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Preparing Activity: NASA Superseding
 UFGS-08 51 13.00 40 (June 2006)
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UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated 9 October 2006

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SECTION 08 51 13.00 40

ALUMINUM WINDOWS 10/06

NOTE: Delete, revise, or add to the text in this section to cover project requirements. Notes are for designer information and will not appear in the final project specification.

This section covers aluminum projected and double-hung windows, standard and thermal-barrier, installed singly or multiply in combination with mullions.

Window assemblies which include insulating panels are specified in Section 08 44 00.00 40 CURTAIN WALL AND GLAZED ASSEMBLIES.

Drawings must indicate the size and type of windows, vents, screens, glass thickness, glazing method, construction details at jambs, heads, and sills, accessory closures, aluminum sills and stools, casings, and accessories.

Glass and installation are specified in Section 08 81 00.00 GLASS.

Sealing perimeter joints between windows and other construction is specified in Section 07 92 00 JOINT SEALANTS.

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.

PART 1 GENERAL

1.1 REFERENCES

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.

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 701 (2004) Voluntary Specification for Pile Weather Strip

AAMA 902 (1998) Voluntary Specification for Sash Balances

AAMA WSG.1 (1995) Window Selection Guide

ASME INTERNATIONAL (ASME)

ASME B29.400 (2001) Combination, "H" Type Mill Chains, and Sprockets

ASTM INTERNATIONAL (ASTM)

ASTM A 1011/A 1011M (2005) Standard Specification for Steel, Sheet, and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and

	High-Strength Low-Alloy with Improved Formability
ASTM A 36/A 36M	(2005) Standard Specification for Carbon Structural Steel
ASTM A 501	(2001) Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing
ASTM B 117	(2003) Standing Practice for Operating Salt Spray (Fog) Apparatus
ASTM B 221	(2005) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ASTM B 221M	(2005) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric)
ASTM B 244	(1997; R 2002) Standard Method for Measurement of Thickness of Anodic Coatings on Aluminum and of Other Nonconductive Coatings on Nonmagnetic Basis Metals with Eddy-Current Instruments
ASTM B 584	(2004) Standard Specification for Copper Alloy Sand Castings for General Applications
ASTM C 920	(2005) Standard Specification for Elastomeric Joint Sealants
ASTM D 1056	(2000) Standard Specification for Flexible Cellular Materials - Sponge or Expanded Rubber
ASTM D 1593	(1999) Standard Specification for Non-rigid Vinyl Chloride Plastic Film and Sheeting
ASTM E 2016	(1999; R 2004e1) Standard Specification for Industrial Woven Wire Cloth
BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)	
BHMA A156.16	(2002) Auxiliary Hardware
INTERNATIONAL WINDOW CLEANING ASSOCIATION (IWCA)	
IWCA I-14	(2001) Window Cleaning Safety Standard
NATIONAL WOOD WINDOW AND DOOR ASSOCIATION (NWWDA)	
AAMA/NWWDA 101/I.S.2	(1997) Voluntary Guide Specifications for Aluminum, Poly(Vinyl Chloride) (PVC) and Wood Windows and Glass Doors

SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)

SAE AMS 3110 (2001) Primer, Zinc Chromate

STEEL WINDOW INSTITUTE (SWI)

SWI-SWS (2005) Steel Windows Specifications

THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC Paint 101 (1982) Aluminum Alkyd Paint Leafing (Type I) and Non-Leafing (Type II)

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

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.

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.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Fabrication Drawings for aluminum window units shall be submitted in accordance with paragraph entitled, "Drawings," of this section.

SD-03 Product Data

Manufacturer's catalog data shall be submitted for the following items, including operating hardware, locking assemblies and strikes, pole and sash operators and weatherstripping.

Projected Windows
Double-Hung Windows
Thermal-Barrier Windows
Mullions
Screens
Shade Screens
Window Cleaners' Bolts

SD-04 Samples

The following samples shall be full-sized as used in construction, and may be used in the work when approved, and the location shall be recorded.

Projected Windows
Double-Hung Windows
Thermal-Barrier Windows
Aluminum Sills
Frames
Screens
Shade Screens

1.3 DELIVERY, HANDLING, AND STORAGE

Windows, mullions, accessories, and trim shall be delivered in the manufacturer's unbroken containers and shall be handled carefully at all times to prevent damage.

Windows shall be stored on edge above ground and protected from the weather in accordance with the manufacturer's directions.

1.4 FIELD MEASUREMENTS

Field measurements shall be taken prior to preparation of the drawings and fabrication.

1.5 PERFORMANCE REQUIREMENTS

1.5.1 Wind Loading Design Pressure

Window components, including mullions, hardware, and anchors, shall be designed to withstand a wind-loading design pressure of at least [_____] pascal pounds per square foot (psf).

1.5.2 Tests

Windows proposed for use shall be tested in accordance with

AAMA/NWWDA 101/I.S.2 for the particular type and quality window specified.

Tests shall be performed by a nationally recognized independent testing laboratory equipped and capable of performing the required tests. Results of the tests shall be submitted as certified laboratory reports required herein.

Minimum design load for a uniform-load structural test shall be 2400 pascal 50 psf.

[Projected windows shall be tested in accordance with the applicable portions of the AAMA WSG.1 for air infiltration, water resistance, uniform-load deflection, and uniform-load structural test.]

[Double-hung windows shall be tested in accordance with the applicable portions of the AAMA WSG.1 for air infiltration, water resistance, uniform-load deflection, and uniform-load structural test.]

1.6 DRAWINGS

Fabrication Drawings for aluminum window units shall be submitted showing complete window assembly including hardware, weatherstripping, and subframe assembly details.

PART 2 PRODUCTS

2.1 PROJECTED WINDOWS

Windows shall be high-performance classification projected aluminum sash complete with fins, closures, accessories, fittings, and trim, meeting or exceeding AAMA/NWWDA 101/I.S.2 for Type P-A2-HP and the requirements specified.

Windows, mullions, hardware, and anchors shall be designed to withstand the wind loading specified.

Outswinging vents shall have not less than a 1800 millimeter 6-foot clearance above the finished grade.

2.1.1 Materials

Frames, ventilators, mullions, mullion covers, glazing beads, and fittings shall be extruded aluminum shapes fabricated from aluminum conforming to ASTM B 221M ASTM B 221, 6063-T5 alloy, AAMA/NWWDA 101/I.S.2. Aluminum sheet and plate shall be 5005 alloy, temper as required.

Joint sealing compound shall be a gun grade, nonsag, single-component butyl or acrylic sealant conforming to ASTM C 920.

Weatherstripping shall be [extruded flexible polyvinylchloride, weatherstripping grade, conforming to ASTM D 1593, Type I, with a tensile strength of at least 15200 kilopascal 2,200 pounds per square inch (psi) and a tear strength of not less than 48200 newton per meter 275 pounds per inch] [closed-cell rubber conforming to ASTM D 1056, Type 2, Grade B Grade 1].

2.1.2 Steel Subframes

[Subframe members shall be the size and weight indicated, formed from steel

sheets conforming to ASTM A 1011/A 1011M, steel shapes conforming to ASTM A 36/A 36M, or steel tubing conforming to ASTM A 501. Members shall be coated as specified under "Dissimilar Materials" herein.]

2.1.1.3 Construction

Windows shall be unequal-leg type, double-contact weathering, with 16 millimeter 5/8-inch anchorage and a combined depth of frame and ventilator of not less than 45 millimeter 1-3/4 inches. Frames shall be not less than 40 millimeter 1-1/2 inches deep, and the ventilator shall be not less than 41 millimeter 1-5/8 inches deep. Minimum web thickness for solid sections shall be 3 millimeter 1/8 inch, and the minimum web thickness for solid-ventilator hardware rails shall be at least 5 millimeter 3/16 inch. Tubular sections shall have a minimum web thickness of 2.4 millimeter 3/32 inch, and flanges shall be not less than 3 millimeter 1/8 inch thick.

Allowance for expansion between component parts shall be provided for window assemblies.

Integral drip holes or weepholes shall be provided for exterior in-sill sections at not more than 600 millimeter 2 feet on center.

Tubular sections shall be used in horizontal meeting rails longer than 1240 millimeter 48-7/8 inches.

Corners of window frame assemblies shall be coped, double mortised-and-tenoned, and riveted, or shall be mitered and welded.

Corners of ventilator frames shall be mitered and welded; mortise and tenon construction is not permitted.

Welds shall be continuous across the web member and up the abutting flanges on the unexposed surface. Welds shall be dressed smooth and flush on exposed and contact surfaces and shall exhibit no discoloration, pitting, or surface defects.

Corner joints shall be accurately fitted, flush, watertight hairline joints not exceeding 0.4 millimeter 1/64 inch in width. Joint-sealing compound shall be applied to the unexposed surface of all mortise and tenon joints.

Ventilators shall be supported on two aluminum side arms at least 5 millimeter 3/16 inch thick by 25 millimeter 1 inch wide fitted with nylon friction shoes. Arms shall be secured to vent and frame with 10 millimeter 3/8-inch corrosion-resistant steel pivot pins with corrosion-resistant steel bushings or 3/8-inch 10 millimeter 3/8-inch aluminum pivot pins with nylon bushings. Ventilator movement shall be controlled by friction shoes sliding in the channel guides of the fixed frame. Assembly shall permit removal of the ventilator after installation and shall provide an adjustable stop to permit a maximum opening angle of 55 degrees for project-out vents and 30 degrees for project-in vents. An adjustable tension device shall hold the window open in any position and shall consist of a fixed- or adjustable-tension corrosion-resistant steel helical spring enclosed in an aluminum or corrosion-resistant steel housing and operating through the friction shoe.

Ventilator hardware and balance-arm assembly shall be attached to ventilator and frame members with corrosion-resistant steel screws threaded into serrated corrosion-resistant steel grommet inserts.

2.1.4 Hardware

Operating hardware shall be nickel-silver castings conforming to ASTM B 584, Alloy C97600, or AISI Series 18-8 corrosion-resistant steel. Hardware shall be a modern design, smoothly finished, free of defects, and suitable for the intended purpose.

Cam-action locking handles and strikes shall be provided for projected-out vents; cam-action locks and keepers shall be provided for projected-in vents. Pole-operated projected-in vents shall be equipped with suitable design cam-action locks or spring-catch fasteners.

Strikes and contact surfaces for lock fasteners shall be corrosion-resistant steel, nickel silver, or a similar abrasion-resistant metal.

Projected-type ventilators 1070 millimeter 42 inches and wider and not pole operated shall be furnished with two sets of cam-action locking handles.

Pole operators shall be provided for projected-type ventilators located 1800 millimeter 6 feet or higher above the finished floor. Pole shall be tubular steel, solid wood, or aluminum conforming to BHMA A156.16, and shall include a cast aluminum or bronze pole hanger, for each pole operator. One pole operator of the required length shall be provided for each room requiring pole operation. Poles shall have a clear lacquer, urethane, or baked-enamel finish.

2.1.5 Hardware for Multiple-Sash Operation

Hardware and controls shall be provided for manually operated multiple-sash operation where indicated and shall be complete with brackets, bolts, clips, anchors, and fittings as required for a complete and operable installation.

Hardware fittings and controls for mechanical operators shall conform to SWI-SWS and the following:

Shaft brackets shall be steel with adjustable, brass roller bearings. Spacing of shaft brackets shall not exceed 2440 millimeter. 8 feet.

Pipe shafts shall be not less than 33 millimeter 1-5/16-inch outside diameter.

Worm-and-gear assemblies shall be cast iron or steel with machine-cut teeth ball bearing mounted in oil-bath, enclosed housings. Gear housings shall be factory-lubricated and sealed.

Operators, shafts, connecting arms, brackets, and control handles shall receive a factory-applied rust-inhibiting primer coat applied to a dry-film thickness of not less than 0.051 millimeter. 2 mils.

[Operation shall be by means of a hand chain. Chain shall be cadmium-plated alloy steel conforming to ASME B29.400].

[Operation shall be by vertical shaft and miter gear with a detachable operating handle. Miter-gear box shall be an oil-bath, enclosed housing.]

[Operator shall be a worm-and-gear torsion lever type.]

[Operator shall be a worm-and-gear torsion rack-and-pinion type. Racks shall be die-cut steel bars meshing with a die-cut steel pinion.]

[Operator shall be a screw type assembled in an enclosed housing and containing a threaded phosphor-bronze gear and cast-iron miter gear mounted on antifriction thrust bearings.]

The completed installation shall operate smoothly without binding and with no noticeable difference in the opening angle between windows in the entire length of the run. Windows shall open and close simultaneously with not more than a 25 millimeter 1-inch difference in opening between the first and the last window at the end of the run and with not more than 5 degrees difference in the angle between connecting arms at the maximum window opening.

2.1.1.6 Glazing Provisions

[Windows shall be designed for inside glazing, using snap-on, screwless, extruded or roll-formed aluminum, or AISI series-300 corrosion-resistant steel beads. Fixed glazing stops and stop beads shall be 20 millimeter 3/4 inch high by 1.5 millimeter 1/16 inch thick. Width of the stop bead shall be as required for the glass thickness.]

[Windows shall be designed for outside glazing using snap-on, screwless, extruded or roll-formed aluminum, or AISI series-300 corrosion-resistant steel beads. Fixed glazing stops and stop beads shall be 20 millimeter 3/4 inch high by 1.5 millimeter 1/16 inch thick. Width of the stop bead shall be as required for the glass thickness.]

[Windows shall be designed for outside glazing, using glazing clips and glazing compound as specified in Section 08 80 00.00 40 GLAZING.]

2.1.1.7 Weatherstripping

[Windows shall have double continuous extruded weatherstripping set in integrally formed pockets in the sash.]

[Windows shall have single continuous extruded weatherstripping set in integrally formed pockets in the sash.]

2.1.1.8 Aluminum Sills

Sills shall be the profiles and dimensions indicated, the same alloy and finish as windows, at least 3 millimeter 1/8 inch thick, and furnished the full width of the window opening.

Sills shall be securely anchored in place with concealed anchors not more than 460 millimeter 18 inches on center.

2.2 DOUBLE-HUNG WINDOWS

Windows shall be the high-performance classification double-hung type meeting or exceeding AAMA/NWWDA 101/I.S.2 for Type DH-A2-HP and the requirements specified, complete with accessories, fittings, and trim.

Windows, mullions, hardware, and anchors shall be designed to withstand the wind loading specified.

2.2.1 Window Materials

Window **Frames** and sash members, mullions, mullion covers, screen frames, and glazing beads shall be extruded aluminum shapes fabricated from aluminum conforming to **ASTM B 221M ASTM B 221**, 6063-T5 aluminum alloy.

Joint-sealing compound shall be a gun grade, nonsag, single-component butyl or acrylic sealant conforming to **ASTM C 920**.

Weatherstripping shall be woven wool pile weatherstripping **5.3 millimeter 0.210 inch** thick, conforming to **AAMA 701**, 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.

2.2.2 Subframes

Subframe members shall be formed from steel sheets conforming to **ASTM A 1011/A 1011M**, Grade 36, steel shapes conforming to **ASTM A 36/A 36M**, or steel tubing conforming to **ASTM A 501**.

2.2.3 Window Construction

Frames, sash, and head members shall have a minimum thickness of **1.57 millimeter. 0.062 inch**. Sills shall have a minimum thickness of **2.36 millimeter, 0.093 inch**, fabricated with an integral stiffening rib, and have weep holes not more than **600 millimeter 2 feet** on center.

Horizontal sash members, muntins, and meeting rails shall be fabricated of extruded tubular-aluminum sections. Minimum depth of horizontal sash members and meeting rails shall be **26.9 millimeter. 1-1/16 inches**. Sash lift shall be the full width of the window, extruded as an integral part of the sash.

Frames shall have a minimum depth of **75 millimeter 3 inches** and shall be provided with integral stiffening ribs, fins, drip at head, and weatherstripping grooves.

Frame and sash members shall be mechanically joined or welded to form rigid flush watertight joints. Joints shall be hairline not exceeding **0.39 millimeter 1/64 inch** and shall be sealed with factory-applied joint compound where required to provide a watertight joint.

Expansion between component parts of the window shall be provided to preclude absorption of thermal stresses in each unit.

2.2.4 Hardware for Double-Hung Windows

Locking hardware shall be nickel-silver castings conforming to **ASTM B 584**, Alloy C97600, or AISI Series 300, 18-8 corrosion-resistant steel, or a combination of the two, furnished in contemporary design, smoothly finished, free of defects, and suitable for the intended purpose.

Sash lifts shall be continuous extrusions, integral with sash frames. Upper sashes shall have matching continuous-extrusion pulls.

Double-hung windows shall be provided with at least one lock and keeper. Windows over **900 millimeter 3 feet** wide shall be fitted with two locks and keepers.

Each sash shall operate on two adjustable, replaceable spring or spiral balances meeting the requirements of [AAMA 902](#). Balances shall be enclosed in aluminum cases and shall be adjustable without removal of the sash from the frame and without the use of special tools.

Meeting rails, [1800 millimeter 6 feet](#) or higher above the finished floor, shall be furnished with pulldown sockets and pole-operated sash locks. Poles shall be tubular or solid steel or aluminum conforming to [BHMA A156.16](#), and shall include a cast bronze pole hanger for each pole operator. One pole operator of the required length shall be provided for each room requiring pole operation. Poles shall have a clear lacquer, urethane, or baked-enamel finish.

2.2.5 Glazing Requirements

[Windows shall be designed for field-applied inside glazing, using snap-on, screwless extruded-aluminum beads. Width of the stop bead shall be as required for the glass thickness.]

[Windows shall be designed for field-applied outside glazing, using snap-on, screwless, extruded-aluminum beads. Width of the stop bead shall be as required for glass thickness.]

[Windows shall be designed for field-applied outside glazing, using glazing clips and glazing compound as specified in Section [08 80 00.00 40 GLAZING](#).]

2.2.6 Weatherstripping Materials

Double weatherstripping shall be installed in jambs, meeting rails, sills, and heads of all windows.

2.3 [THERMAL-BARRIER WINDOWS](#)

Thermal-barrier windows, complete with accessories and fittings, shall be provided where indicated.

Material and construction shall be as specified except as follows:

Aluminum alloy shall be 6063-T6.

Frame construction, including operable sash, shall be factory-assembled and factory-sealed inner and outer aluminum completely separated from metal-to-metal contact. Assembly shall be joined by a continuous, concealed, low conductance divider housed in an interlocking extrusion of the inner frame. Metal fasteners, straps, or anchors shall not bridge the connection between the inner and outer frame.

Operating hardware for each sash shall consist of spring-loaded nylon cushion blocks and pin locks designed to lock in predetermined locations.

Sash shall be completely separated from metal-to-metal contact by means of woven-pile weatherstripping, plastic, or elastomeric separation members.

Operating and storm sash shall be factory-glazed with the type of glass indicated and of the quality specified in Section [08 80 00.00 40 GLAZING](#).

2.4 MULLIONS

NOTE: Drawings must indicate the profile and dimensions of mullions, anchorage and reinforcing members as required for wind loading, and the type, profile, and fastening system for the mullion cover (screw-fastened or snap-on).

Mullions shall be provided between multiple-window units where indicated.

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

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

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

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

2.5 SCREENS

Removable, rewireable, interchangeable aluminum insect screens shall be provided for window openings as indicated and shall be complete with installation hardware and fasteners.

Frames shall be extruded tubular aluminum, the same alloy and finish coating as specified for windows, at least 1.5 millimeter 1/16 inch web thickness, at least 11 millimeter 7/16 inch deep by 40 millimeter 1-1/2 inches high. Corners shall be mitered, welded, and dressed smooth and flush. Frames shall include integral extruded grooves to receive and retain screen splines. Splines shall be miter cut and shall provide neat close-fitting joints no wider than 0.79 millimeter. 1/32 inch.

Fabric shall be 1.0 by 1.18 millimeter by 0.28 millimeter 18 by 16 mesh by 0.011 inch diameter, Alclad aluminum alloy wire screen conforming to ASTM E 2016. Screens shall be held taut and smooth in frames by removable vinyl splines.

[Projected windows shall receive screens over ventilators where indicated. Horizontal sliding or hinged wicket screens shall be provided where access to operating hardware is required. Wicket screens shall be framed with horizontal and vertical aluminum tubular or solid frame members and shall be equipped with friction catches.]

[Double-hung windows shall receive single vertical sliding screens with integral extruded hand grips, corrosion-resistant steel friction springs, and concealed locking bolts, mounted in integral guides in the window frame.]

[Double-hung windows shall receive double vertical sliding screens with

integral extruded hand grips, corrosion-resistant steel friction springs, and concealed locking bolts, mounted in integral guides in the window frame.]

2.6 SHADE SCREENS

Where indicated, hinged removable-louver design shade screens shall be provided, complete with frame rails, braces, fasteners, and accessories as required for a complete installation.

Screens shall be fabricated from enamel-coated bronze woven into louvers approximately 1.2 millimeter wide by 1.2 millimeter 0.05 inch wide by 0.05 inch thick, color as selected, spaced at 23 louvers per 25 millimeter inch and set at an angle of 17 degrees from the horizontal. Screens shall have an area open to horizontal vision of 49 percent and a free-air flow of 79 percent and shall also function as an insect screen.

Screens shall be framed in reinforced tubular aluminum rails at least 1.5 millimeter thick by 13 millimeter 1/16 inch thick by 1/2 inch wide by the height required for the screen size and shall be braced with a 13 by 25 millimeter 1/2- by 1-inch extruded aluminum shapes. Perimeter of the screen shall be encased in vinyl caps and splines designed to fit the extrusion pockets of rails and braces.

Framed screens shall be full length continuous-hinge mounted in accordance with the shade-screen manufacturer's printed instructions for an insect-tight screen installation.

Frame rails shall be 6063-T5 aluminum alloy and shall receive an AA Architectural Class II natural anodic coating (designation AA-M12 C22 A31) in accordance with AA DAF-45. Anodic coating shall be not less than 0.01 millimeter 0.4 mil in thickness when tested in accordance with ASTM B 244.

2.7 WINDOW CLEANERS' BOLTS

Window cleaners' bolts shall be provided for all windows 2100 millimeter 7 feet or higher above finished grade, except windows located so they may be removed for cleaning or cleaned from the ground or from a lower roof level without the use of an extension ladder. Two bolts shall be provided for each single window unit and each fixed glass unit and shall be located 1120 millimeter 44 inches above the window sill.

Window cleaners' bolts shall be double-head type, AISI Series 300 corrosion-resistant steel, size and design complying with IWCA I-14. Contact side of the bolts shall be ground to fit flat against window jambs. Bolts may be factory- or field-attached before windows are set. Backs of frames to receive bolts shall be reinforced with 6 by 150 millimeter 1/4- by 6-inch corrosion-resistant steel or aluminum plates bolted or welded to the frames at the factory. Special wall anchors shall be provided on frames at the point of bolt attachment.

2.8 FINISH

NOTE: When a colored finish is required, review AA
DAF-45 to determine the proper designation.

[Aluminum windows, mullions, glazing beads, trim, and accessory fittings

shall be cleaned, and receive an Architectural Class II natural anodic coating (designation AA-M-12C22A31) in accordance with AA DAF-45. Anodic coating shall be not less than 0.01 millimeter. 0.4 mil.]

[Aluminum window, mullions, glazing beadings, trim, and accessory fittings shall be thoroughly cleaned and shall receive an Architectural Class I natural anodic coating (designation AA-M-12C22A41) in accordance with AA DAF-45. Anodic-coating thickness shall be not less than 0.018 millimeter. 0.7 mil.]

Thickness of the anodic coating shall be tested in accordance with ASTM B 244.

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

PART 3 EXECUTION

3.1 INSTALLATION

Windows shall be set plumb, level to a tolerance of not more than 1.5 millimeter in 3048 millimeter 1/16 inch in 10 feet and in alignment without frame distortion and securely anchored in place as indicated, in accordance with the manufacturer's printed instructions and the approved drawings.

Fasteners shall be concealed except for specifically indicated mullion covers, window-operating hardware, screen attachment hardware, and similar surface-applied trim.

Ventilators and operating parts shall be protected against cement, lime, plaster, adhesives, and other building material after installation and until completion.

Steel work shall be drilled and tapped for the attaching window units, trim, and accessories. Where window units are set in prepared masonry openings, anchorage items shall be placed during wall construction. Anchors and fasteners shall be welded or bolted securely to the frame and shall be built-in, anchored, or bolted to the building construction with sufficient anchors to hold each window unit firmly in place. Anchors shall be not more than 460 millimeter 18 inches on center at heads, jambs, and sills.

Fasteners, clips, fittings, aluminum trim, closures, and shapes shall be provided as indicated and as required to provide a complete installation.

Joints shall be sealed between sash units, aluminum sills, mullions, and covers and similar metal-to-metal contact surfaces with sealant or tape as recommended and furnished by the window manufacturer. Installations shall be weathertight.

Joint sealing and calking between metal and masonry is specified in Section 07 92 00 JOINT SEALANTS.

3.2 DISSIMILAR MATERIALS

Aluminum shall be kept from direct contact with steel or other dissimilar materials by painting, nonabsorptive tape, gasket, or other approved system

as recommended by the manufacturer and as specified.

Aluminum surfaces in contact with steel shall be given one coat of zinc-chromate primer conforming to SAE AMS 3110, applied to a dry-film thickness of not less than 0.038 millimeter, 1.5 mils, or one coat of a suitable nonhardening joint compound capable of excluding moisture from the joint during prolonged service.

Steel surfaces in contact with aluminum shall be given one coat of zinc-chromate paint conforming to SAE AMS 3110, applied to a dry-coat thickness of 0.038 millimeter, 1.5 mils, and two or more coats of aluminum paint conforming to SSPC Paint 101, aluminum alkyd, Type II, applied to a dry-film thickness of 0.038 millimeter 1.5 mils for each coat and a total dry-film thickness of 0.076 millimeter. 3.0 mils.

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

Aluminum surfaces placed in contact with wood, concrete, or masonry construction shall be given one coat of bituminous paint conforming to SSPC Paint 12, applied to a thickness of at least 1.5 millimeter. 1/16 inch.

3.3 ADJUSTMENT AFTER INSTALLATION

After the sash is erected and glazed, ventilators shall be lubricated and adjusted for smooth weathertight operation. Guides shall be waxed or lubricated and balances shall be adjusted for the proper tension.

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

3.4 FEELER-GAGE FIELD TEST

NOTE: Test is for nonweatherstripped projected
windows only.

Windows shall be tested after installation, glazing, and adjustment for metal-to-metal contact between ventilators and frames by feeler-gage tests in accordance with SWI-SWS.

Windows failing to meet the requirements of the feeler-gage tests shall be corrected as required to meet the tests. Such windows shall be retested and, if they fail the tests again, shall be removed and replaced.

3.5 CLEANING AFTER INSTALLATION

Interior and exterior metal surfaces of windows shall be cleaned of mortar, plaster, paint spattering or spots, and other foreign matter, and washed with soap and water, brushed with a fiber brush, and thoroughly rinsed with clear water. Acid solutions, steel wool, or other harsh abrasives shall not be used.

Stained or discolored windows shall be cleaned in accordance with the window manufacturer's recommendations. Windows that cannot be satisfactorily cleaned and windows with abraded, stained, or defective

surface finish that cannot be satisfactorily repaired shall be replaced.

-- End of Section --