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USACE / NAVFAC / AFCEA UFGS-08520N (February 2004)  
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Preparing Activity: NAVFAC Superseding  
UFGS-08520N (August 2001)

## UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMLR dated 22 December 2004

Latest change indicated by CHG tags

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### SECTION TABLE OF CONTENTS

#### DIVISION 08 - DOORS AND WINDOWS

##### SECTION 08520N

##### ALUMINUM WINDOWS

02/04

#### PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 CERTIFICATION
- 1.3 SUBMITTALS
- 1.4 QUALITY ASSURANCE
  - 1.4.1 Shop Drawing Requirements
  - 1.4.2 Sample Requirements
    - 1.4.2.1 Finish Sample Requirements
    - 1.4.2.2 Window Sample Requirements
  - 1.4.3 Design Data Requirements
  - 1.4.4 Test Report Requirements
- 1.5 DELIVERY AND STORAGE
- 1.6 PROTECTION

#### PART 2 PRODUCTS

- 2.1 WINDOWS
  - 2.1.1 Awning Windows (AP)
  - 2.1.2 Casement Windows (C)
  - 2.1.3 Double Hung Windows (DH)
  - 2.1.4 Horizontal Sliding Windows (HS)
  - 2.1.5 Projected Windows (AP)
  - 2.1.6 Top-Hinged Windows (TH)
  - 2.1.7 Vertically Pivoted Windows (VP)
  - 2.1.8 Fixed Windows (F)
  - 2.1.9 Forced Entry Resistant Windows
  - 2.1.10 Glass and Glazing
  - 2.1.11 Calking and Sealing
  - 2.1.12 Weatherstripping
  - 2.1.13 Sash Poles
- 2.2 FABRICATION
  - 2.2.1 Provisions for Glazing
  - 2.2.2 Weatherstripping

- 2.2.3 Fasteners
- 2.2.4 Drips and Weep Holes
- 2.2.5 Combination Windows
- 2.2.6 Mullions and Transom Bars
- 2.2.7 Accessories
  - 2.2.7.1 Hardware
  - 2.2.7.2 Fasteners
  - 2.2.7.3 Window-Cleaner Anchors
- 2.2.8 Finishes
  - 2.2.8.1 Anodic Coating
  - 2.2.8.2 Organic Coating
- 2.2.9 Screens
- 2.3 SPECIAL OPERATORS
  - 2.3.1 Pole Operators
  - 2.3.2 Extension Crank Operators
  - 2.3.3 Mechanical Operators

## PART 3 EXECUTION

- 3.1 INSTALLATION
  - 3.1.1 Method of Installation
  - 3.1.2 Dissimilar Materials
  - 3.1.3 Anchors and Fastenings
  - 3.1.4 Adjustments After Installation
- 3.2 CLEANING
- 3.3 SCHEDULE

-- End of Section Table of Contents --

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### SECTION 08520N

#### ALUMINUM WINDOWS 02/04

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NOTE: This guide specification covers the requirements for residential, commercial and heavy commercial grade aluminum windows.

Comments and suggestions on this guide specification are welcome and should be directed to the technical proponent of the specification. A listing of technical proponents, including their organization designation and telephone number, is on the Internet.

Recommended changes to a UFGS should be submitted as a Criteria Change Request (CCR).

Use of electronic communication is encouraged.

Brackets are used in the text to indicate designer choices or locations where text must be supplied by the designer.

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1. Windows requiring UL fire rating must be steel, and may occur in conjunction with aluminum windows which cannot be approved for this use. When steel windows are used in conjunction with aluminum, specify finish matching aluminum windows. Steel windows should be specified in Section 08510 STEEL WINDOWS.

2. Aluminum windows are not acceptable for use as security windows which should be steel, specified in Section 08510 STEEL WINDOWS. Security steel windows are designed and constructed to give protection against unauthorized entrance and removal of materials from warehouses and other storage type areas; they are not designed for detention use. Guard windows for detention use are not included in this guide; where such windows are desired, consult

Steel Window Institute Recommended Specifications  
and manufacturers' data, and specify in Section  
08510 STEEL WINDOWS.

3. Specify the following items of related work  
under other sections of the specifications:

- a. Glass and glazing and the furnishing of glazing  
clips and gaskets.
- b. Calking and sealants.
- c. Structural building supports at window mullions.
- d. Wood subframes for windows in frame walls.
- e. Drilling and tapping for attachment of window  
shades, drapery rods, and venetian blinds. The  
drilling and tapping of window frames to receive  
brackets for shades, venetian blinds, and curtain  
rods has been omitted from this specification. It  
is contemplated that this work will be done after  
erection of windows by the trade for the item to be  
installed. On projects where factory drilling for  
these items is required, revise this specification  
accordingly.
- f. Brackets and supports for window shades, drapery  
rods, and venetian blinds.
- g. Electrical requirements for motor driven  
operators.

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NOTE: On the drawings, show:

- 1. Sizes and types of windows; metal and wood  
subframes, casings, or stools; and hardware.
- 2. Sizes, location, and swing of ventilators;  
direction of slide for sliding ventilators; location  
and details of fixed sash.
- 3. Typical window sections and details. Show glass  
thickness. Show special glazing.
- 4. Method of anchoring windows to adjoining  
construction; size and types of clips, anchors,  
screws, or other fasteners.
- 5. Details of nonstructural mullions and mullion  
covers; details of anchoring and reinforcing  
nonstructural mullions at windows to receive window  
cleaner anchors.
- 6. Number and locations of window cleaner anchors.
- 7. Locations of windows requiring special

operators. Show method of operation and concealment of operators, cables and rods. Show wiring diagram for motor driven operators.

8. Locations of windows designated as forced entry resistant.

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## PART 1 GENERAL

### 1.1 REFERENCES

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NOTE: Issue (date) of references included in project specifications need not be more current than provided by the latest guide specification. Use of SpecsIntact automated reference checking is recommended for projects based on older guide specifications.

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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 45 (2003) Designation System for Aluminum Finishes

#### AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

AAMA 101 (2002) Voluntary Specifications for Aluminum, Vinyl (PVC) and Wood Windows and Glass Doors

AAMA 1302 (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 2603 (2002) Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels

AAMA 2604 (2002) Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels

AAMA 2605 (2002) Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels

AAMA 611	(1998) Voluntary Specification for Anodized Architectural Aluminum; includes 604.2, 606.1, 607.1 and 608.1 (which are no longer available as separate documents)
AAMA 902	(1999) Voluntary Specification for Sash Balances

## 1.2 CERTIFICATION

Each prime window unit shall 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

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NOTE: Submittals must be limited to those necessary for adequate quality control. The importance of an item in the project should be one of the primary factors in determining if a submittal for the item should be required.

A "G" following a submittal item indicates that the submittal requires Government approval. Some submittals are already marked with a "G". Only delete an existing "G" if the submittal item is not complex and can be reviewed through the Contractor's Quality Control system. Only add a "G" if the submittal is sufficiently important or complex in context of the project.

For submittals requiring Government approval on Army projects, a code of up to three characters within the submittal tags may be used following the "G" designation to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy projects.

Submittal items not designated with a "G" are considered as being for information only for Army projects and for Contractor Quality Control approval for Navy projects.

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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.] The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Windows; G

SD-03 Product Data

Windows; G

Hardware; G

Fasteners; G

Screens; G

Weatherstripping; G

Accessories; G

SD-04 Samples

Finish Sample

Window Sample

SD-05 Design Data

Structural calculations for deflection; G

SD-06 Test Reports

Minimum condensation resistance factor

[ Resistance to forced entry]

SD-10 Operation and Maintenance Data

Windows, Data Package 1; G

Submit in accordance with Section 01781 OPERATION AND  
MAINTENANCE DATA.

1.4 QUALITY ASSURANCE

1.4.1 Shop Drawing Requirements

Drawings shall 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.

1.4.2 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

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NOTE: Choose one of the following options. Include the first choice for projects requiring a large number of windows. Include the second choice for projects requiring a limited number of windows.  
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[Submit one full-size window of each type proposed for use, complete with AAMA Label, glazing, hardware, anchors, and other accessories. Where screens or weatherstripping is required, fit sample windows with such items that are to be used. After approval, install each sample in work, clearly identified, and record its location.]

[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. Calculations shall be provided by a Professional Engineer.

#### 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. Damaged windows shall be repaired 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, except that no coatings or lacquers shall be applied to surfaces to which calking and glazing compounds must adhere.

### PART 2 PRODUCTS

#### 2.1 WINDOWS

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NOTE: Designation system consists of three part product nomenclature representing Product Type, Performance Class and Performance Grade (example DH-C30). Product Type is an abbreviation for window type (A for awning, C for casement, DH for double hung, etc.). Class represents the product's intended use (R for residential, LC for light



commercial, C for commercial, HC for heavy commercial, and AW for architectural). Performance Grade represents the design pressure to which the window is constructed.

AAMA 101 establishes minimum Performance Grade for each Class: 15 for residential (corresponding to a design pressure of 720 Pa 15 psf); 25 for light commercial (corresponding to a design pressure of 1200 Pa 25 psf); 30 for commercial (corresponding to a design pressure of 1440 Pa 30 psf); 40 for heavy commercial (corresponding to a design pressure of 1920 Pa 40 psf); and 40 for architectural (corresponding to a design pressure of 1920 Pa 40 psf).

AAMA 101 also includes criteria for specifying windows required to meet higher design pressures if minimum pressure is inadequate. These windows are designated as Optional Performance Grade and should be specified in increments of 240 Pa 5 psf above the minimum Performance Grade.

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NOTE: Consult AAMA 1503 "Voluntary Test Method for Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections" and select the minimum Condensation Resistance Factor (CRF) required for the particular project conditions.

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NOTE: Consult AAMA 101 to calculate design pressure(s) applicable to the project. Adjust "design factors" because naval facilities are typically less than 100 miles from hurricane oceanline.

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Prime windows shall 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 shall 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. Structural calculations for deflection shall be provided 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 shall 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 AAMA 1503.

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NOTE: Include the bracketed paragraph below when personnel density is greater than one person per 40 square meters 430 square feet and minimum AATFP

standoff distances are met. This does not include guard type facilities, single and duplex detached family housing. These requirements are specified in "Department of Defense Antiterrorism Standards for Buildings".

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[Exterior frames, mullions, and window hardware shall be designed to resist equivalent static design loads of 7 kilopascals 1 pound per square inch applied to the surface of the glazing. Frame and mullion deformations shall not exceed 1/60 of the unsupported member lengths. A window that complies with the AAMA 101 Optional Performance Grade 60 is acceptable in lieu of tests or calculations showing compliance with load requirement specified above. The Contractor may use other products, but must demonstrate by calculations or tests that the window complies with the loading requirement. Equivalent static design loads for connections of window to the surrounding walls or hardware and associated connections, and glazing stop connections shall be 75 kilopascals 10.8 pounds per square inch for glazing panels with a vision area less than or equal to 1.0 square meter 10.8 square feet and 30 kilopascals 4.4 pounds per square inch for glazing panels with a vision area greater than 1.0 square meter 10.8 square feet but less than or equal to 3.0 square meters 32 square feet. Alternatively, use frames that provide an equivalent level of performance.]

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NOTE: Performance Grades represent design pressure values for which products have been tested. Specify an Optional Performance Grade where a higher than minimum Performance Grade is desired due to severe weather conditions and wind loadings. Optional Performance Grade windows shall be tested in compliance with AAMA 101. Testing shall substantiate requirements for uniform loading (structural), water resistance, and air infiltration.

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NOTE: Use frame designation C, HC or AW with a minimum Optional Performance Grade 60 for windows that are required to meet minimum measures in Department of Defense Antiterrorism Standards for Buildings.

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#### 2.1.1 Awning Windows (AP)

Type AP- [R15] [C30] [HC40] [[C] [HC] [AW] - 60 (Optional Performance Grade)]. Conceal operating mechanism within the frame members or enclose within a metal casing not less than 1.59 mm 0.0625 inch thick sheet aluminum.

#### 2.1.2 Casement Windows (C)

Type C- [R15] [C30] [HC40] [[C] [HC] [AW] - 60 (Optional Performance Grade)]. Ventilators shall be [rotary crank] [handle] operated. Provide ventilators over 1650 millimeters 66 inches high with two separate locking devices or a two-point locking device operated by rods from a single lever handle. Conceal rods where possible. [Provide casement windows in combination with [fixed] [projected] windows specified below.]

### 2.1.1.3 Double Hung Windows (DH)

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NOTE: Tilt-in windows most likely will not meet ATFP  
pressure requirements and should not be specified if  
force protection is required.  
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Type DH-[R15] [C30] [HC40] [[C] [HC] [AW] - 60 (Optional Performance Grade)].  
Sash balances shall be tested and rated to conform with AAMA 902.

### 2.1.1.4 Horizontal Sliding Windows (HS)

Type HS-[R15] [C30] [HC40] [[C] [HC] [AW] - 60 (Optional Performance Grade)].

### 2.1.1.5 Projected Windows (AP)

Type AP-[R15] [C30] [HC40] [[C] [HC] [AW] - 60 (Optional Performance Grade)].  
Provide projected windows with concealed four bar friction hinges only.

### 2.1.1.6 Top-Hinged Windows (TH)

Type TH-[C30] [HC40] [[C] [HC] [AW] - 60 (Optional Performance Grade)].  
Top-hinged windows shall be [inswinging] [outswinging].

### 2.1.1.7 Vertically Pivoted Windows (VP)

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NOTE: Pivoting windows most likely will not meet  
ATFP pressure requirements and should not be  
specified if force protection is required.  
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Type VP-[R15] [C30] [HC40] [[\_\_\_\_\_] (Optional Performance Grade)]. [Provide  
window with remotely operated venetian blind mounted between an access sash  
and the main sash.]

### 2.1.1.8 Fixed Windows (F)

Type F-[R15] [C30] [HC40] [[C] [HC] [AW] - 60 (Optional Performance Grade)].

### 2.1.1.9 Forced Entry Resistant Windows

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NOTE: Conventional aluminum windows offer nominal  
resistance to forced entry by unskilled or  
opportunistic intruders. While there is no way to  
make a window absolutely "burglar proof," windows  
complying with AAMA 1302 can provide reasonable  
assurance that entry, or attempted entry, will leave  
ample evidence of "forced entry." It establishes  
only a pass/fail condition when specific  
concentrated loads are applied to sash or ventilator  
in attempt to open or remove sash or ventilator from  
window frame and specifies no measured time delay.  
It provides moderate degree of security against  
unskilled or opportunistic intruder at little or no  
additional cost. When forced entry resistant  
windows are specified, coordinate glazing

requirements and specify impact resistant glass and glazing materials in Section 08800, "Glazing."

For projects requiring security windows, specify steel security windows in Section 08510, "Steel Windows." Protection in high crime areas against skilled professional intruders requires a more sophisticated approach to physical security. Consult Design Manual 13.1 "Physical Security" for recommendations.

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In addition to meeting the requirements of AAMA 101, windows designated for resistance to forced entry shall conform to the requirements of AAMA 1302.

#### 2.1.10 Glass and Glazing

Materials are specified in Section 08800 GLAZING.

#### 2.1.11 Calking and Sealing

Are specified in Section 07920 JOINT SEALANTS.

#### 2.1.12 Weatherstripping

AAMA 101.

#### 2.1.13 Sash Poles

Seamless aluminum tube, 1.59 mm 0.0625 inch minimum wall thickness, 25 mm one inch diameter, [\_\_\_\_\_] m feet long, with cast aluminum hook and protective cover or tip on the lower end. Finish shall match windows.

### 2.2 FABRICATION

Fabrication of window units shall comply with AAMA 101.

#### 2.2.1 Provisions for Glazing

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NOTE: Specify glass thickness and vinyl gaskets in Section 08800, "Glazing." Inside glazing is preferred, especially for windows above first floor and other locations where access is difficult. Windows designed for inside glazing may not be available in double-hung type; check manufacturers' literature. Where project requires insulating glass, show sash members, glazing beads, and hardware of sufficient size and weight to receive and support glass of thickness specified. Allow 3 mm 1/8 inch minimum between each side of insulating glass and metal frame and between edges of glass and frame for glazing compound and expansion. Drawings should clearly indicate method for securing insulating glass in place.

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NOTE: Include the bracket option for minimum

glazing frame bite requirements when personnel density is greater than one person per 40 square meters 430 square feet and minimum ATFP standoff distances are met. This does not include guard type facilities, single and duplex detached family housing. These requirements are specified in Department of Defense Antiterrorism Standards for Buildings.

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Design windows and rabbets suitable for glass thickness shown [or specified]. [Exterior glazing shall have a minimum frame bite of 9.5 mm 3/8 inch for structurally glazed window systems and 25 mm 1 inch for window systems that are not structurally glazed. ]Design sash for [inside] [outside] [single] [double] glazing and for securing glass with [metal beads,] [glazing clips,] [glazing channels,] 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) 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 2 mm 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 shall 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 shall be the same class and grade and shall 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

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NOTE: Specify the design pressure used to specify the Performance Grade or the Optional Performance Grade for the adjoining windows.

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NOTE: Include the bracketed paragraph included under the "WINDOWS" heading for static loads when minimum measures of antiterrorism/force protection (ATFP) are required and delete the first bracketed sentence in the following paragraph.

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[Provide mullions between multiple window units which meet the design pressure of [720] [1440] [1920] [\_\_\_\_\_] Pa [15] [30] [40] [\_\_\_\_\_] psf.] Provide mullions with a structural 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.]

#### 2.2.7 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 shall 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 shall be compatible with the window and the adjoining construction. Provide a minimum of three anchors for each jamb located approximately 150 mm 6 inches from each end and at midpoint.

##### 2.2.7.3 Window-Cleaner Anchors

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NOTE: Window-cleaner anchors should be shown and specified for windows having sills more than [1800 mm] [6 feet] above grade, adjoining balconies, or adjoining roofs, unless window cleaning methods at activity make use of anchors unnecessary. Coordinate window cleaning procedures and requirements with using activity. When requested by using activity, removable or tilting-type sash may be provided instead of anchors. Removable or tilting-type sash may be specified as Contractor option when these units are desired by using activity and are economically competitive with double-hung sash equipped with anchors. When appropriate, add the following at end of paragraph

entitled "Window-Cleaner Anchors":

"Removable or tilting-type sash may be provided in lieu of double-hung windows equipped with window cleaner anchors. Sash shall be designed so that both sides of glass can be readily cleaned from interior without dismantling any part of window or screens. Provide removable and tilting-type sash with tamper-proof hardware to prevent sash removal by unauthorized personnel."

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Provide double head anchors for windows [indicated] [specified]. Anchors shall be stainless steel of size and design required for the window type and application. Provide two anchors for each single window [and each adjacent fixed glass window unit]. Fasten anchors 1120 mm 44 inches above the window sill utilizing appropriate methods for the window type and application in accordance with industry safety standards.

#### 2.2.8 Finishes

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NOTE: Specify anodic and organic coatings as Contractor's option when these finishes are determined to be economically competitive in the project area, unless the project requires use of one or the other to match an existing condition.

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Exposed aluminum surfaces shall be factory finished with an [anodic coating] [or] [organic coating]. [Color shall be [\_\_\_\_\_] [as indicated].] All windows [for each building] shall have the same finish.

##### 2.2.8.1 Anodic Coating

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NOTE: Specify Architectural Class I for highly corrosive industrial atmospheres where dust, gases, salts, and other destructive elements that attack metal exist. Specify Architectural Class II for all atmospheric conditions not requiring Class I.

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

- [a. Architectural Class II (0.01 to 0.0175 mm 0.4 mil to 0.7 mil), designation AA-M10-C22-[A31, clear (natural)] [A32, integral color] [A34, electrolytically deposited color] anodized.]
- [b. Architectural Class I (0.0175 mm 0.7 mil or thicker), designation AA-M10-C22-[A41, clear (natural)] [A42, integral color] [A44, electrolytically deposited color] anodized.]

##### 2.2.8.2 Organic Coating

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NOTE: When anodic and organic coatings are determined to be economically competitive in the

project area, specify baked enamel finish (AAMA 2603) as an option to Architectural Class II, anodic coating or high-performance finish (AAMA 2604 or AAMA 2605) as an option to Architectural Class I, anodic coating.

\*\*\*\*\*

Clean and prime exposed aluminum surfaces. Provide a [baked enamel finish in accordance with AAMA 2603 with total dry film thickness not less than 0.02 mm 0.8 mil] [high-performance finish in accordance with [AAMA 2604] [AAMA 2605] with total dry film thickness of not less than 0.03 mm 1.2 mils].

#### 2.2.9 Screens

AAMA 101. 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.

#### 2.3 SPECIAL OPERATORS

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**NOTE: Remote and group operated windows will require special operators. Identify these windows on the drawings and show method of operation.**

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For windows having operating hardware or locking or latching devices located more than 1800 mm 6 feet 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 shall be of proper length to permit window operation from 1500 mm 5 feet 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 6 feet above the floor. Provide one removable handle for each room.

##### 2.3.3 Mechanical Operators

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**NOTE: When motor driven operators are specified, specify electrical characteristics in Section 16402, "Interior Distribution System."**

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



## 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 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, the aluminum surface shall be protected from dissimilar materials as recommended in the Appendix to AAMA 101. Surfaces in contact with sealants after installation shall not be coated 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 shall have head and jamb members designed to recess into masonry wall not less than 11 mm 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.]

### 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.

### 3.3 SCHEDULE

Some metric measurements in this section are based on mathematical conversion of inch-pound measurements, and not on metric measurement commonly agreed to by the manufacturers or other parties. The inch-pound and metric measurements are as follows:

<u>PRODUCTS</u>	<u>INCH-POUND</u>	<u>METRIC</u>
Metal Casing	0.0625 inch	1.59 mm
Aluminum Tube	0.0625 inch	1.59 mm
(Diameter)	1 inch	25 mm

-- End of Section --