

## SECTION 085113 - ALUMINUM WINDOWS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes fixed and/or operable aluminum-framed windows for exterior locations.
- B. Related Sections include the following:
  - 1. Division 08 Section "Aluminum-Framed Entrances and Storefronts" for coordinating finish among aluminum fenestration units.
  - 2. Division 08 Section "Glazing" for additional glazing requirements for aluminum windows.

#### 1.3 DEFINITIONS

- A. Performance class designations according to AAMA/WDMA/CSA 101/I.S.2/A440-17:
  - 1. AW: Architectural.
- B. Performance grade number according to AAMA/WDMA/CSA 101/I.S.2/A440-17:
  - 1. Design pressure number in pounds force per square foot (pascals) used to determine the structural test pressure and water test pressure.
- C. Structural Test Pressure: For uniform load structural test, is equivalent to 150 percent of the design pressure.
- D. Minimum Test Size: Smallest size permitted for performance class (gateway test size) or as specified elsewhere in this section, whichever is more stringent. Products must be tested at minimum test size or at a size larger than minimum test size to comply with requirements for performance class. Downsized test reports will not be considered acceptable.

#### 1.4 PERFORMANCE REQUIREMENTS

- A. General: Provide aluminum windows capable of complying with performance requirements indicated, based on testing manufacturer's windows that are representative of those specified, and that are of minimum test size indicated below:
  - 1. Double Hung Windows: 60" x 99".

- B. Structural Performance: Provide aluminum windows capable of withstanding the effects of the following loads, based on testing units of the minimum test size specified herein that pass AAMA/WDMA/CSA 101/I.S.2/A440-17, Uniform Load Structural and Uniform Load Deflection Tests:
  - 1. Uniform Load Structural Test: 150 psf (positive and negative).
  - 2. Uniform Load Deflection Test: 100 psf (positive and negative).
- C. Windborne-Debris Resistance: Provide glazed windows capable of resisting large missile impact from windborne debris, based on the pass/fail criteria as determined from testing glazed windows identical to those specified, according to ASTM E 1886 and testing information in ASTM E 1996 and requirements of authorities having jurisdiction.

## 1.5 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, fabrication methods, dimensions of individual components and profiles, hardware, finishes, and operating instructions for each type of aluminum window indicated.
- B. Shop Drawings: Include plans, elevations, sections, details, hardware, attachments to other work, operational clearances, installation details, and the following:
  - 1. Mullion details, including reinforcement and stiffeners.
  - 2. Joinery details.
  - 3. Weather-stripping details.
  - 4. Thermal-break details.
  - 5. Glazing details.
- C. Samples for Initial Selection: For units with factory-applied color finishes.
  - 1. Include similar samples of hardware and accessories involving color selection.
- D. Maintenance Data: For operable window sash, operating hardware and finishes to include in maintenance manuals.
- E. Warranty: Special warranty specified in this Section.

## 1.6 QUALITY ASSURANCE

- A. Product Qualifications: In order to confirm that the proposed product(s) conform to the material and performance requirements contained in these specifications, bidders shall include the following with their bid. Failure to comply with these requirements shall cause the bid to automatically be rejected.
  - 1. Bidder's Acknowledgement: Bidders shall include a letter in their bid stating the manufacturer and series (model) number of the product upon which its bid has been based. Changes in product (manufacturer or series) will not be permitted after the bid.

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2. Product Data: Bidders submitting bids based on products other than the Basis of Design product listed in Paragraph 2.1 must also include the following with their bid:
  - a. Comprehensive test reports not more than four years old prepared by a qualified testing agency for each product type being used on the project demonstrating compliance with the air, water and structural requirements outlined herein. Test reports based on the use of downsized test units will not be accepted.
  - b. Thermal simulations prepared by a qualified independent testing agency for each product type being used on the project demonstrating compliance with the thermal transmittance requirements outlined in Paragraph 2.3.
  - c. Full size product details showing all frame and sash details, dimensions, thermal break construction, wall thicknesses and joinery. Details must accurately reflect all glazing and hardware options specified herein.
  
- B. Product Requirements: For maximum performance, windows for this project must meet both the testing requirements as contained herein and the minimum material requirements specified. Windows that carry the applicable AAMA rating but do not meet the material thicknesses, depths, etc. shall not be acceptable for use on this project.
  
- C. Installer Qualifications: An installer acceptable to aluminum window manufacturer for installation of units required for this Project.
  
- D. Source Limitations: Obtain aluminum windows through one source from a single manufacturer.
  
- E. Product Options: Drawings indicate size, profiles, and dimensional requirements of aluminum windows and are based on the specific system indicated. Do not modify size and dimensional requirements.
  1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.
  
- F. Fenestration Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440-17, "Standard/Specification for Windows, Doors, and Unit Skylights" for definitions and minimum standards of performance, materials, components, accessories, and fabrication. Comply with more stringent requirements if indicated.
  
- G. Glazing Publications: Comply with published recommendations of glass manufacturers and with GANA's "Glazing Manual" unless more stringent requirements are indicated.
  
- H. Preinstallation Conference: If requested, conduct conference at project site to review methods and procedures related to aluminum windows including, but not limited to, the following:
  1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
  2. Review, discuss, and coordinate the interrelationship of aluminum windows with other exterior wall components.
  3. Review and discuss the sequence of work required to construct a watertight and weathertight exterior building envelope.
  4. Inspect and discuss the condition of substrate and other preparatory work performed by other trades.

## 1.7 PROJECT CONDITIONS

- A. Field Measurements: For retrofit installations, verify aluminum window openings by field measurements before fabrication and indicate measurements on Shop Drawings.
  - 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish opening dimensions and proceed with fabricating aluminum windows without field measurements. Coordinate wall construction to ensure that actual opening dimensions correspond to established dimensions.

## 1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace aluminum windows that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Failure to meet performance requirements.
    - b. Structural failures including excessive deflection, water leakage, or air infiltration.
    - c. Faulty operation of movable sash and hardware.
    - d. Deterioration of metals or other materials beyond that which is normal.
    - e. Failure of insulating glass.
  - 2. Warranty Period:
    - a. Window: Five years from date of Substantial Completion.
    - b. Balances: Class 6, Ten years from date of Substantial Completion.
    - c. Insulated Glazing: 10 years from date of Substantial Completion.
    - d. Painted Metal Finishes:
      - 1) Five years from date of Substantial Completion for AAMA 2603 Baked Enamel Finishes.
      - 2) Twenty years from date of Substantial Completion for AAMA 2605 Superior Performance Finishes.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Product: Double Hung Side Load as manufactured by:
  - 1. Architectural Window Manufacturing Corporation, Rutherford, New Jersey, Series 4700i (Basis of Design).
  - 2. Efc0 Corporation,
  - 3. Kawneer Co.
  - 4. Approved Equal

- B. Equivalents: Subject to compliance with all material and performance requirements outlined in these specifications, “or equal” products by other manufacturers will be considered for use subject to review by the Architect. The Architect’s decision regarding equivalency is final.

## 2.2 MATERIALS

- A. Aluminum Extrusions: Alloy and temper recommended by aluminum window manufacturer for strength, corrosion resistance, and application of required finish, but not less than 22,000-psi (150-MPa) ultimate tensile strength, not less than 16,000-psi (110-MPa) minimum yield strength, and not less than 0.080-inch (1.6-mm) thickness at any location for the main frame and sash members, except the frame sill which shall be a minimum of 0.125-inch.
- B. Frame/Sash Depth: 4 ¼” minimum frame depth; 1 ¾” minimum sash depth.
- C. Fasteners: Aluminum, nonmagnetic stainless steel, epoxy adhesive, or other materials warranted by manufacturer to be noncorrosive and compatible with aluminum window members, trim, hardware, anchors, and other components.
  - 1. All fasteners must be concealed except where unavoidable for application of hardware.
  - 2. For application of hardware, where required, use non-magnetic stainless steel phillips machine screws.
- D. Anchors, Clips, and Accessories: Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.
- E. Compression-Type Weather Stripping: Provide compressible weather stripping designed for permanently resilient sealing under bumper or wiper action and for complete concealment when aluminum window is closed.
  - 1. Weather-Stripping Material: Manufacturer's standard system and materials complying with AAMA/WDMA/CSA 101/I.S.2/A440-17.
- F. Sliding-Type Weather Stripping: Provide woven-pile weather stripping of wool, polypropylene, or nylon pile and resin-impregnated backing fabric. Comply with AAMA 701/702.
  - 1. Weather Seals: Provide weather stripping with integral barrier fin or fins of semirigid, polypropylene sheet or polypropylene-coated material. Comply with AAMA 701/702.
- G. Replaceable Weather Seals: Comply with AAMA 701/702.
- H. Sealant: For sealants required within fabricated windows, provide window manufacturer's standard, permanently elastic, nonshrinking, and nonmigrating type recommended by sealant manufacturer for joint size and movement.

## 2.3 WINDOW

- A. Window Type: Double hung

- B. AAMA/WDMA Performance Requirements: Provide aluminum windows of performance indicated that comply with AAMA/WDMA/CSA 101/I.S.2/A440-17.
1. Performance Class and Grade: AW-PG100.
- C. Condensation-Resistance Factor (CRF): Provide aluminum windows tested with insulating glass for thermal performance according to AAMA 1503, showing a minimum CRF of 50.
- D. Thermal Transmittance: Provide aluminum windows with whole-window U-factor and SHGC maximums indicated when simulated in accordance with NFRC 100 and NFRC 200 at a model size of 48" x 72" and glazed with 1" Argon filled sputter coat Low-E (#5) insulated glass using a warm edge spacer.
1. U-Factor: 0.40 Btu/sq. ft. x h x deg F or less.
  2. SHGC: 0.32.
- E. Air Infiltration: Maximum rate not more than indicated when tested according to AAMA/WDMA/CSA 101/I.S.2/A440-17, Air Infiltration Test.
1. Maximum Rate: 0.19 cfm/sq. ft. (5 cu. m/h x sq. m) of area at an inward test pressure of 6.24 lbf/sq. ft. (300 Pa).
- F. Water Resistance: No water leakage as defined in AAMA/WDMA referenced test methods at a water test pressure equaling that indicated, when tested according to AAMA/WDMA 101/I.S.2/NAFS, Water Resistance Test.
1. Test Pressure: 20 percent of positive design pressure, but not more than 15 lbf/sq. ft.
- G. Forced-Entry Resistance: Comply with Performance Grade 10 requirements when tested according to ASTM F 588.
- H. Life-Cycle Testing: Test according to AAMA 910 and comply with AAMA/WDMA/CSA 101/I.S.2/A440-17.
- I. Operating Force and Auxiliary (Durability) Tests: Comply with AAMA/WDMA/CSA 101/I.S.2/A440-17 for operating window types indicated.

## 2.4 INSULATED GLAZING

- A. Construction: All windows (except those receiving insulated panels) shall be factory glazed with hermetically sealed 1" insulating glass units with a dual seal of polyisobutylene and silicone and a desiccant filled spacer. Insulated glass must be set into a continuous bed of two-part structural silicone sealant and held in place with removable extruded aluminum snap-in beads. Wrap around (marine) glazing which requires the removal and disassembling of the sash for re-glazing will not be acceptable. Units must be IGCC certified for a CBA rating level.
1. Exterior Glazing:
    - a. Thickness: 5/16"
    - b. Tint: Clear

- c. Type: Laminated Glass (.090" PVB Interlayer)
2. Interior Glazing:
  - a. Thickness: 1/4"
  - b. Tint: Clear
  - c. Type: Tempered Glass
  - d. Coating: Guardian SuperNeutral 68, Vitro Solarban 60, Viracon VE-2M Low-E (or equal) (# 5 Surface)
3. Interspace Content: Argon
4. Spacer Type: Warm Edge

B. Insulated Panels:

1. Overall thickness: 1"
2. Exterior Face: Kynar paint on smooth .032" aluminum - color to be selected from manufacturer's standard.
3. Interior Face: Kynar paint on smooth .032" aluminum - color to be selected from manufacturer's standard.
4. Exterior Substrate: 3/16" mineral fiber board.
5. Interior Substrate: 3/16" mineral fiber board.
6. Core: Polyisocyanurate.

## 2.5 HARDWARE

- A. General: Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, carbon steel complying with AAMA 907, or other corrosion-resistant material compatible with aluminum; designed to smoothly operate, tightly close, and securely lock aluminum windows and sized to accommodate sash or ventilator weight and dimensions. Do not use aluminum in frictional contact with other metals.
- B. Locks and Latches: Designed to allow unobstructed movement of the sash across adjacent sash in direction indicated and operated from the inside only.
- C. Pole Operators: Tubular-shaped anodized aluminum; with rubber-capped lower end and standard push-pull hook at top to match hardware design; of sufficient length to operate window without reaching more than 60 inches (1500 mm) above floor; 1 pole operator and pole hanger per room that has operable window hardware more than 72 inches (1800 mm) above floor.
- D. Double-Hung Windows: Provide the following operating hardware:
  1. Counterbalancing Mechanism: Comply with AAMA 902.
    - a. Sash Balance: Class 6, concealed Ultralift Extreme spring type capable of lifting 80% of sash weight, of size and capacity to hold sash stationary at any open position.
  2. Removable Lift-out Sash: Design windows and provide with hardware to permit removal of sash from inside for cleaning. Units with tilt-in sash will not be acceptable.
  3. Handle: Continuous, integral lift rail on bottom rail of lower sash and pull-down rail on top rail of upper sash.
  4. Lower Sash Lock: Spring-loaded, snap-type white bronze lock on bottom rail of lower sash (two if window is greater than 48" wide).

5. Upper Sash Lock: Pole-operated snap type white bronze lock on top rail of upper sash. Spring-loaded, snap-type aluminum lock on top rail of upper sash.
6. Limit Device: Continuous extruded aluminum sash stop limit device with rubber bumper; for each operable sash located at jamb; two per sash. Operation shall be limited to 8" of travel.

## 2.6 INSECT SCREENS

- A. General: Design windows and hardware to accommodate screens in a tight-fitting, removable arrangement, with a minimum of exposed fasteners and latches. Locate screens on outside of window. Provide insect screens on all operable sash.
- B. Aluminum Insect Screen Frames: Manufacturer's standard aluminum alloy complying with SMA 1004. Fabricate frames with mitered or coped joints or corner extrusions, concealed fasteners, and removable PVC spline/anchor concealing edge of frame.
  1. Extruded-Aluminum Tubular Framing Sections and Cross Braces: Not less than 0.050-inch (1.3-mm) wall thickness.
  2. Finish: Match aluminum window members.
- C. Glass-Fiber Mesh Fabric: 18-by-16 (1.0-by-1.1-mm) mesh of PVC-coated, glass-fiber threads; woven and fused to form a fabric mesh resistant to corrosion, shrinkage, stretch, impact damage, and weather deterioration; in the following color. Comply with ASTM D 3656.
  1. Mesh Color: Charcoal gray.

## 2.7 FABRICATION

- A. Fabricate aluminum windows in sizes indicated. Include a complete system for assembling components and anchoring windows.
- B. Fabricate aluminum windows that are reglazable without dismantling sash or ventilator framing.
- C. Thermally Improved Construction: Fabricate aluminum windows with an integral, concealed (products with exposed thermal barriers will not be acceptable), low-conductance thermal barrier; located between exterior materials and window members exposed on interior side; in a manner that eliminates direct metal-to-metal contact.
  1. All exterior aluminum shall be separated from interior aluminum by a rigid, structural thermal barrier. For purposes of this specification, a structural thermal barrier is defined as a system that shall transfer shear during bending and, therefore, promote composite action between the exterior and interior extrusions.
  2. No thermal short circuits shall occur between the exterior and interior.
  3. The thermal barrier shall be INSULBAR® or equal and shall consist of two glass reinforced polyamide nylon 6/6 struts mechanically crimped in raceways extruded in the exterior and interior extrusions.
  4. Poured and debridged urethane thermal barriers shall not be permitted.

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- D. Weather Stripping: Provide full-perimeter weather stripping for each operable sash and ventilator.
- E. Weep Holes: Provide weep holes and internal passages to conduct infiltrating water to exterior.
- F. Mullions: Provide mullions and cover plates as shown, matching window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections, as indicated. Provide mullions and cover plates capable of withstanding design loads of window units.
- G. Subframes: Provide subframes with anchors for window units as shown, of profile and dimensions indicated but not less than 0.093-inch- thick extruded aluminum. Finish to match window units. Provide subframes capable of withstanding design loads of window units.
- H. Factory-Glazed Fabrication: Glaze aluminum windows in the factory where practical and possible for applications indicated. Comply with requirements in Division 08 Section "Glazing" and with AAMA/WDMA/CSA 101/I.S.2/A440-17.
- I. Glazing Stops: Provide snap-on glazing stops coordinated with Division 08 Section "Glazing" and glazing system indicated. Provide glazing stops to match sash and ventilator frames.
- J. Muntins: Where shown on drawings, muntins shall be 3/8" deep profiled extruded aluminum applied to the exterior of 1" deep insulating glass. Roll formed muntins shall not be acceptable. Exterior applied muntins, where applicable, must be pinned to an integral bevel on the frame or sash. Products using applied bevels will not be accepted.

## 2.8 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- C. Exterior of Window:
  - 1. Superior-Performance Organic Finish: AA-C12C40R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2605 and with coating and resin manufacturer's written instructions.
    - a. Fluoropolymer Two-Coat System: Manufacturer's standard two-coat thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 2605.

- b. Color: Bronze Metallic or as selected by Architect from manufacturer's standard mica/metallic colors. (Note: Exterior color may be different from interior color.)

D. Interior of Window:

1. Baked-Enamel Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Apply baked enamel complying with paint manufacturer's written instructions for cleaning, conversion coating, and painting.
  - a. Organic Coating: Thermosetting, modified-acrylic enamel primer/topcoat system complying with AAMA 2603 Organic Coating: Thermosetting, modified-acrylic enamel primer/topcoat system complying with AAMA 2603.
  - b. Color: As selected by Architect from manufacturer's standard non-mica, non-exotic, non-metallic colors. (Note: Exterior color may be different from interior color.)

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work. Verify rough opening dimensions, levelness of sill plate, and operational clearances. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure a coordinated, weathertight window installation.
  1. Masonry Surfaces: Visibly dry and free of excess mortar, sand, and other construction debris.
  2. Wood Frame Walls: Dry, clean, sound, well nailed, free of voids, and without offsets at joints. Ensure that nail heads are driven flush with surfaces in opening and within 3 inches (76 mm) of opening.
  3. Metal Surfaces: Dry; clean; free of grease, oil, dirt, rust, corrosion, and welding slag; without sharp edges or offsets at joints.
  4. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Comply with Drawings, Shop Drawings, and manufacturer's written instructions for installing windows, hardware, accessories, and other components.
- B. Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support.
- C. Set sill members in bed of sealant or with gaskets, as indicated, for weathertight construction.

- D. Install windows and components to drain condensation, water penetrating joints, and moisture migrating within windows to the exterior.
- E. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

### 3.3 FACTORY TESTING

- A. One window for each seventy-five manufactured shall be randomly selected by the Owner and Architect to be tested at the manufacturer's facility for air and water infiltration in order to confirm compliance of the project's windows with the performance requirements contained in these specifications. Bidders are to include the cost of transportation, food, and lodging for four representatives of the Owner and/or Architect to witness these tests.

### 3.4 FIELD QUALITY CONTROL

- A. Testing Agency: If desired, Owner will engage a qualified testing agency to perform tests and inspections and prepare test reports.
  - 1. Testing and inspecting agency will interpret tests and state in each report whether tested work complies with or deviates from requirements.
- B. Testing Services: Testing and inspecting of installed windows shall take place as follows:
  - 1. Testing Methodology: Testing of windows for air infiltration and water resistance shall be performed according to AAMA 502, Test Method A. Field test pressures and allowable limits shall be as factored by AAMA 502 from those minimums required to determine laboratory compliance with the applicable Performance Class and Grade pursuant to AAMA/WDMA/CSA 101/I.S.2/A440-17.
  - 2. Testing Extent: One window as selected by Architect and a qualified independent testing and inspecting agency. Windows shall be tested immediately after installation.
  - 3. Test Reports: Shall be prepared according to AAMA 502.
- C. Remediate noncomplying windows and retest as specified above.
- D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of remediated doors or additional work with specified requirements.

### 3.5 ADJUSTING, CLEANING, AND PROTECTION

- A. Adjust operating sashes and ventilators, screens, hardware, and accessories for a tight fit at contact points and weather stripping for smooth operation and weathertight closure. Lubricate hardware and moving parts.
- B. Manufacturer shall clean all glass and aluminum prior to shipment.

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- C. Protection of newly installed windows and/or final cleaning of glass and aluminum to remove any accumulations that may have occurred during the construction period is to be the responsibility of the General Contractor or Owner.
- D. Comply with manufacturer's written recommendations for final cleaning and maintenance.

3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain window operating system.

END OF SECTION 085113