testing documentation. Individual coating performance certification is required for each color applied to a manufactures fence panel. If a specifier requires a custom or untested color the procedures specified in AAMA 2603-02, 6.8 shall apply.

NOTE 5—Since ornamental aluminum fence manufacturers offer many fence panel models, styles and heights is recommended that the maximum height and span for a specific model be tested and lesser heights and spans will be considered in compliance.

10.2 Recertification or internal re-testing is required every five years or whenever there is a change in the material, color, design, component dimension, or addition of a new model.

11. Keywords

11.1 aluminum wrought iron fence; architectural metal fence; ornamental aluminum fence; ornamental fence; ornamental metal fence; picket fence; tubular picket fence; vertical tube fence