

SECTION 08 51 13

ALUMINUM WINDOWS

05/19

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.

ASTM INTERNATIONAL (ASTM)

ASTM E1886	(2019) Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials
ASTM E1996	(2017) Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricanes

JAPANESE INDUSTRIAL STANDARDS COMMITTEE (JISC)

JIS A 1514	(2015) Test Method of Dew Condensation for Windows and Doorsets
JIS A 1516	(1998) Windows and Doorsets - Air Permeability Test
JIS A 1517	(2020) Windows and Doorsets - Watertightness Test Under Dynamic Pressure
JIS A 4706	(2015) Windows
JIS A 4709	(2018) Screens for windows
JIS B 1220	(2015) Set of Anchor Bolt for Structures
JIS B 1051	(2014) Coarse And Fine Screws Mechanical Properties of Fasteners Made of Carbon Steel and Alloy Steel Bolts, Screws and Studs with Specified Property Classes-Coarse Thread and Fine Pitch Thread
JIS H 8601	(1999) Anodic Oxide Coatings on Aluminum and Aluminum Alloys
JIS K 5906	(1998) Aluminum Pigments For Paints

MINISTRY OF LAND, INFRASTRUCTURE, TRANSPORT AND TOURISM (MLIT)

MLIT SS Chapter 16	(2019) Building Construction Standard
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Specifications - Chapter 16 Opening
Construction

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 101 (2021; TIA 21-1) Life Safety Code

U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 4-020-01 (2008) DoD Security Engineering Facilities
Planning Manual

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are [for Contractor Quality Control approval.][for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance with Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Windows; G[, [_____]]

Fabrication Drawings

SD-06 Test Reports

[Windborne-Debris-Impact Performance

] SD-10 Operation and Maintenance Data

Windows, Data Package 1; G[, [_____]]

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

1.3 QUALITY ASSURANCE

1.3.1 Qualification of Manufacturer

Window manufacturer must specialize in designing and manufacturing the type of aluminum windows specified in this section, and have a minimum of 5 years of documented successful experience. Manufacturer must have the facilities capable of meeting contract requirements, single-source responsibility and warranty.

1.3.2 Shop Drawing Requirements

Take field measurements prior to preparation of drawings and fabrications. 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,] [stools,]

[casings,] [sills,] [trim,] [window cleaner anchors,] installation details, and other related items.

1.3.3 Engineer's Qualifications for Blast Design

All blast design calculations must be performed by or under the direct supervision of a registered engineer with a minimum of 5 years experience performing blast design. The engineer performing the blast design must be able to demonstrate experience on similar size projects using similar design methods to meet the requirements outlined in this specification.

1.3.4 Sample Requirements

1.3.4.1 Finish Sample Requirements

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

1.3.4.2 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, only required for large scale projects with numerous windows.

1.3.5 Design Data Requirements

Submit calculations to substantiate compliance with deflection requirements[and Antiterrorism Performance Requirements]. A registered Professional Engineer must provide calculations.

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.

1.3.6 Test Report Requirements

Submit test reports for each type of window attesting that identical windows have been tested and meet the requirements specified herein by independent testing agency including test size, [and] minimum condensation resistance factor (CRF)[, and resistance to forced entry].

1.3.7 Certification

Ensure that construction is performed with products that meet or exceed JIS A 4706 requirement.

Each prime window unit must demonstrate that the product complies with JIS A 4706. Certified test reports attesting that the prime window units meet the requirements of JIS A 4706, including test size, will be acceptable in lieu of product labeling.

1.4 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.

1.5 PERFORMANCE REQUIREMENTS

1.5.1 Wind Loading Design Pressure

Design window components, including mullions, hardware, and anchors, to withstand a wind-loading design pressure of at least [_____] pascal.

[1.5.2 Tests

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. For windows conforming to Japanese standards, provide structural calculations to prove compliance.

Minimum design load for a uniform-load structural test must be 2400 pascal.

[Test projected windows in accordance with the applicable portions of the JIS A 1516 for air infiltration, water resistance, uniform-load deflection, and uniform-load structural test.

] [Test double-hung windows in accordance with the applicable portions of the JIS A 1516 for air infiltration, water resistance, uniform-load deflection, and uniform-load structural test.

]1.6 DRAWINGS

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

1.7 WINDOW PERFORMANCE

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

1.7.1 Structural Performance

Structural test pressures on window units must be for positive load (inward) and negative load (outward). 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 for the window types and classification specified in this section.

1.7.2 Air Infiltration

Air infiltration must not exceed the amount established by JIS A 1516 for each window type.

1.7.3 Water Penetration

Water penetration must not exceed the amount established by JIS A 1517 for

each window type.

1.7.4 Thermal Performance

Windows shall meet specified Solar Heat Gain Coefficient (SHGC) and Visual Transmittance (VT) or greater.

[1.7.4.1 Southern Climate

Windows installed in Climate Zone [1] [2] will have a U-Factor of [1.3] [1.25] [_____] $\text{W/m}^2\cdot^{\circ}\text{C}$ or less and a SHGC of [0.25] [_____] or less.

] [1.7.4.2 South-Central Climate

Windows installed within Climate Zone 3 will have a U-Factor of [0.85] [1.25] [_____] $\text{W/m}^2\cdot^{\circ}\text{C}$ or less and a SHGC of [0.25] [_____] or less.

] [1.7.4.3 North-Central Climate

Windows installed within Climate Zone 4 will have a U-Factor of [0.85] [1.25] [_____] $\text{W/m}^2\cdot^{\circ}\text{C}$ or less and a SHGC of [0.36] [_____] or less.

] [1.7.4.4 Northern Climate

Windows installed within Climate Zone [5] [6] [7] will have a U-Factor of [0.65] [1.25] [_____] $\text{W/m}^2\cdot^{\circ}\text{C}$ or less and a SHGC of [0.36] [0.41] [_____] or less.

] [1.7.4.5 Subarctic Climate

Windows installed within Climate Zone 8 will have a U-Factor of [0.45] [1.25] [_____] $\text{W/m}^2\cdot^{\circ}\text{C}$ or less. There is no SHGC limit for this climate zone.

] [1.7.5 Life Safety Criteria

Provide windows that conform to NFPA 101 Life Safety Code when rescue and/or second means of escape are indicated.

] [1.7.6 Sound Attenuation

Provide window with sound attenuation with the window glazed with 13 mm air space between two pieces of 6 mm. Provide documentation to support transmission loss properties.

] [1.7.7 Windborne-Debris-Impact Performance

Exterior window system including glazing must comply with indicated basis or enhanced protection testing requirements in ASTM E1996 for [Wind Zone 1] [Wind Zone 2] [Wind Zone 3] [Wind Zone 4] when tested according to ASTM E1886. Test specimens must be no smaller in width and length than glazing indicated for use on Project and must be installed in same manner as glazing indicated for use on Project.

- a. Refer to drawings for classification of window requiring basic or enhanced protection.

- [b. Large-Missile Test: For glazing located within 9.1 m of grade.
-] [c. Small-Missile Test: For glazing located more than 9.1 m above grade.
-] 1.8 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 MLIT SS Chapter 16, JIS A 4706 and the requirements specified herein. In addition to compliance with JIS A 4706, window framing members for each individual light of glass must not deflect to the extent that deflection perpendicular to the glass light 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 [_____] when tested in accordance with JIS A 1514. Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, carbon steel complying with JIS B 1051, or other corrosion-resistant material compatible with adjacent materials; designed to smoothly operate, tightly close, and securely lock windows, and sized to accommodate sash weight and dimensions.

2.1.1 Awning Windows (AP)

Type AP-[R15] [LC25] [CW30] [AW40] [[R] [LC] [CW] [AW]- [_____] (Optional Performance Grade)]. Conceal operating mechanism within the frame members or enclose within a metal casing not less than 1.59 mm thick sheet aluminum.

2.1.2 Horizontal Sliding Windows (HS)

Type HS-[R15] [LC25] [CW30] [AW40] [[R] [LC] [CW] [AW]- [_____] (Optional Performance Grade)].

2.1.3 Fixed Windows (F)

Type F-[R15] [LC25] [CW30] [AW40] [[R] [LC] [CW] [AW]- [_____] (Optional Performance Grade)].

2.1.4 Forced Entry Resistant Windows

In addition to meeting the requirements of JIS A 4706, windows designated for resistance to forced entry must conform to the requirements per UFC 4-020-01 as applicable.

2.1.5 Glass and Glazing

Materials are specified in Section 08 81 00 GLAZING.

2.1.6 Caulking and Sealing

Are specified in Section 07 92 00 JOINT SEALANTS.

2.1.7 Weatherstripping

JIS A 4706. Provide for all ventilating (operable) sash for all windows. Provide woven wool pile weatherstripping 5.3 millimeter thick, or polypropylene multifilament fiber weatherstripping installed in an integral weatherstripping groove in the sash or frame, and flexible polyvinylchloride weatherstripping installed in the sill member.

2.1.8 Sash Poles

Seamless aluminum tube, 1.59 mm minimum wall thickness, 25 mm diameter, [_____] m long, with cast aluminum hook and protective cover or tip on the lower end. Finish must match windows.

2.2 FABRICATION

Fabrication of window units must comply with JIS A 4706.

2.2.1 Fasteners

Use window manufacturer's standard for windows, trim, and accessories. Self-tapping sheet-metal screws are not acceptable for material more than 2 mm thick.

2.2.2 Adhesives

Provide joint sealants as specified in Section 07 92 00 JOINT SEALANTS. For interior application of joint sealants, comply with applicable regulations regarding reduced VOC's, and as specified in Section 07 92 00 JOINT SEALANTS.

2.2.3 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.

2.2.4 Combination Windows

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

2.2.5 Mullions and Transom Bars

[Provide mullions between multiple window units to resist two times (2X) glazing resistance in accordance with impact force: [_____] kpa].]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.[Where window cleaner anchors are required, reinforce mullions and anchor to adjoining construction so as to provide safe and adequate support.] Provide mullion

covers on the interior and exterior to completely close exposed joints and recesses between window units and to present a neat appearance.[Provide special covers over structural support at mullions as indicated.]

2.2.6 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.]

2.2.6.1 Hardware

The item, type, and functional characteristics must be the manufacturer's standard for the particular window type. Provide [stainless steel]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.

2.2.6.2 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 150 mm from each end and at midpoint.

2.2.6.3 Window-Cleaner Anchors

Provide double head anchors for windows[indicated][specified]. Anchors must be stainless steel of size and design required for the window type and application, conforming to JIS B 1220. Provide two anchors for each single window[and each adjacent fixed glass window unit]. Fasten anchors 1120 mm above the window sill utilizing appropriate methods for the window type and application in accordance with industry safety standards.

2.2.6.4 Window Anchors

Anchoring devices for installing windows must be made of aluminum or stainless steel, or zinc-plated steel conforming to JIS B 1220.

2.2.7 Finishes

Comply with JIS H 8601 for applying and designating finishes. Exposed aluminum surfaces must be factory finished with an[anodic coating][or][organic coating].[Color must be [____][as indicated].] All windows[for each building] must have the same finish.

2.2.7.1 Anodic Coating

Clean exposed aluminum surfaces and provide an anodized finish conforming to JIS H 8601. Finish shall be selected from JIS standard.

2.2.7.2 Organic Coating

Clean and prime exposed aluminum surfaces. Provide a[baked enamel finish in accordance with JIS K 5906 with total dry film thickness not less than 0.02 mm]

2.2.8 Screens

Provide one insect screen for each operable exterior sash or ventilator. Design screens to be rewirable, easily removable from inside the building, and to permit easy access to operating hardware. Manufacturers standard aluminum frame complying with JIS A 4709. Fabricate frames with mitered or coped joints or corner extrusion, concealed fasteners and removable PVC spline/anchors concealing edge of frame.

2.2.8.1 Insect Screen

Insect screen mesh to be[glass-fiber mesh, 18x16 of PVC-coated glass-fiber threads; woven and fused to form a fabric mesh in accordance with] [aluminum wire fabric, 18x16 mesh of 0.2794 mm diameter coated aluminum wire].

2.3 SPECIAL OPERATORS

For windows having operating hardware or locking or latching devices located more than 1800 mm above the floor, provide suitably designed operators or locking or latching devices necessary for convenient and proper window operation.

2.3.1 Pole Operators

Poles must be of proper length to permit window operation from 1500 mm above the floor. Provide one pole operator for each room, and one pole hanger for each pole. Locate hangers where directed.

2.3.2 Extension Crank Operators

Provide removable handles for crank-operated rotary-type operators located more than 1800 mm above the floor. Provide one removable handle for each room.

2.3.3 Mechanical Operators

Provide [manual] [electric motor driven] operators for group operation of continuous rows of windows [located [_____] mm above the floor]. Operators must be capable of opening and closing windows without appreciable deflection, vibration or rattle. Provide means of adjustment for transmission lines. Provide operators to control window units in groups [as recommended by the window manufacturer] [or] [as indicated].

2.4 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 must 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 must be factory-glazed with the type of glass indicated and of the quality specified in Section 08 81 00 GLAZING.

2.5 MULLIONS

Provide mullions between multiple-window units where indicated.

Provide profiles for mullions and mullion covers, 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 fabricated of the materials specified and meet the specified design loading.

2.6 WINDOW CLEANERS' BOLTS

Provide window cleaners' bolts for all windows 2100 millimeter or higher above finished grade, except for windows that can be removed and cleaned from the ground or from a lower roof level without the use of an extension ladder. Provide two bolts for each single window unit and each fixed glass unit. Locate bolts 1120 millimeter above the window sill.

Window cleaners' bolts must be double-head type, corrosion-resistant steel, size and design per manufacturer. Contact side of the bolts must be ground to fit flat against window jambs. Bolts must be factory- or field-attached before windows are set. Reinforce backs of frames to receive bolts with 6 by 150 millimeter corrosion-resistant steel or aluminum plates bolted or welded to the frames at the factory. Special wall anchors must be provided on frames at the point of bolt attachment.

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.

Any materials that show visual evidence of biological growth due to the presence of moisture must not be installed on the building project.

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. Do not coat surfaces in contact with sealants after installation with any type of protective material. Do not apply coatings or lacquers to surfaces to which caulking and glazing components must adhere.

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 11 mm.

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. Verify that products are properly installed, connected, and adjusted.

3.2 CLEANING

Clean interior and exterior surfaces of window units of mortar, plaster, 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 --