

SECTION 08 51 13

ALUMINUM WINDOWS
01/08

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ALUMINUM ASSOCIATION (AA)

AA DAF-45 (2003) Designation System for Aluminum Finishes

AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

AAMA 101 (2005) Standard Specification for Windows, Doors, and Unit Skylights

AAMA 1302.5 (1976) Voluntary Specifications for Forced-Entry Resistant Aluminum Prime Windows

AAMA 1503 (1998) Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections

AAMA 611 (1998) Voluntary Specification for Anodized Architectural Aluminum

ASTM INTERNATIONAL (ASTM)

ASTM B 117 (2007) Standard Practice for Operating Salt Spray (Fog) Apparatus

ASTM B 244 (1997; R 2002) Standard Method for Measurement of Thickness of Anodic Coatings on Aluminum and of Other Nonconductive Coatings on Nonmagnetic Basis Metals with Eddy-Current Instruments

ASTM E 2016 (2006) Standard Specification for Industrial Woven Wire Cloth

ASTM E 283 (2004) Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen

ASTM E 330 (2002) Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference

NATIONAL FENESTRATION RATING COUNCIL (NFRC)

NFRC 100 (2004) Procedure for Determining Fenestration Product U-Factors

NFRC 200 (2004) Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence

NATIONAL WOOD WINDOW AND DOOR ASSOCIATION (NWWDA)

AAMA/NWWDA 101/I.S.2 (1997) Voluntary Guide Specifications for Aluminum, Poly(Vinyl Chloride) (PVC) and Wood Windows and Glass Doors

THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC Paint 101 (1982) Paint Specification No. 101 Aluminum Alkyd Paint Leafing (Type I) and Non-Leafing (Type II)

SSPC Paint 12 (1982; E 2000) Paint Specification No. 12 Cold-Applied Asphalt Mastic (Extra Thick Film)

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

Energy Star (1992; R 2006) Energy Star Energy Efficiency Labeling System

1.2 CERTIFICATION

Each prime window unit must bear the AAMA Label warranting that the product complies with AAMA 101. Certified test reports attesting that the prime window units meet the requirements of AAMA 101, including test size, will be acceptable in lieu of product labeling.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Windows; G, AE

Fabrication Drawings

SD-03 Product Data

Windows; G, AE

Hardware; G, AE

Fasteners; G, AE
Aluminum Windows; G, AE
Frames; G, AE
THERMAL-BARRIER WINDOWS; G
MULLIONS; G
Screens; G, AE
Weatherstripping; G, AE
Accessories; G, AE
Windows; G, AE

Submit documentation for Energy Star qualifications.

SD-04 Samples

Finish Sample; G, AE
Window Sample; G, AE

SD-05 Design Data

Structural calculations for deflection; G, AE
Design Analysis; G, AE

SD-06 Test Reports

Minimum condensation resistance factor; G, AE
Resistance to forced entry; G, AE

SD-10 Operation and Maintenance Data

Windows, Data Package 1; G

Submit in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA.

When not labeled, identify types in Operation and Maintenance Manual.

1.4 QUALITY ASSURANCE

1.4.1 Shop Drawing Requirements

Provide drawings that indicate elevations of windows, full-size sections, thickness and gages of metal, fastenings, proposed method of anchoring, size and spacing of anchors, details of construction, method of glazing, details of operating hardware, mullion details, method and materials for weatherstripping, method of attaching screens, material and method of attaching subframes, sills, trim, installation details, and other related items.

1.4.2 Sample Requirements

1.4.2.1 Finish Sample Requirements

Submit color chart of standard factory color coatings when factory-finish color coating is to be provided.

1.4.2.2 Window Sample Requirements

Submit one full-size corner of each window type proposed for use. Where screens or weatherstripping is required, fit sample with such items that are to be used.

1.4.3 Design Data Requirements

Submit calculations to substantiate compliance with deflection requirements. A Professional Engineer must provide calculations.

Submit **design analysis** with calculations showing that the design of each different size and type of aluminum window unit and its anchorage to the structure meets the requirements of paragraph 1.9.1 "Minimum Antiterrorism Performance Criteria". Calculations verifying the structural performance of each window proposed for use, under the given loads, must be prepared and signed by a registered professional engineer. Reflect the window components and anchorage devices to the structure, as determined by the **design analysis**, in the shop drawings.

1.4.4 Test Report Requirements

Submit test reports for each type of window attesting that identical windows have been tested and meet the requirements specified herein for conformance to **AAMA 101** including test size, and **minimum condensation resistance factor** (CRF) , and **resistance to forced entry**.

1.5 DELIVERY AND STORAGE

Deliver windows to project site in an undamaged condition. Use care in handling and hoisting windows during transportation and at the jobsite. Store windows and components out of contact with the ground, under a weathertight covering, so as to prevent bending, warping, or otherwise damaging the windows. Repair damaged windows to an "as new" condition as approved. If windows can not be repaired, provide a new unit.

1.6 PROTECTION

Protect finished surfaces during shipping and handling using the manufacturer's standard method. Do not apply coatings or lacquers to surfaces to which calking and glazing compounds must adhere.

1.7 FIELD MEASUREMENTS

Take field measurements prior to preparation of the drawings and fabrication.

1.8 PERFORMANCE REQUIREMENTS

1.8.1 Glazing

Glazing must have laminated glass as specified in Section 08 81 00 GLAZING.

1.8.2 Aluminum Window Frames

Restrict aluminum framing members deflections of edges of glazing they support to $L/160$ under an equivalent 3-second duration loading of 30 pounds per square foot (psf), where L denotes the length of the glazing supported edge.

The glazing frame bite for the window frames must be adequate to accept the width of structural silicone sealant or glazing tape as specified in paragraph "Provisions for Glazing" below.

1.8.3 Window Frame Anchors

Fasten window frames to the supporting structure with anchors designed to resist forces generated by a 3-second duration load of 30 pounds per square foot (psf) acting on the entire window unit.

1.8.4 Wind Loading Design Pressure

Design window components, including mullions, hardware, and anchors, to withstand a wind-loading design pressure of at least 30 pounds per square foot (psf).

1.8.5 Tests

Test windows proposed for use in accordance with AAMA/NWWDA 101/I.S.2 for the particular type and quality window specified.

Perform tests by a nationally recognized independent testing laboratory equipped and capable of performing the required tests. Submit the results of the tests as certified laboratory reports required herein.

Minimum design load for a uniform-load structural test must be 50 psf.

1.9 DRAWINGS

Submit the Fabrication Drawings for aluminum window units showing complete window assembly including hardware, weatherstripping, and subframe assembly details.

1.10 WINDOW PERFORMANCE

Aluminum windows must meet the following performance requirements. Perform testing requirements by an independent testing laboratory or agency.

1.10.1 Structural Performance

Structural test pressures on window units must be for positive load (inward) and negative load (outward) in accordance with ASTM E 330. After testing, there will be no glass breakage, permanent damage to fasteners, hardware parts, support arms or actuating mechanisms or any other damage which could cause window to be inoperable. There must be no permanent deformation of any main frame, sash or ventilator member in excess of the

requirements established by [AAMA 101](#) for the window types and classification specified in this section.

1.10.2 Air Infiltration

Air infiltration must not exceed the amount established by [AAMA 101](#) for each window type when tested in accordance with [ASTM E 283](#).

1.10.3 Water Penetration

Water penetration must not exceed the amount established by [AAMA 101](#) for each window type when tested in accordance with [ASTM E 283](#).

1.10.4 Thermal Performance

Thermal transmittance for thermally broken aluminum windows with insulating glass must not exceed a U-factor of $0.75 \text{ Btu/hr-ft}^2\text{-F}$ determined according to [NFRC 100](#), and a solar heat gain coefficient (SHGC) of $0.40 \text{ Btu/hr-ft}^2\text{-F}$ determined according to [NFRC 200](#). Provide window units that comply with the U.S. Department of Energy, Energy Star Window Program for the Southern Climate Zone.

1.10.5 Condensation Index Rating

The condensation index rating must be 85 as determined using NFRC approved software THERM.

1.11 QUALIFICATION

Window manufacturer must specialize in designing and manufacturing the type of aluminum windows specified in this section, and have a minimum of 10 years of documented successful experience. Manufacturer must have the facilities capable of meeting contract requirements, single-source responsibility and warranty.

1.12 WARRANTY

Provide Manufacturer's standard performance guarantees or warranties that extend beyond a 1 year period.

PART 2 PRODUCTS

2.1 WINDOWS

Provide prime windows that comply with [AAMA 101](#) and the requirements specified herein. In addition to compliance with [AAMA 101](#), window framing members for each individual lite of glass must not deflect to the extent that deflection perpendicular to the glass lite exceeds $L/175$ of the glass edge length when subjected to uniform loads at specified design pressures. Provide [Structural calculations for deflection](#) to substantiate compliance with deflection requirements. Provide windows of types, performance classes, performance grades, combinations, and sizes indicated or specified. Design windows to accommodate hardware, glass, weatherstripping, screens, and accessories to be furnished. Each window must be a complete factory assembled unit with or without glass installed. Dimensions shown are minimum. Provide windows with insulating glass and thermal break necessary to achieve a minimum Condensation Resistance Factor (CRF) of 45 when tested in accordance with [AAMA 1503](#). Glazed systems (including frames and glass) will be [Energy Star](#) labeled products as

appropriate to climate zone and as applicable to window type.

2.1.1 Top-Hinged Windows (TH)

Type TH-HC-65 Optional Performance Grade). Top-hinged windows must be outswinging.

2.1.2 Fixed Windows (F)

Type F-AW-60 Optional Performance Grade).

2.1.3 Forced Entry Resistant Windows

In addition to meeting the requirements of [AAMA 101](#), windows designated for resistance to forced entry must conform to the requirements of [AAMA 1302.5](#).

2.1.4 Glass and Glazing

Materials are specified in Section [08 81 00](#) GLAZING.

2.1.5 Calking and Sealing

Are specified in Section [07 92 00](#) JOINT SEALANTS.

2.1.6 Weatherstripping

[AAMA 101](#).

2.2 FABRICATION

Fabrication of window units must comply with [AAMA 101](#).

2.2.1 Provisions for Glazing

Design windows and rabbets suitable for glass thickness shown or specified. Design sash for outside double glazing and for securing glass with glazing clips, or glazing compound.

2.2.2 Weatherstripping

Provide for ventilating sections of all windows to ensure a weather-tight seal meeting the infiltration requirements specified in [AAMA 101](#). Provide easily replaceable factory-applied weatherstripping. Use molded vinyl, molded or molded-expanded neoprene or molded or expanded Ethylene Propylene Diene Terpolymer (EPDM) compression-type weatherstripping for compression contact surfaces. Use treated woven pile or wool, or polypropylene or nylon pile bonded to nylon fabric and metal or plastic backing strip weatherstripping for sliding surfaces. Do not use neoprene or polyvinylchloride weatherstripping where they will be exposed to direct sunlight.

2.2.3 Fasteners

Use fasteners as standard with the window manufacturer for windows, trim, and accessories. Self-tapping sheet-metal screws are not acceptable for material more than [1/16 inch](#) thick.

2.2.4 Drips and Weep Holes

Provide continuous drips over heads of top ventilators. Where fixed windows adjoin ventilators, drips must be continuous across tops of fixed windows. Provide drips and weep holes as required to return water to the outside.

2.2.5 Combination Windows

Windows used in combination must be the same class and grade and will be factory assembled. Where factory assembly of individual windows into larger units is limited by transportation considerations, prefabricate, match mark, transport, and field assemble.

2.2.6 Mullions and Transom Bars

Provide mullions between multiple window units which meet the design pressure of 30 psf. Provide mullions with a thermal break. Secure mullions and transom bars to adjoining construction and window units in such a manner as to permit expansion and contraction and to form a weathertight joint. Provide mullion covers on the interior and exterior to completely close exposed joints and recesses between window units and to present a neat appearance.

2.2.7 Accessories

Provide windows complete with necessary hardware, fastenings, clips, fins, anchors, glazing beads, and other appurtenances necessary for complete installation and proper operation. Furnish extruded aluminum subframe receptors and subsill with each window unit.

2.2.7.1 Hardware

AAMA 101. The item, type, and functional characteristics must be the manufacturer's standard for the particular window type. Provide hardware of suitable design and of sufficient strength to perform the function for which it is used. Equip all operating ventilators with a lock or latching device which can be secured from the inside.

2.2.7.2 Fasteners

Provide concealed anchors of the type recommended by the window manufacturer for the specific type of construction. Anchors and fasteners must be compatible with the window and the adjoining construction. Provide a minimum of three anchors for each jamb located approximately 6 inches from each end and at midpoint.

2.2.8 Finishes

Exposed aluminum surfaces must be factory finished with an anodic coating. Color must be as indicated in Window and Relight Schedule on Drawings.

2.2.8.1 Anodic Coating

Clean exposed aluminum surfaces and provide an anodized finish conforming to AA DAF-45 and AAMA 611. Finish must be:

- a. Architectural Class II (0.4 mil to 0.7 mil), designation AA-M10-C22- A32, integral color anodized in medium bronze.

2.2.9 Screens

AAMA 101. Provide one insect screen for each operable exterior ventilator. Design screens to be rewirable, easily removable from inside the building, and to permit easy access to operating hardware.

2.3 THERMAL-BARRIER WINDOWS

Provide thermal-barrier windows, complete with accessories and fittings, where indicated.

Specify material and construction except as follows:

- a. Aluminum alloy must be 6063-T6.
- b. Frame construction, including operable sash, must be factory-assembled and factory-sealed inner and outer aluminum completely separated from metal-to-metal contact. Join assembly by a continuous, concealed, low conductance divider housed in an interlocking extrusion of the inner frame. Metal fasteners, straps, or anchors will not bridge the connection between the inner and outer frame.
- c. Operating hardware for each sash must consist of spring-loaded nylon cushion blocks and pin locks designed to lock in predetermined locations.
- d. Sash must be completely separated from metal-to-metal contact by means of woven-pile weatherstripping, plastic, or elastomeric separation members.
- e. Operating and storm sash will be factory-glazed with the type of glass indicated and of the quality specified in Section 08 81 00 GLAZING.

2.4 MULLIONS

Provide mullions between multiple-window units where indicated.

Mullions and mullion covers must be the profile indicated, reinforced as required for the specified wind loading, and securely anchored to the adjoining construction. Mullion extrusion will include serrations or pockets to receive weatherstripping, sealant, or tape at the point of contact with each window flange.

Mullion assembly must include aluminum window clamps or brackets screwed or bolted to the mullion and the mullion cover.

Mullion cover must be screw-fastened to the mullion unless otherwise indicated.

Mullion reinforcing members must be steel or aluminum shapes provided by the window manufacturer to meet the specified design loading.

2.5 SCREENS

Provide removable, rewirable, interchangeable aluminum insect screens for window openings as indicated and complete with installation hardware and

fasteners.

Frames must be extruded tubular aluminum, the same alloy and finish coating as specified for windows, at least $1/16$ inch web thickness, at least $7/16$ inch deep by $1-1/2$ inches high. Corners must be mitered, welded, and dressed smooth and flush. Frames will include integral extruded grooves to receive and retain screen splines. Splines must be miter cut and provide neat close-fitting joints no wider than $1/32$ inch.

Fabric must be 18 by 16 mesh by 0.011 inch diameter, Alclad aluminum alloy wire screen conforming to ASTM E 2016. Screens will be held taut and smooth in frames by removable vinyl splines.

2.6 FINISH

Aluminum windows, mullions, glazing beads, trim, and accessory fittings must be cleaned, and receive an Architectural Class II natural anodic coating (designation AA-M-12C22A31) in accordance with AA DAF-45. Anodic coating will be not less than 0.4 mil.

Test the thickness of the anodic coating in accordance with ASTM B 244.

Anodic coating must be continuous and, without being lacquered, will be capable of withstanding 500 hours of salt-spray exposure for Class A anodic coatings and 250 hours of salt-spray exposure for Class B anodic coatings when tested in accordance with ASTM B 117.

2.6.1 Color

Color: Medium bronze.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Method of Installation

Install in accordance with the window manufacturer's printed instructions and details. Build in windows as the work progresses or install without forcing into prepared window openings. Set windows at proper elevation, location, and reveal; plumb, square, level, and in alignment; and brace, strut, and stay properly to prevent distortion and misalignment. Protect ventilators and operating parts against accumulation of dirt and building materials by keeping ventilators tightly closed and locked to frame. Bed screws or bolts in sill members, joints at mullions, contacts of windows with sills, built-in fins, and subframes in mastic sealant of a type recommended by the window manufacturer. Install and caulk windows in a manner that will prevent entrance of water and wind. Fasten insect screens securely in place.

3.1.2 Dissimilar Materials

Where aluminum surfaces are in contact with, or fastened to masonry, concrete, wood, or dissimilar metals, except stainless steel or zinc, protect the aluminum surface from dissimilar materials as recommended in the Appendix to AAMA 101. Do not coat surfaces in contact with sealants after installation with any type of protective material.

3.1.3 Anchors and Fastenings

Make provision for securing units to each other, to masonry, and to other adjoining construction. Windows installed in masonry walls must have head and jamb members designed to recess into masonry wall not less than $7/16$ inch.

3.1.4 Adjustments After Installation

After installation of windows and completion of glazing and field painting, adjust all ventilators and hardware to operate smoothly and to provide weathertight sealing when ventilators are closed and locked. Lubricate hardware and operating parts as necessary. Adjust double hung windows to operate with maximum applied force of 25 pounds in either direction, not including breakaway friction force. Verify that products are properly installed, connected, and adjusted.

3.2 ADJUSTMENT AFTER INSTALLATION

Lubricate and adjust ventilators for smooth weathertight operation. Wax or lubricate guides and adjust balances for the proper tension.

Weatherstripping must make weathertight contact around the entire weatherstripped area when ventilators are closed and locked. Weatherstripping must not cause the sash to bind or prevent closing and locking the ventilator.

3.2.1 Hardware Adjustments

Make final operating adjustments after glazing work is complete. Operating ventilators must operate smoothly and be weathertight when in locked position.

3.2.2 Cleaning

Clean aluminum window finish and glass on exterior and interior sides in accordance with window manufacturer's recommendations. Do not use alkaline or abrasive agents. Take precautions to avoid scratching or marring window finish and glass surfaces.

3.3 DISSIMILAR MATERIALS

Aluminum must be kept from direct contact with steel or other dissimilar materials by painting, nonabsorptive tape, gasket, or other approved system as recommended by the manufacturer and as specified.

Give aluminum surfaces in contact with steel one coat of zinc-chromate primer applied to a dry-film thickness of not less than 1.5 mils, or one coat of a suitable nonhardening joint compound capable of excluding moisture from the joint during prolonged service.

Give steel surfaces in contact with aluminum one coat of zinc-chromate paint applied to a dry-coat thickness of 1.5 mils, and two or more coats of aluminum paint conforming to SSPC Paint 101, aluminum alkyd, Type II, applied to a dry-film thickness of 1.5 mils for each coat and a total dry-film thickness of 3.0 mils.

Corrosion-resistant, aluminized, or hot-dip galvanized steel placed in contact with aluminum need not be painted.

Give aluminum surfaces placed in contact with wood, concrete, or masonry construction one coat of bituminous paint conforming to [SSPC Paint 12](#), applied to a thickness of at least [1/16 inch](#).

3.4 CLEANING

Clean interior and exterior surfaces of window units of mortar, paint spattering spots, and other foreign matter to present a neat appearance, to prevent fouling of weathering surfaces and weather-stripping, and to prevent interference with the operation of hardware. Replace all stained, discolored, or abraded windows that cannot be restored to their original condition with new windows.

-- End of Section --