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USACE / NAVFAC / AFCESA / NASA	**UFGS-08 51 14.00 10 (April 2006)**
Preparing Activity: USACE	**Replacing without change UFGS-08520A (September 2004)**

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated 18 July 2006

Latest change indicated by CHG tags
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DIVISION 08 - OPENINGS

SECTION 08 51 14.00 10

ALUMINUM AND ENVIRONMENTAL CONTROL ALUMINUM WINDOWS

04/06

-- End of Section Table of Contents --

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SECTION 08 51 14.00 10

ALUMINUM AND ENVIRONMENTAL CONTROL ALUMINUM WINDOWS
04/06

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NOTE: This guide specification covers the requirements for aluminum windows, accessories, and screens; and for aluminum environmental control windows to be used for monumental type buildings or hospitals with year-round air-conditioning.

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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PART 1 GENERAL

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NOTE: Drawings will indicate location, dimensions, elevations, schedules, content, details, and such other information as required to indicate the extent of the work.

Product selections shall be based on esthetic values, appearance, and cost as related to project needs.

Remove environmental control requirements when only plain aluminum windows are used.
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1.1 REFERENCES

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NOTE: This paragraph is used to list the publications cited in the text of the guide specification. The publications are referred to in the text by basic designation only and listed in this paragraph by organization, designation, date, and title.

Use the Reference Wizard's Check Reference feature when you add a RID outside of the Section's Reference Article to automatically place the reference in the Reference Article. Also use the Reference Wizard's Check Reference feature to update the issue dates.

References not used in the text will automatically be deleted from this section of the project specification when you choose to reconcile references in the publish print process.

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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 DAF-45	(2003) Designation System for Aluminum Finishes

AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

AAMA 101	(2005) Voluntary Specifications for Aluminum, Vinyl (PVC) and Wood Windows and Glass Doors
AAMA 2603	(2002) Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels
AAMA 2604	(2005) Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels

ASTM INTERNATIONAL (ASTM)

ASTM A 276	(2005) Stainless Steel Bars and Shapes
ASTM D 3656	(2004) Insect Screening and Louver Cloth Woven from Vinyl-Coated Glass Yarns
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
ASTM E 331	(2000) Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference
ASTM E 413	(2004) Rating Sound Insulation
ASTM E 547	(2000) Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Cyclic Static Air Pressure Difference
ASTM E 90	(2004) Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements

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 FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 101	(2006) Life Safety Code

SCREEN MANUFACTURERS ASSOCIATION (SMA)

SMA 1004	(1987; R 1998) Aluminum Tubular Frame Screens for Windows

1.2 SUBMITTALS

****

NOTE: Review submittal description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list to reflect only the submittals required for the project. Submittals should be kept to the minimum required for adequate quality control.

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, Air Force, and NASA projects.

Choose the first bracketed item for Navy, Air Force and NASA projects, or choose the second bracketed item for Army 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.] [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 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Aluminum Windows
Insect Screens

Drawings indicating elevations of window, rough-opening dimensions for each type and size of window, full-size sections, thicknesses of metal, fastenings, methods of installation and anchorage, connections with other work, type of wall construction, size and spacing of anchors, method of glazing, types and locations of operating hardware, mullion details, weatherstripping details, [screen details including method of attachment,] [window cleaner anchor details], and window schedules showing locations of each window type.

SD-03 Product Data

Aluminum Windows

Manufacturer's descriptive data and catalog cut sheets. Manufacturer's preprinted installation instructions and cleaning instructions.

SD-04 Samples

Aluminum Windows

Submit [three][_____] color samples of the specified finishes.

SD-06 Test Reports

Aluminum Windows

Reports for each type of aluminum window attesting that

identical windows have been tested and meet all performance requirements established under paragraph WINDOW PERFORMANCE.

SD-07 Certificates

Aluminum Windows

Certificates stating that the aluminum windows are AAMA certified conforming to requirements of this section. Labels or markings permanently affixed to the window will be accepted in lieu of certificates. Product ratings determined using NFRC 100 and NFRC 200 shall be authorized for certification and properly labeled by the manufacturer.

1.3 WINDOW PERFORMANCE

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NOTE: Structural performance, air infiltration and water penetration are standard performance requirements for all aluminum window types. "Thermal Performance" and "Sound Attenuation" are optional to designer, and should be omitted or revised as needed to meet project requirements.
****

Aluminum windows shall meet the following performance requirements. Testing requirements shall be performed by an independent testing laboratory or agency.

1.3.1 Structural Performance

Structural test pressures on window units shall be for positive load (inward) and negative load (outward) in accordance with ASTM E 330. After testing, there shall 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 shall 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.

1.3.2 Air Infiltration

Air infiltration shall not exceed the amount established by AAMA 101 for each window type when tested in accordance with ASTM E 283.

1.3.3 Water Penetration

Water penetration shall not exceed the amount established by AAMA 101 for each window type when tested in accordance with [ASTM E 547] [ASTM E 331].

1.3.4 Thermal Performance

****
NOTE: A U-factor of up to 4.3 W/m^{2}K (0.75 Btu/hr-ft^2-F) may be acceptable for particular climate zones in the United States for aluminum window products and thermally improved aluminum window products. Solar heat gain coefficient (SHGC) ratings should be equal to or less than 2.3 W/m^{2}K (0.40 Btu/hr-ft^2-F).

Selection and use of the window products in this category should be used only in cooling dominated climates and be dependent upon qualifying for the Southern climate zone as determined by the DOE Energy Star Windows program. Certain products that have aluminum frames and/or thermally improved aluminum frames may qualify per the Energy Star Windows program for the Central and Northern Climate Zones.

****

Thermal transmittance for thermally broken aluminum windows with insulating glass shall not exceed a U-factor of [4.3 W/m^2K (0.75 Btu/hr-ft^2-F) 0.75 Btu/hr-ft^2-F determined according to NFRC 100, and a solar heat gain coefficient (SHGC) of 2.3 W/m^2K (0.40 Btu/hr-ft^2-F) 0.40 Btu/hr-ft^2-F determined according to NFRC 200. Window units shall comply with the U.S. Department of Energy, Energy Star Window Program for the Southern Climate Zone.].[2.3 W/m^2K (0.40 Btu/hr-ft^2-F) 0.40 Btu/hr-ft^2-F determined according to NFRC 100, and a solar heat gain coefficient (SHGC) of 3.1 W/m^2 K (0.55 Bth/hr-ft^2-F 0.55 Btu/hr-ft^2-F determined according to NFRC 200. Window units shall comply with the U.S. Department of Energy, Energy Star Window Program for the Central Climate Zone.].[2.0 W/m^2K (0.35 Btu/hr-ft^2-F) 0.35 Btu/hr-ft^2-F determined according to NFRC 100. Window units shall comply with the U.S. Department of Energy, Energy Star Window Program for the Northern Climate Zone.]

1.3.5 Condensation Index Rating

****

NOTE: Determination of the resistance of the window unit to the formation of condensation in any form, referred to as the Condensation Index, shall be accomplished using the NFRC-approved software tool, THERM. The following criteria shall be used to evaluate and determine compliance with the condensation specifications:

a. Interior environmental temperature of 21.1 C (±0.25 C) (70.0 F (± 0.5 F)).

b. Exterior environmental temperature of -17.8C (±0.25 C) (0.0 F (±0.5F)).

c. A 35% RH providing a dew point temperature of approximately 5.0 C (41 F).

Others for consideration:

a. 30% RH = dew point of 2.8 C (37 F).

b. 40% RH = dew point of 7.2 C (45 F).

The Condensation Index shall be determined as follows:

a. calculate the average interior ambient surface temperature for each individual thermocouple

location.

b. Calculate the wetted area assigned to each individual surface thermocouple sensor as described (proposed from NFRC Test Procedure).

c. Calculate the percent area for each individual surface thermocouple based on the total calculated wetted surface area of all 20 pre-determined thermocouple locations.

d. Identify the thermocouple temperatures that are less than the dew point temperature of the standard dew point temperature of 5.0 C (41 F) (if that is the dew point temperature assigned as the standard).

e. Calculate the percentage of area that has surface temperatures less than the dew point temperature and subtract that from the total percentage of area (100%).

f. That number would reflect the amount of interior window area that would exhibit condensation at the prescribed conditions. This number would be the Condensation Index (CI).

For products that cannot be simulated, the following procedures shall be used to determine the Condensation Index:

Use the current wiring diagrams and temperature measurement locations as specified in the NFRC Test Procedure. These are pre-specified locations for temperature measurement on the interior surfaces of the glass and frame members. The surface temperatures shall be area-weighted in the same manner as for U-factor calculation purposes. The window product should not have a Condensation Index less than 85, meaning that 14% or less of the product will exhibit condensation on the interior area-wetted exposed surfaces. Of the 14% area permitted to exhibit condensation, no greater than 5% of the interior surfaces of the frame members shall have condensation in any form. The window product Condensation Index must meet the criteria prescribed in the following table:

Minimum Recommended Condensation Index Ratings

Relative Humidity	20%	25%	30%	35%	40%	45%	50%
Dew Point @ 21.1 C (70.0 F)	-3.3C (26F)	0.6C (33F)	2.8C (37F)	5.0C (41F)	7.2C (45F)	9.4C (49F)	10.0C (50F)
Outside Design Temperature							

-34 C (-30 F)	85	85	85	85	90	95	95
-29 C (-20 F)	85	85	85	85	90	95	95
-23 C (-10 F)	85	85	85	85	85	90	95
-18 C (0 F)	85	85	85	85	85	90	95
-12 C (+10 F)	85	85	85	85	85	90	95
-07 C (+20 F)	85	85	85	85	85	90	95
-01 C (+30 F)	85	85	85	85	85	85	90

Note: The table is based on 21.1 C (70.0 F) and an exterior (outside) wind velocity of 24 km/h (15 mph). The Condensation Index value in the table indicates the percentage of area-weighted surface area that must have a temperature greater than the Dew Point Temperature indicated for the percent Relative Humidity.

Example

A thermal performance evaluation on a window unit indicates that 12% of the determined exposed interior surface area has a temperature less than the standard dew point temperature of 5.0 C (41 F). Take 100% of the interior determined exposed surface area and subtract 12% from it. This gives a CI number of 88. This window would have very good resistive qualities to the formation of condensation.

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The condensation index rating shall be [85] [_____] as determined using NFRC approved software THERM.

1.3.6 Life Safety Criteria

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NOTE: Designer must indicate on the drawings which windows serve as rescue and/or secondary means of escape.

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Windows shall conform to NFPA 101 Life Safety Code when rescue and/or second means of escape are indicated.

1.3.7 Sound Attenuation

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NOTE: Aluminum environmental control windows have a "built-in" sound attenuation. This paragraph will be used only when sound attenuation is a design parameter.

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The window unit shall have a minimum STC of [[41] [_____] with the window glazed with two pieces of 6 mm 1/4 inch thick laminated glass] [[34] [_____] with the window glazed with 13 mm 1/2 inch air space between two pieces of 6 mm 1/4 inch thick glass] when tested in accordance with ASTM E 90 and ASTM E 413.

1.4 QUALIFICATION

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

1.5 MOCK-UPS

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NOTE: Requesting mock-up samples of aluminum windows is not required for most projects. Size of project and scope of quality control should be carefully evaluated before requiring Contractor to provide a costly mock-up. Delete paragraph if mock-ups are not required.
****

Before fabrication, full-size mock-up of [each type of aluminum window] [one window unit] [_____] complete with glass and AAMA certification label for structural purposes and NFRC Temporary and Permanent Label for certification of thermal performance raitingwill be required for review of window construction and quality of hardware operation.

1.6 DELIVERY AND STORAGE

Aluminum windows shall be delivered to project site and stored in accordance with manufacturer's recommendations. Damaged windows shall be replaced with new windows.

1.7 WARRANTY

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

PART 2 PRODUCTS

2.1 ALUMINUM WINDOW TYPES

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NOTE: Window types and window materials will be selected on the basis of functional requirements and economical considerations. Functional requirements include the operation of the window, consideration of the weather environment, conditions of usage, and aesthetic factors. Economic considerations include initial costs as well as maintenance costs over the life of the facility.

1. The grade designations denote the product's intended application: R for residential, LC for light commercial, C for commercial, HC for heavy commercial, and AW for Architectural. A minimum performance class is set for each grade: 15 for (R) windows (corresponding to a design pressure of 720 Pa (15 psf), 25 for (LC) windows, 30 for (C) windows, and 40 for (HC) and (AW) windows. See Section 2.2 of AAMA 101 for performance requirements

for AW windows; see paragraph GLASS AND GLAZING for guidance on minimum recommended condensation resistance factors.

2. The designer can select a higher design pressure from among fifteen "Optional Performance Classes" shown in the following table. For example, if the minimum design pressure of 720 Pa (15 psf) is judged insufficient for a double-hung (H) residential window, the specifier may choose a window built to a design pressure of 1436 Pa (30 psf). The symbol would be H-R30 (instead of H-R15). The higher performance class, in addition to including a higher design pressure, also specifies correspondingly higher test criteria for uniform structural load and water resistance. Optional Performance Classes other than those specifically listed may be specified by setting any design pressure in increments of 250 Pa (5 psf). When an Optional Performance Class is specified, the following statement should be added: "Windows shall conform to Optional Performance Class [_____] when tested in accordance with AAMA 101."

OPTIONAL PERFORMANCE CLASSES METRIC

Optional Performance Class	Applicable Product Designation	*A Design Pressure Pa	*B Structural Test Pressure Pa	Water Resistance Test Pressure Pa	
				R,C,HC	AW
20	R	958	1436	144	
25	R	1197	1796	180	
30	R,LC	1436	2155	215	
35	R,LC,C	1676	2514	251	
40	R,LC,C	1915	2873	287	
45	R,LC,C,HC,AW	2155	3232	323	
50	R,LC,C,HC,AW	2394	3591	359	
55	R,LC,C,HC,AW	2633	3950	395	526.7
60	R,LC,C,HC,AW	2873	4309	430.9	574.6
65	R,LC,C,HC,AW	3112	4668	466.8	574.6
70	R,LC,C,HC,AW	3352	5027	502.7	574.6
75	R,LC,C,HC,AW	3591	5387	538.7	574.6
80	R,LC,C,HC,AW	3830	5746	576	576
85	R,LC,C,HC,AW	4070	6105	610	610
90	R,LC,C,HC,AW	4309	6464	646	646

*A. Design pressure = Performance Class

*B. Structural test pressures shown are for both positive and negative loads.

OPTIONAL PERFORMANCE CLASSES ENGLISH

Optional Performance Class	Applicable Product Designation	*A Design Pressure lb/ft sq.	*B Structural Test Pressure lb/ft sq.	Water Resistance Test Pressure lb/ft sq. R,C,HC	AW
20	R	20.0	30.0	3.00	
25	R	25.0	37.5	3.75	
30	R,LC	30.0	45.0	4.50	
35	R,LC,C	35.0	52.5	5.25	
40	R,LC,C	40.0	60.0	6.00	
45	R,LC,C,HC,AW	45.0	67.5	6.75	
50	R,LC,C,HC,AW	50.0	75.0	7.50	
55	R,LC,C,HC,AW	55.0	82.5	8.25	11.0
60	R,LC,C,HC,AW	60.0	90.0	9.00	12.0
65	R,LC,C,HC,AW	65.0	97.5	9.75	12.0
70	R,LC,C,HC,AW	70.0	105.0	10.50	12.0
75	R,LC,C,HC,AW	75.0	112.5	11.25	12.0
80	R,LC,C,HC,AW	80.0	120.0	12.00	12.0
85	R,LC,C,HC,AW	85.0	127.5	12.00	12.0
90	R,LC,C,HC,AW	90.0	135.0	12.00	12.0

*A. Design pressure = Performance Class

*B. Structural test pressures shown are for both positive and negative loads.

3. For projects which require security windows, refer to AR 190-51 "Security of Army Property at Unit and Installation Level" and Section 08 34 01 FORCED ENTRY RESISTANT COMPONENTS.

4. For projects which require fire-rated windows to meet UL and NFPA requirements, specify a steel type unit as specified in Section 08 51 23 STEEL WINDOWS; aluminum windows are not approved for this purpose.

5. For basements, projected windows shall be the inward swinging (project-in) type.

6. The hardware specified is typical for each window type. Refer to manufacturer's catalog for optional hardware selections.

7. Double glazed windows with a specified Condensation Resistance Factor (CRF) may be specified for occupied buildings such as barracks, medical facilities, administration buildings, etc. The CRF is a rating number, obtained under test conditions, that predicts the point at which condensation will occur on either the glass or frame. Where outside temperature and inside humidity indicate that condensation may be a problem, the appropriate CRF should be inserted in

the space provided.

8. For Environmental Control windows, the designer can select a higher design pressure and water resistance pressure from among the "Optional Performance Grades" table shown in Section 4 of AAMA 101.

****

Aluminum windows shall consist of complete units including sash, glass, frame, weatherstripping, [_____], and hardware. Windows shall conform to AAMA 101. Windows shall be [single-glazed] [double-glazed] [thermal break type double-glazed. Thermal barrier shall be neoprene, rigid vinyl, or polyurethane and shall be resistant to weather. Window members shall be heli-arc welded or angle-reinforced and mechanically joined and sealed. Exposed welded joints shall be dressed and finished. Joints shall be permanent and weathertight. Frames shall be constructed to provide a minimum 6 mm 1/4 inch thermal break between the exterior and interior frame surfaces. Sash corners shall be internally sealed to prevent air and water leaks. Inner sash shall be key-controlled to swing to the interior to allow maintenance and replacement of the glass. Not less than [_____] control keys shall be furnished]. Operable windows shall permit cleaning the outside glass from inside the building.

2.1.1 Awning/Hopper/Projected Windows

Aluminum awning (A),hopper and projected windows shall conform to AAMA 101 Designation [AP-R15] [AP-LC25] [AP-C30] [AP-HC40] [PA-AW40] [PA-AW50] [PA-AW60] [_____] type consisting of hinged ventilators arranged in a single or vertical series within a common frame. Ventilators shall be [operated by a device which shall securely close the ventilator at both jambs without the use of additional manually-controlled locking device] [equipped with [concealed four-bar friction hinges] [_____]]. Operating hardware, except ventilator arms and rotary operators, shall be concealed within frame and sill. Ventilator arms shall be concealed when windows are closed.

2.1.2 Casement Windows

Aluminum casement (C) windows shall conform to AAMA 101 Designation [C-R15] [LC-25] [C-C30] [C-HC40] [C-AW40] [C-AW50] [C-AW60] [____]type with ventilators which swing on side jamb. Hinges shall be [butt (close-up)] [_____] type. Operators shall be [roto-type][as required for hinge type]. [Keyed locking] [_____] devices shall be provided to secure ventilators tightly in the frame in the closed position.

2.1.3 Single-Hung and Double-Hung Windows

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NOTE: Double-hung or single-hung windows are typically used for living quarters and also for facilities with window air-conditioners.

****

Aluminum single-hung (H) and double-hung (H) windows shall conform to AAMA 101 [H-R15] [H-LC25] [H-C30] [H-HC40] [H-AW40] type which operate vertically with the weight of sash offset by a counterbalancing mechanism mounted in window to hold the sash stationary at any open position. Windows shall be provided with a tilt-in sash. Single-hung and double-hung

windows shall be provided with locking devices to secure the sash in the closed position. Counterbalancing mechanisms shall be easily replaced after installation.

2.1.4 Fixed Windows

Aluminum fixed (F) windows shall conform to AAMA 101 [F-R15] [F-LC25] [F-C30] [F-HC40] [F-AW40] type, non-operable glazed frame, complete with provisions for reglazing in the field.

2.1.5 Horizontal-Sliding Windows

Aluminum horizontal (HS) sliding windows shall conform to AAMA 101 [HS-R15] [HS-LC25] [HS-C30] [HS-HC40] [HS-AW40] type consisting of sliding sash and fixed lite. Sash guides shall be nylon wheels. Windows shall be provided with locking devices to secure the sash in the closed position.

2.1.6 Top-Hinged Windows

Aluminum top-hinged (TH) (in-swinging) windows shall conform to AAMA 101 [TH-C30] [TH-HC40] [TH-AW40] [TH-AW50] [TH-AW60] [_____] type consisting of a ventilator hinged to the main frame at the head to swing into the room. Hinges shall be [continuous applied type] [_____]. Holding devices shall be [hold-open arms attached to frame and ventilator] [removable stay-bar attached when ventilator is opened] to provide positive positioning of ventilator. Locking devices shall be [key-operated] [_____]type located at jambs and sill [to secure the sash in the closed position] [_____].

2.1.7 Vertically/Horizontally Pivoted Windows

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NOTE: Vertically/horizontally pivoted windows are typically used only for multistory buildings with year-round air-conditioning systems. This type of window should not be used for buildings where window washing can be accomplished more economically from outside.

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Aluminum vertically/horizontally pivoted (VP) windows shall conform to AAMA 101 [VP-R15] [VP-LC25] [VP-C30] [VP-HC40] [VP-AW40] [VP-AW50] [VP-AW60] [_____] type consisting of a ventilator pivoted head and sill at the center of main frame which can reverse or rotate a full 360 degrees around the vertical axis, and be opened and held at 180 degrees. Pivot assemblies shall be designed to allow for removal of ventilator and provide for smooth operation of ventilator. Pivot assembly and locks shall be stainless steel, manganese bronze, aluminum alloy or other material compatible with aluminum. Pivot pins shall be stainless steel. Windows shall be provided with devices to secure the sash in the closed position. Vertically pivoted sash shall be [key-controlled to rotate 360 degrees in either direction, automatically locking at each 180 degree intervals] [_____]. Locks shall be [key-operated] [_____] removable only when the lock is in the locked position.

2.2 WEATHERSTRIPPING

Weatherstripping for ventilating sections shall be of type designed to meet water penetration and air infiltration requirements specified in this section in accordance with AAMA 101, and shall be manufactured of material

compatible with aluminum and resistant to weather. Weatherstrips shall be factory-applied and easily replaced in the field. Neoprene or polyvinylchloride weatherstripping are not acceptable where exposed to direct sunlight.

2.3 INSECT SCREENS

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NOTE: Screens are typically not required for air-conditioned buildings or spaces. To prevent entry of flying insects, screens are typically used in medical facilities, food preparation areas, dining areas, sleeping areas, and similar locations when these facilities are not air-conditioned. Screen locations, sizes, and mounting types, such as outside or inside, should be indicated on drawings.
****

Insect screens shall be aluminum window manufacturer's standard design, and shall be provided where scheduled on drawings. Insect screens shall be fabricated of [roll-formed] [extruded] tubular-shaped [aluminum frames conforming to SMA 1004 and (18 x 16) [aluminum mesh screening] [vinyl coated glass screening conforming to ASTM D 3656]]. [[Roll-formed tubular shaped] [_____] stainless steel frames conforming to SMA 1004 and (18 x 14) bronze mesh screening.]

2.4 ACCESSORIES

2.4.1 Fasteners

Fastening devices shall be window manufacturer's standard design made from aluminum, [non-magnetic] [magnetic] stainless steel, cadmium-plated steel, nickel/chrome-plated steel in compliance with AAMA 101. Self-tapping sheet metal screws will not be acceptable for material thicker than 2 mm 1/16 inch.

2.4.2 Hardware

Hardware shall be as specified for each window type and shall be fabricated of aluminum, stainless steel, cadmium-plated steel, zinc-plated steel or nickel/chrome-plated steel in accordance with requirements established by AAMA 101.

2.4.3 Window Anchors

Anchoring devices for installing windows shall be made of aluminum, cadmium-plated steel, stainless steel, or zinc-plated steel conforming to AAMA 101.

2.4.4 Window Cleaner Anchors

****
NOTE: The designer should determine when window cleaning anchors are required. If outside face of glass is to be cleaned from the inside, delete this paragraph.
****

Window cleaner anchors shall be manufactured of stainless-steel conforming to ASTM A 276. Window frames shall be reinforced to receive window cleaner

anchors. Locations of window cleaner anchors shall be as shown.

2.5 GLASS AND GLAZING

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NOTE: Coordinate project window requirements with aluminum window manufacturer's "standard" glass for windows and Section 08 81 00 GLAZING. Inside glazing should be specified but may not be available for double-hung windows; verify with manufacturer's data. Double-glazing may be used in accordance with TI 800-01 Design Criteria. When double-glazing is used, specify "Thermal Performance" indicated in paragraph under "WINDOW PERFORMANCE".

****

Aluminum windows shall be designed for inside glazing, field glazing, and for glass types scheduled on drawings and specified in Section 08 81 00 GLAZING. Units shall be complete with glass and glazing provisions to meet AAMA 101. Glazing material shall be compatible with aluminum, and shall not require painting.

2.6 FINISH

****
NOTE: Anodic coatings and baked-acrylic resin-based coatings are typically used for economic reasons. High-performance fluoropolymer coatings may cost more than anodizing or resin-based coatings but is a very durable coating with excellent colorfastness. For a broader selection, refer to Aluminum Association AA DAF-45 publication "Designation System for Aluminum Finishes" which establishes a wide range of coatings and colors. Omit the non-applicable paragraphs below.
****

2.6.1 Anodized Aluminum Finish

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NOTE: The 0.010 mm (0.4 mil) thick anodized finish costs less than, but is more easily scratched and not as durable in appearance and performance as, the 0.02 mm (0.7 mil) thickness.
****

Exposed surfaces of aluminum windows shall be finished with anodic coating conforming to AA DAF-45: [Architectural Class II, AA-M10-C22-A31, clear anodic coating, 0.010 to 0.02 mm 0.4 to 0.7 mil thick, 204-R1 Natural Color] [Architectural Class I, AA-M10-C22-A41, clear anodic coating, 0.02 mm 0.7 mil or thicker, 215-R1 Natural Color] [Architectural Class I, AA-M10-C22-A44, color anodic coating, 0.02 mm 0.7 mil or thicker]. Finish shall be free of scratches and other blemishes.

2.6.2 Baked-Acrylic Resin-Based Coating

Exposed surfaces of aluminum windows shall be finished with acrylic

resin-based coating conforming to AAMA 2603, total dry thickness of 0.03 mm 1.0 mils. Finish shall be free of scratches and other blemishes.

2.6.3 High-Performance Coating

Exposed surfaces of aluminum windows shall be finished with a two-coat fluoropolymer coating system containing at least 70 percent by weight polyvinylidene fluoride, PVF2 resin, factory-applied, oven-baked, conforming to AAMA 2604, with a primer coat of 0.005 to 0.008 mm 0.20 to 0.30 mils and a color coat of minimum 0.025 mm 1.0 mil, total dry film thickness of 0.030 to 0.033 mm 1.20 to 1.3 mils. Finish shall be free of scratches and other blemishes.

2.6.4 Color

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NOTE: Editing of color reference sentence(s) shall be coordinated with the Government. Generally the 09 06 90 COLOR SCHEDULE or drawing is used when the project is designed by an Architect or Interior designer. Color shall be selected from manufacturers standard colors or identified as a manufacturers color in this specification only when the project is very simple and has minimal finishes.

When the Government directs that color be located in the drawings a note shall be added that states: "Where color is shown as being specific to one manufacturer, an equivalent color by another manufacturer may be submitted for approval. Manufacturers and materials specified are not intended to limit the selection of equal colors from other manufacturers. The word "color" as used herein includes surface color and pattern."

Prior to specifying a custom color finish, research to determine if additional cost and lead time is feasible. Note there is often a minimum order requirement; this requirement will also affect future orders.

When a manufacturer's name, stock number, pattern, and color is used, be certain that the product conforms to this specification, as edited.
****

Color shall be [in accordance with Section 09 06 90 COLOR SCHEDULE] [as indicated on the drawings] [selected from manufacturers standard colors]. [[_____] Color listed is not intended to limit the selection of equal colors from other manufacturers].

PART 3 EXECUTION

3.1 INSTALLATION

Aluminum windows shall be installed in accordance with approved shop drawings and manufacturer's published instructions. Aluminum surfaces in contact with masonry, concrete, wood and dissimilar metals other than

stainless steel, zinc, cadmium or small areas of white bronze, shall be protected from direct contact using protective materials recommended by AAMA 101. The completed window installation shall be watertight in accordance with Section 07 92 00 JOINT SEALANTS. Glass and glazing shall be installed in accordance with requirements of this section and Section 08 81 00 GLAZING.

3.2 ADJUSTMENTS AND CLEANING

3.2.1 Hardware Adjustments

Final operating adjustments shall be made after glazing work is complete. Operating sash or ventilators shall operate smoothly and shall be weathertight when in locked position.

3.2.2 Cleaning

Aluminum window finish and glass shall be cleaned on exterior and interior sides in accordance with window manufacturer's recommendations. Alkaline or abrasive agents shall not be used. Precautions shall be taken to avoid scratching or marring window finish and glass surfaces.

-- End of Section --