
USACE / NAVFAC / AFCESA UFGS-08900 (September 1999)

Preparing Activity: NAVFAC Replacing without revision
NFGS of same number and date

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated 25 June 2004

SECTION TABLE OF CONTENTS

DIVISION 08 - DOORS AND WINDOWS

SECTION 08900

GLAZED CURTAIN WALL

09/99

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUBMITTALS
- 1.3 REQUIREMENT FOR DESIGN DATA
- 1.4 QUALITY ASSURANCE
 - 1.4.1 Testing Requirements
 - 1.4.2 Mockup
 - 1.4.2.1 Construction
 - 1.4.2.2 Performance Test
 - 1.4.2.3 Approved Mock-Up
 - 1.4.3 Factory Tests
 - 1.4.3.1 Deflection and Structural Tests
 - 1.4.3.2 Water Penetration Test
 - 1.4.3.3 Air Infiltration Test
 - 1.4.3.4 Delamination Test
 - 1.4.3.5 Thermal Conductance Tests
 - 1.4.3.6 Window Tests
 - 1.4.3.7 Fire Resistance Tests
 - 1.4.3.8 Sound Transmission Loss Test
- 1.5 GLAZED CURTAIN WALL SYSTEM REQUIREMENTS
 - 1.5.1 Source
 - 1.5.2 Design
 - 1.5.3 Thermal Movement
 - 1.5.4 Tolerances
 - 1.5.5 Structural Requirements
- 1.6 QUALIFICATION OF WELDERS
- 1.7 DELIVERY AND STORAGE
 - 1.7.1 Protective Covering
 - 1.7.2 Identification
- 1.8 WARRANTY

PART 2 PRODUCTS

- 2.1 MATERIALS
 - 2.1.1 Aluminum

- 2.1.1.1 Wrought Aluminum Alloys
- 2.1.1.2 Cast Aluminum Alloys
- 2.1.1.3 Welding Rods and Electrodes
- 2.1.1.4 Finish
- 2.1.1.5 Strength
- 2.1.2 Bronze
- 2.1.3 Copper
- 2.1.4 Carbon Steel
- 2.1.5 Stainless Steel
- 2.1.6 Weathering High-Strength Low-Alloy Steel
- 2.1.7 High-Strength, Low-Alloy Steel
- 2.1.8 Metal Fasteners
- 2.1.9 Porcelain Enamel
- 2.1.10 Joint Sealants and Accessories
 - 2.1.10.1 Elastomeric, Single or Multiple Component
 - 2.1.10.2 Single Component Silicone Rubber Base
 - 2.1.10.3 Solvents and Primers
 - 2.1.10.4 Backing Material
 - 2.1.10.5 Bond Preventive Materials
 - 2.1.10.6 Preformed Sealing Compound
- 2.1.11 Glass and Glazing
 - 2.1.11.1 Glass Sizes and Clearances
 - 2.1.11.2 Clear Primary Float Glass
 - 2.1.11.3 Heat-Absorbing Glass
 - 2.1.11.4 Insulating Glass
 - 2.1.11.5 Spandrel Glass [With Adhered Backing]
 - 2.1.11.6 Glass Setting Materials
- 2.1.12 Firestopping Material
- 2.1.13 Tempered Hardboard
- 2.1.14 Screens
- 2.1.15 Paint and Finishes
 - 2.1.15.1 Primer
- 2.1.16 Panels
 - 2.1.16.1 Metal Facing Panels, Single Thickness
 - 2.1.16.2 Adhesively Bonded Panels
 - 2.1.16.3 Nonmetallic Panels
- 2.1.17 Metal Windows
 - 2.1.17.1 Frames
 - 2.1.17.2 Operating Windows
 - 2.1.17.3 Window Construction
- 2.1.18 Insect Screens
- 2.1.19 Metal Accessories

PART 3 EXECUTION

3.1 FABRICATION

- 3.1.1 Joints
- 3.1.2 Welding
- 3.1.3 Soldering and Brazing
- 3.1.4 Ventilation and Drainage
- 3.1.5 Protection and Treatment of Metals
 - 3.1.5.1 General
 - 3.1.5.2 Galvanic Action
 - 3.1.5.3 Protection for Aluminum

3.2 INSTALLATION

- 3.2.1 Bench Marks and Reference Points
- 3.2.2 Verifying Conditions and Adjacent Surfaces
- 3.2.3 Panels
- 3.2.4 Windows

- 3.2.4.1 Sealing
- 3.2.4.2 Ventilators and Hardware
- 3.2.4.3 Weatherstripping
- 3.2.5 Joint Sealants
 - 3.2.5.1 Surface Preparation
 - 3.2.5.2 Applications
 - 3.2.5.3 Primer
 - 3.2.5.4 Backing
 - 3.2.5.5 Bond Prevention
 - 3.2.5.6 Protection and Cleaning
- 3.2.6 Glass
 - 3.2.6.1 Inspection of Sash and Frames
 - 3.2.6.2 Preparation of Glass and Rabbets
 - 3.2.6.3 Positioning Glass
 - 3.2.6.4 Setting Methods
 - 3.2.6.5 Void Space
 - 3.2.6.6 Insulating Glass
 - 3.2.6.7 Insulating Glass With Edge Bands
- 3.2.7 Firestopping
- 3.2.8 Field Applied Insulation
- 3.3 FINISHES
 - 3.3.1 Galvanizing
 - 3.3.1.1 Repair of Zinc-Coated Surfaces
 - 3.3.2 Shop Cleaning and Painting
 - 3.3.2.1 Cleaning
 - 3.3.2.2 Painting Steel or Iron Surfaces
 - 3.3.2.3 Painting Weathering Steel
- 3.4 FIELD TESTS
- 3.5 CLEANING AND PROTECTION
 - 3.5.1 Glass
 - 3.5.2 Aluminum Surfaces
 - 3.5.3 Other Metal Surfaces
- 3.6 SCHEDULE

-- End of Section Table of Contents --

USACE / NAVFAC / AFCESA UFGS-08900 (September 1999)

Preparing Activity: NAVFAC Replacing without revision
NFGS of same number and date

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated 25 June 2004

SECTION 08900

GLAZED CURTAIN WALL 09/99

NOTE: This guide specification covers the requirements for complete glazed curtain wall system exclusive of doors, entrances, and store fronts.

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.

NOTE: On the drawings, show:

1. Sizes and configuration of framing members, panels, and other components. Details of flashings, copings, weeps, and drainage system.
2. Methods of securing framing to structure and details of fastenings, anchors, and auxiliary shapes.
3. Expansion joint details.
4. Type and thickness of glass and glazing details.
5. Details for installing each panel type.
6. Details of field applied insulation, baffles, fillers, fire stops, or other seals at joints between curtain wall and floor slab edges.
7. A schedule of system types and sizes and all

window units.

PART 1 GENERAL

1.1 REFERENCES

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.

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 ASD1 (2003) Aluminum Standards and Data

AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

AAMA 101 (1999) Voluntary Specifications for Aluminum, Vinyl (PVC) and Wood Windows and Glass Doors

AAMA 501 (1994) Methods of Test for Exterior Walls

AAMA 609/610 (2002) Cleaning and Maintenance Guide for Architecturally Finished Aluminum

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 800 (1992) Voluntary Specifications and Test Methods for Sealants

AAMA CW-10 (1997) Care and Handling of Architectural Aluminum from Shop to Site

AAMA MCWM-1 (1989) Metal Curtain Wall Manual

AMERICAN HARDBOARD ASSOCIATION (AHA)

AHA A135.4 (1995) Basic Hardboard

AMERICAN WELDING SOCIETY (AWS)

AWS A5.10/A5.10M (1999) Bare Aluminum and Aluminum Alloy Welding Electrodes and Rods

AWS D1.1/D1.1M (2002) Structural Welding Code - Steel

ASTM INTERNATIONAL (ASTM)

ASTM A 123/A 123M	(2002) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 153/A 153M	(2003) Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A 167	(1999) Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM A 242/A 242M	(2003a) High-Strength Low-Alloy Structural Steel
ASTM A 36/A 36M	(2003a) Carbon Structural Steel
ASTM A 424	(2000) Steel, Sheet, for Porcelain Enameling
ASTM A 570/A 570M	(1998) Steel, Sheet and Strip, Carbon, Hot-Rolled
ASTM A 572/A 572M	(2003a) High-Strength Low-Alloy Columbium-Vanadium Structural Steel
ASTM A 588/A 588M	(2003) High-Strength Low-Alloy Structural Steel with 50 ksi (345 MPa) Minimum Yield Point to 4 in. (100 mm) Thick
ASTM A 606	(2001) Steel, Sheet and Strip, High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, with Improved Atmospheric Corrosion Resistance
ASTM A 607	(1998) Steel, Sheet and Strip, High-Strength, Low-Alloy, Columbium or Vanadium, or Both, Hot-Rolled and Cold-Rolled
ASTM A 611	(1997) Structural Steel (SS), Sheet, Carbon, Cold-Rolled
ASTM A 653/A 653M	(2003) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM B 108	(2003a) Aluminum-Alloy Permanent Mold Castings
ASTM B 136	(1984; R 2003) Measurement of Stain Resistance of Anodic Coatings on Aluminum
ASTM B 137	(1995; R 2000) Measurement of Coating Mass Per Unit Area on Anodically Coated Aluminum
ASTM B 152	(1997a) Copper Sheet, Strip, Plate, and Rolled Bar

ASTM B 152M	(1997a) Copper Sheet, Strip, Plate, and Rolled Bar Metric)
ASTM B 209	(2002a) Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B 209M	(2002a) Aluminum and Aluminum-Alloy Sheet and Plate (Metric)
ASTM B 221	(2002) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ASTM B 221M	(2002) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric)
ASTM B 244	(1997; R 2002) Measurement of Thickness of Anodic Coatings on Aluminum and of Other Nonconductive Coatings on Nonmagnetic Basis Metals with Eddy-Current Instruments
ASTM B 26/B 26M	(2003) Aluminum-Alloy Sand Castings
ASTM B 85	(2003) Aluminum-Alloy Die Castings
ASTM C 1036	(2001) Flat Glass
ASTM C 1048	(1997b) Heat-Treated Flat Glass - Kind HS, Kind FT Coated and Uncoated Glass
ASTM C 236	(1989; R 1993e1) Steady-State Thermal Performance of Building Assemblies by Means of a Guarded Hot Box
ASTM C 542	(1994; R 1999) Lock-Strip Gaskets
ASTM C 612	(2000a) Mineral Fiber Block and Board Thermal Insulation
ASTM C 665	(2001e1) Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
ASTM C 864	(1999) Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers
ASTM C 920	(2002) Elastomeric Joint Sealants
ASTM D 1037	(1999) Evaluating Properties of Wood-Base Fiber and Particle Panel Materials
ASTM D 3656	(1997) Insect Screening and Louver Cloth Woven from Vinyl-Coated Glass Yarns
ASTM E 119	(2000a) Fire Tests of Building Construction and Materials
ASTM E 136	(1999e1) Behavior of Materials in a

Vertical Tube Furnace at 750 Degrees C

ASTM E 283	(1991; R 1999) 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 34	(1994; R 2002) Chemical Analysis of Aluminum and Aluminum-Base Alloys
ASTM E 546	(1988; R 1999e1) Frost Point of Sealed Insulating Glass Units
ASTM E 576	(1988; R 1999e1) Frost Point of Sealed Insulating Glass Units in the Vertical Position
ASTM E 774	(1997) Classification of the Durability of Sealed Insulating Glass Units
ASTM E 84	(2003) Surface Burning Characteristics of Building Materials
ASTM E 90	(2002) Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

NAAMM MFM	(1988)Metal Finishes Manual
-----------	-----------------------------

PORCELAIN ENAMEL INSTITUTE (PEI)

PEI 1001	(1996) Architectural Porcelain Enamel (ALS-100)
----------	---

STEEL WINDOW INSTITUTE (SWI)

SWI SGSW	(2002) Architect's Guide to Steel Windows
----------	---

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

16 CFR 1201	Safety Standard for Architectural Glazing Materials
-------------	---

1.2 SUBMITTALS

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.

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

Glazed curtain wall system

Submit for curtain wall system, accessories, and mock-up. [Tentative approval of drawings shall be received before fabrication of mock-up. Final approval of drawings will be deferred pending approval of mock-up and accessories.] Drawings shall indicate in detail all system parts including elevations, full-size sections, framing, jointing, panels, types and thickness of metal, flashing and coping details, field connections, weep and drainage system, finishes, sealing methods, glazing, glass sizes and details, firestopping insulation materials, and erection details.

SD-03 Product Data

Glazed curtain wall system

Include descriptive literature, detailed specifications, and available performance test data.

SD-05 Design Data

Calculations

SD-08 Manufacturer's Instructions

Glazed curtain wall system

Insulating glass

1.3 REQUIREMENT FOR DESIGN DATA

Submit structural and thermal calculations for complete wall assembly.

1.4 QUALITY ASSURANCE

1.4.1 Testing Requirements

NOTE: Revise this paragraph as necessary to cover project requirements.

The components listed below shall have been tested in accordance with the requirements below, and shall meet performance requirements specified.

- a. Joint and Glazing Sealants: Perform tests as required by applicable publications referenced.
- b. Preformed Compression Gaskets and Seals: ASTM C 864.
- c. Preformed Lock-strip Gaskets: ASTM C 542, modified as follows: Heat age specimens seven days at 70 degrees C 158 degrees F, in zipped or locked position under full design compression. Unzip, cool for one hour, re-zip, and test lip seal pressure, which shall be minimum 0.045 kilograms per linear millimeter 2.5 pounds per linear inch on any extruded or corner specimen.
- d. Spandrel Glass: Fallout resistance test, ASTM C 1048.
- e. Porcelain Enamel: Acid resistance, color retention, and spall resistance tests, PEI 1001.
- f. Anodized Finishes: Stain resistance, coating weight, and coating thickness tests, ASTM B 136, ASTM B 137, and ASTM B 244, respectively.
- g. Insulating Glass: ASTM E 546 or ASTM E 576 at [minus 29 degrees C 20 degrees F] [____], no frost or dew point.

1.4.2 Mockup

NOTE: Size of project and system specified will determine whether mock-ups are necessary. Complete information should be given concerning extent,

details, and purpose of mock-ups. Where mock-ups have been previously tested for another project or for commercial production, they may serve the purpose. When testing of a mock-up is required, the unit should be erected at a testing laboratory or other location where adequate testing equipment is available.

1.4.2.1 Construction

Construct at [job site] [manufacturer's plant] [approved testing laboratory] full size typical wall unit which incorporates horizontal and vertical joints, framing, window units, panels, glazing, and other accessories as detailed and specified. Mock-up wall unit size and design shall be as indicated.

1.4.2.2 Performance Test

Conduct after approval of visual aspects has been obtained. Finished work shall match approved mock-up.

1.4.2.3 Approved Mock-Up

After completion and approval of test results [[transport mock-up to job site and] install, where directed, for reference during construction.] [Approved mock-up shall remain property of the Contractor.]

1.4.3 Factory Tests

NOTE: The overall performance requirements and tests will vary with the design and geographical location of the building as well as with the type of construction and components specified. Only those tests which are necessary to establish compliance with specifications should be included in the project specification. Refer to AAMA Curtain Wall Manual for detailed testing methods and the recommended minimum performance requirements and safety factors.

Perform the following tests except that where a curtain wall system or component of similar type, size, and design as specified for this project has been previously tested, under the conditions specified herein, the resulting test reports may be submitted in lieu of testing the components listed below:

- a. [_____]
- b. [_____]
- c. [_____]

1.4.3.1 Deflection and Structural Tests

No curtain wall framing member shall deflect, in a direction normal to the plane of the wall, more than 1/175 of its clear span or 20 mm 3/4 inch,

whichever is less, when tested in accordance with ASTM E 330, except that when a plastered surface will be affected the deflection shall not exceed 1/360 of the span. No framing member shall have a permanent deformation in excess of 0.2 percent of its clear span when tested in accordance with ASTM E 330 for a minimum test period of 10 seconds at 1.5 times the design wind pressures specified.

1.4.3.2 Water Penetration Test

NOTE: The test method of ASTM E 331 is that of determining resistance of the curtain wall to water penetration under uniform static air pressure difference. When testing under dynamic conditions is required, AAMA Specification 501 should be referenced. The availability of facilities for conducting dynamic testing is very limited and should be checked before specifying this type of test.

No water penetration shall occur when the wall is tested in accordance with ASTM E 331 at a differential static test pressure of 20 percent of the inward acting design wind pressure as specified, but not less than 0.19 kPa 4 psf. Make provision in the wall construction for adequate drainage to the outside of water leakage or condensation that occurs within the outer face of the wall. Leave drainage and weep openings in members and wall open during test.

1.4.3.3 Air Infiltration Test

Air infiltration through the wall, when tested in accordance with ASTM E 283, shall not exceed 0.005 cms per sq. m 0.06 cfm per square foot of fixed wall area, plus the permissible allowance specified for operable windows within the test area.

1.4.3.4 Delamination Test

Adhesively bonded metal-faced [[_____] faced] panels shall show no evidence of delamination, warpage or other deterioration or damage when subjected to the six "Accelerated Aging Cycles" specified in ASTM D 1037.

1.4.3.5 Thermal Conductance Tests

The thermal transmittance of opaque panels shall not exceed specified U-value, when tested in accordance with ASTM C 236. The average calculated thermal transmittance of the complete wall assembly including panels, windows, and all other components shall not exceed a U-value of [_____] . Determine U-values of components in accordance with ASTM C 236.

1.4.3.6 Window Tests

NOTE: Inert appropriate Section number and title in blank below using format per UFC 1-300-02.

Windows shall meet the requirements specified in [_____] except where the requirements of this section differ, this section shall govern. Windows

shall meet the same requirements for deflection and structural adequacy as specified for framing members when tested in accordance with ASTM E 330 except permanent deformation shall not exceed 0.4 percent; there shall be no glass breakage, and no permanent damage to fasteners, anchors, hardware, or operating devices. Windows shall have no water penetration when tested in accordance with ASTM E 331.

1.4.3.7 Fire Resistance Tests

NOTE: The exception to the smoke developed requirement as given in this paragraph does not apply to hospitals and confinement (correctional) facilities; insulation for these facilities must have a smoke developed rating not exceeding 150.

Insulation [provided in the curtain wall system] [field applied in conjunction with the curtain wall system] shall have a flame spread rating not exceeding 75 and a smoke developed rating not exceeding 150 when tested in accordance with ASTM E 84, except as specified otherwise herein.

- a. Insulation: Insulation [contained entirely within panel assemblies which meets the flame spread and smoke developed ratings of 75 and 150 respectively] [isolated from the building interior by masonry walls, masonry cavity walls, or encased in masonry cores] is not required to comply with the flame spread and smoke developed ratings specified.
- b. Curtain Wall Systems: Material for firestopping the opening between the edge of the floor slab and back of the curtain wall system, shall have not less than the flame spread and smoke developed ratings specified for insulation which is neither isolated from the building interior nor encased in masonry cores.
- c. Curtain Wall Panels: Panels for fire resistive curtain walls shall have a fire resistive rating of [_____] hours when tested in accordance with ASTM E 119.
- d. Firestopping Materials and Devices: Firestopping material and attachment devices shall be an effective barrier against the spread of fire, smoke, and gases for a period of [_____] hours when exposed to the conditions of the standard ASTM E 119 time-temperature curve for a period equivalent to the fire rating of the floor system and shall also be rated noncombustible when tested in accordance with ASTM E 136.

1.4.3.8 Sound Transmission Loss Test

Sound transmission loss (TL) of the wall shall be less than [_____] db, when tested in accordance with ASTM E 90 for the frequency range from [125] [_____] to [400] [_____] Hz.

1.5 GLAZED CURTAIN WALL SYSTEM REQUIREMENTS

NOTE: This specification is intended for use with glazed curtain walls for low rise buildings and multi-story buildings. Since aluminum shapes are

usually extruded and most other metal shapes are rolled-formed or brake-formed, the project drawings and details must show the materials and shapes desired. The Contractor should not be requested to submit alternate bids or be allowed to substitute one metal for another unless complete details are shown for each type of metal components permitted.

Provide system complete with framing, mullions, trim, [framed pre-assembled units,] panels, windows, glass, glazing, sealants, insulation, fasteners, anchors, accessories, concealed auxiliary members, and attachment devices for securing the wall to the structure as specified or indicated.

1.5.1 Source

Curtain wall system components shall be furnished by one manufacturer or fabricator; however, all components need not be products of the same manufacturer.

1.5.2 Design

NOTE: Refer to AAMA Curtain Wall Design Guide Manual "Testing, Types and Systems" for an explanation of the various curtain wall systems. The systems included in this guide specification are the standard architectural type as opposed to custom type. Generally the custom type of system is more expensive and should only be considered for special projects. When a system other than those listed is required this paragraph must be adjusted accordingly.

[Stick system] [Unit system] [Unit and mullion system] [[_____] system] with [mullions,] [horizontal rails,] [panels,] [window units,] [screens] [framed pre-assembled units with [integral] [nonintegral] spandrel panels [_____]]. Fully coordinate system accessories directly incorporated, and adjacent to contiguous related work and insure materials compatibility, deflection limitations, thermal movements, and clearances and tolerances as indicated or specified.

1.5.3 Thermal Movement

NOTE: The ambient temperature range appropriate to the geographic location of the project site should be inserted.

Fabricate, assemble, and erect system with adequate allowances for expansion and contraction of components and fastenings to prevent buckling damage, joint seal failure, glass breakage, undue stress on fastenings or other detrimental effects. For design purposes, base provisions for thermal movement on assumed ambient temperature range of from [_____] degrees C F to [_____] degrees C F.

1.5.4 Tolerances

NOTE: The finished wall system requires the coordination and efforts of many different manufacturers, suppliers, and construction trades. Contractor submittal requirements should include sufficient detail to insure coordination between them.

Design and erect wall system to accommodate tolerances in building frame and other contiguous work as indicated or specified. Provide with the following tolerances:

- a. Maximum variation from plane or location shown on approved shop drawings: one millimeter per 12 meters 1/8 inch per 12 feet of length up to not more than 13 mm 1/2 inch in any total length.
- b. Maximum offset from true alignment between two identical members abutting end to end in line: 2 mm 1/16 inch.

1.5.5 Structural Requirements

NOTE: When mullions are used to support window cleaning rigs, the loads on the mullion members created by the rigs must be considered in the mullion design and the appropriate figures listed in blank spaces.

No member shall deflect in a direction parallel to the plane of the wall, when carrying its full design load, more than an amount which will reduce the edge cover or glass bite below 75 percent of the design dimension. No member after deflection under full design load, shall have a clearance between itself and the top of the panel, glass, sash, or other part immediately below it less than 3 mm 1/8 inch; the clearance between the member and an operable window or door shall be minimum 2 mm 1/16 inch. [Design system members serving as guide rails for window cleaning equipment to carry mid-span concentrated load of [] kilograms pounds normal to plane of wall and [] kilograms pounds applied horizontally, parallel to wall plane without deflection which would affect adjacent surfaces.] Design entire system to withstand the indicated wind and concentrated loads, and the following wind loads acting normal to the plane of the wall:

- a. On the first [] stories above grade [] kPa psf acting inward, and the same load acting outward.
- b. On the next [] stories above grade [] kPa psf acting inward, and the same load acting outward.
- c. On corner areas, extending [] meters feet from the building corners on the [] stories, on all facades, the outward-acting (negative) design load shall be increased to [] kilopascals pounds per square foot.

1.6 QUALIFICATION OF WELDERS

Welding shall be performed by certified welders qualified in accordance with AWS D1.1/D1.1M using procedures, materials, and equipment of the type required for the work.

1.7 DELIVERY AND STORAGE

Inspect materials delivered to the site for damage; unload and store with a minimum of handling in accordance with recommendations contained in AAMA CW-10. Storage spaces shall be dry locations with adequate ventilation, free from heavy dust, not subject to combustion products or sources of water, and shall permit easy access for inspection and handling. Deliver calking and sealing compounds to the job site in sealed containers labeled to show the designated name, formula or specifications number; lot number; color; date of manufacturer; shelf life; and curing time when applicable.

1.7.1 Protective Covering

Prior to shipment from the factory, place knocked-down lineal members in cardboard containers and cover finished surfaces of [aluminum] [stainless steel] with protective covering of adhesive paper, waterproof tape, or strippable plastic. Covering shall not chip, peel, or flake due to temperature or weather, shall protect against discoloration and surface damage from transportation, and storage, and shall be resistant to alkaline mortar and plaster. Do not cover [aluminum] [stainless steel] surfaces that will be in contact with sealants after installation.

1.7.2 Identification

Prior to delivery, mark wall components to correspond with shop and erection drawings placement location and erection.

1.8 WARRANTY

NOTE: The warranty clause in this guide
specification has been approved by NAVFACENGCOMHQ in
accordance with the requirements of NAVFAC P-68.
The paragraph in this guide specification may be
used without any other HQ approval or request for
waiver.

Insulating glass units shall be guaranteed not to develop material obstruction of vision as a result of dust or film formation on the inner glass surface caused by failure of the seal, other than through glass breakage, within a period of 5 years from date of acceptance of work by the Government. Units failing to comply with the terms of this guarantee shall be replaced with new units without additional cost to the Government. The Contractor shall require the manufacturer to execute their warranties in writing directly to the Government.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Aluminum

Shall be free from defects impairing strength or durability of surface finish. Standard alloys shall conform to standards and designations of AA ASD1. Special alloys, not covered by the following ASTM specifications, shall conform to standards and designations recommended by the manufacturer for the purpose intended.

2.1.1.1 Wrought Aluminum Alloys

Shall be those which include aluminum alloying elements not exceeding the following maximum limits when tested and additional in accordance with ASTM E 34. These limits apply to both bare products and the core of clad products. The cladding of clad products shall be within the same limits except that the maximum zinc limit may be 2.5 percent in order to assure that the cladding is anodic to the core. Special wrought alloys with a silicon content not more than 7.0 percent will be acceptable for limited structural uses where special appearance is required:

<u>ALLOY</u>	<u>PERCENT</u>
Silicon	1.5
Magnesium, Manganese, and Chromium combined	6.0
Iron	1.0
Copper	0.4
Zinc	1.0

Within the chemical composition limits set forth above, wrought aluminum alloys shall conform to the following:

- a. Extruded bars, rods, shapes and tubes: ASTM B 221M ASTM B 221.
- b. Sheet and Plate: ASTM B 209M ASTM B 209.

2.1.1.2 Cast Aluminum Alloys

Provide those in which the alloying elements are silicon, magnesium, manganese, or a combination of these. Other elements shall not exceed the following limits:

<u>ELEMENT</u>	<u>PERCENT</u>
Iron	1.2
Copper	0.4
Nickel	0.4
Titanium	0.2

<u>ELEMENT</u>	<u>PERCENT</u>
Others (total)	0.5

Within the chemical composition limits set forth above, cast aluminum alloys shall conform to the following:

- a. Sand castings: ASTM B 26/B 26M.
- b. Die casting: ASTM B 85.
- c. Permanent mold castings: ASTM B 108.

2.1.1.3 Welding Rods and Electrodes

Welding rods and bare electrodes shall conform to AWS A5.10/A5.10M as recommended by the manufacturer of the aluminum base metal alloy being used.

2.1.1.4 Finish

Anodized finish on aluminum surfaces shall match in appearance or fall within the two extremes of color range of the approved samples. The following designation of finishes refer to standard finishes as defined in the NAAMM MFM. Aluminum used for framing shall have a color anodized finish designation AA-MIO-C22-A34 and AA-MIOC22-A44, meeting the requirements of AAMA 611.

2.1.1.5 Strength

Aluminum extrusions for framing members used in curtain walls and main frame and sash or ventilator members in windows shall have a minimum ultimate tensile strength of 152 MPa 22,000 psi and a minimum yield strength of 110 MPa 16,000 psi.

2.1.2 Bronze

Bronze sheets, tubes, and drawn shapes shall be commercial bronze, alloy No. 220. Extruded shapes shall be architectural bronze, alloy No. 385. Rolled or drawn rods shall be [commercial bronze, alloy No. 220] [or] [architectural bronze, alloy No. 385]. Bronze used for [_____] shall have a [_____] finish.

2.1.3 Copper

Conform to ASTM B 152M ASTM B 152, hot or cold-rolled of the temper suitable for the respective forming operations.

2.1.4 Carbon Steel

Conform to the following specifications:

- a. Rolled shapes, plates, and bars: ASTM A 36/A 36M.
- b. Galvanized sheets: ASTM A 653/A 653M.
- c. Sheets for porcelain enameling: ASTM A 424.
- d. Other sheets: ASTM A 570/A 570M or ASTM A 611.

2.1.5 Stainless Steel

NOTE: Type 316 stainless steel offers additional corrosion resistance through the addition of molybdenum. It is often recommended for use in salty or highly corrosive atmospheres. Since its cost is greater than Types 302 or 304, Type 316 should be specified only when the project requirements justify the additional cost.

Conform to ASTM A 167, Type 302 or 304, and finish in accordance with the NAAMM MFM conform to Metal Finishes Manual as follows:

- a. Concealed flashings: Dead soft fully annealed, [2 D finish] [[_____] finish].
- b. Exposed work: [No. 4 finish] [[_____] finish] to match approved sample.

2.1.6 Weathering High-Strength Low-Alloy Steel

NOTE: Water draining or dripping from weathering steel surface for the first two or three years while the oxide coating is developing, will contain oxide particles which may stain or streak adjacent materials. Permanent provisions must be made through design, detailing, and the selection of materials and colors to accommodate or divert this run-off water. Refer to weathering steel manufacturer's recommendations for suggested methods to prevent staining.

Weathering steel shall be a high-strength, low-alloy steel conforming to ASTM A 242/A 242M, ASTM A 588/A 588M, ASTM A 606, and ASTM A 607 as applicable to the shapes and thicknesses required. In addition, the steel shall be capable of developing a tightly adhered protective oxide coating when left unpainted and subjected to atmospheric exposure. Steel shall conform to the manufacturer's published mechanical properties and chemical composition. [Protect weathering steel used for [_____] on the unexposed side with a shop coat of paint.] Perform cleaning, surface preparation, handling, bolting, riveting, and welding of weathering steel in strict accordance with the specification and recommendations of the steel manufacturer.

2.1.7 High-Strength, Low-Alloy Steel

Conform to ASTM A 572/A 572M for structural shapes, plates, and bars.

2.1.8 Metal Fasteners

Provide fasteners as specified in paragraph entitled "Fastener Metals for Joining Various Metal Combinations" in "Part 2 - Products" of the AAMA MCWM-1. [Fastener metals used in connection with weathering steel shall be of type recommended by the weathering steel manufacturer.] Metals used for fasteners shall be chemically and galvanically compatible with contiguous

materials.

2.1.1.9 Porcelain Enamel

Apply to all areas of each unit over base metal surfaces of [metal facing panels,] [adhesively bonded panels, metal-faced,] in compliance with PEI 1001. Apply colored enamel to exposed faces as follows:

- a. Color: [____].
- b. Texture: [____].
- c. Gloss: [____].
- d. Thickness of coating: [____].

2.1.1.10 Joint Sealants and Accessories

NOTE: This specification permits the three listed compounds to be used at Contrators option. Each is acceptable for intended purpose. Do not use silicone type sealants in horizontal surfaces where water occurs over the joint. For projects where it is desirable to limit sealant types, revised text accordingly.

Provide manufacturer's standard colors as closely matching the adjacent surfaces as possible.

2.1.10.1 Elastomeric, Single or Multiple Component

ASTM C 920, [Type S, single component] [Type M, multiple component]. Use Grade NS, nonsag type in joints on vertical surfaces and use Grade P, self-leveling or flow type, in joints on horizontal surfaces.

2.1.10.2 Single Component Silicone Rubber Base

ASTM C 920, Type S, Grade NS (Silicone).

2.1.10.3 Solvents and Primers

Provide material which is quick drying, colorless, nonstaining, compatible with compound used, as recommended by sealant manufacturer. Where primer is specified or recommended by sealant manufacturer, tests related to that material shall include primer.

2.1.10.4 Backing Material

Provide material which is nonstaining, nonabsorbent, and compatible with sealing compound. Closed cell resilient urethane, polyvinylchloride or polyethylene foam; closed-cell sponge of vinyl or rubber; closed cell neoprene or butyl rod; or polychloroprene tubes or beads.

2.1.10.5 Bond Preventive Materials

Provide polyethylene tape with pressure-sensitive adhesive; aluminum foil or waxed paper.

2.1.10.6 Preformed Sealing Compound

Provide nonskinning type conforming to AAMA 800. Tapes, beads, ribbons or other shapes as required.

2.1.11 Glass and Glazing

[Materials are specified under Section 08800 GLAZING.] [Conform to ASTM C 1036, except ASTM C 1048 for spandrel glass. All glazing material must be certified as meeting 16 CFR 1201.]

2.1.11.1 Glass Sizes and Clearances

Sizes indicated are nominal. Verify actual sizes required by measuring frames. Coordinate dimensions for glass and glass holding members to meet applicable minimum clearances as recommended by glass manufacturer. Do not nip to remove flares or to reduce oversized dimensions.

2.1.11.2 Clear Primary Float Glass

Provide Type I, Class I, quality q3, [6 mm1/4 inch thick] [_____].

2.1.11.3 Heat-Absorbing Glass

Clean cut, Type [I] [II], Class [2], style [A] [B], [_____] in color, thickness [[_____] mm inch] [as indicated].

2.1.11.4 Insulating Glass

Fused glass, banded, or unbanded. Banded type, ASTM E 774, Class [A] [_____] shall have perimeter banded or sealed, and encased in a nonferrous metal or stainless steel frame. Unbanded type shall have perimeter sealed by manufacturer's standard organic sealant. Do not field cut.

2.1.11.5 Spandrel Glass [With Adhered Backing]

ASTM C 1048, kind FT or HS, condition B, Type I, [_____] thickness [[_____] mm inch] [as indicated].

2.1.11.6 Glass Setting Materials

- a. Sealants and preformed sealing compounds: Shall be as specified under paragraph entitled "Joint Sealant and Accessories."
- b. Preformed compression gaskets and seals: ASTM C 864, color [black] [_____]. Gaskets used for [_____] shall have durable compatible, and colorfast coating.
- c. Preformed lock-strip type gaskets: ASTM C 542, factory formed, color [black] [_____]. Provide separate filler or locking strips, approximately 10 Shore "A" Durometer points harder than gasket body, and insure permanent and continuous pressure of sealing lips. Grooves and ends shall be square butted or mitered 45 degrees.
- d. Setting blocks, edge blocks, and spacer shims: Fabricate from neoprene or other materials recommended by glass manufacturer compatible with compounds, sealants, or gaskets used. Unless

otherwise recommended by the glass manufacturer, shore "A"
Durometer hardness for setting and edge blocks shall be 90 plus or
minus 5; for spacer shims, 50 plus or minus 5.

2.1.12 Firestopping Material

NOTE: Refer to AAMA TIR-A3-1975, "Fire Resistive
Design Guidelines for Curtain Wall Assemblies," for
other recommended materials and methods used for
firestopping the opening between the curtain wall
and floor edges.

[Portland cement concrete of same design and strength as floor slab] [As
specified in Section 03300N CAST-IN-PLACE CONCRETE] [Mineral fiber
manufactured from asbestos-free materials, and conforming to ASTM C 612 or
ASTM C 665, meeting fire resistance requirements specified].

2.1.13 Tempered Hardboard

AHA A135.4, Class 1, [_____] mm inch thick.

2.1.14 Screens

ASTM D 3656, Class 2, 18 by 14 mesh, color [charcoal] [grey] [_____] .

2.1.15 Paint and Finishes

2.1.15.1 Primer

NOTE: Zinc chromate, strontium chromate and lead
coatings are not allowed.

Zinc-molydate, alkyd type.

2.1.16 Panels

NOTE: Double glazing and thermal breaks in wall and
window framing systems will result in considerable
reduction of heat transmission through wall system.
Refer to ASHRAE Handbook of Fundamentals, and AAMA
Curtain Wall Manual, "Design for Energy Conservation
in Aluminum Curtain Walls" for additional
information on heat transmission losses and
condensation on interior surfaces.

NOTE: When other types of panels are required the
text must be modified accordingly. When nonmetallic
panels such as stone, precast concrete, tile or
other materials are required, they must be included
in the project specification. All panels which are
a part of the wall system, regardless of the
material or type, must be included as a part of the

curtain wall specification.

Maximum U-value [____]. Where, in order to meet the requirements specified, the proposed panel assembly is thicker than indicated, make corresponding adjustments in accessories and other work such as door, window and louver frames, flashing, coping, and trim products at no extra cost to the Government. Unless otherwise indicated, design for installation from outside the building. Provide vapor barrier on interior face of insulation. Seal edges of panels with cores of absorptive material to prevent entrance of water and allow venting of the core space to outside air.

2.1.16.1 Metal Facing Panels, Single Thickness

Metal facing panels shall be single thickness. Panel facing shall be [flat sheet] [textured] [impressed-relief] [____] type, made of [porcelain enamel] [aluminum] [bronze] [stainless steel] and, with [backside stiffeners] [or] [edge flanges] spaced as required to meet flatness specified. Where indicated, backup panels with [____].

2.1.16.2 Adhesively Bonded Panels

NOTE: The same metal should be used on both the exposed and nonexposed faces of the panels, particularly in the case of aluminum, in order to minimize differential thermal expansion between the faces and thus reduce potential warping or buckling of the panel.

Adhesively bonded panels shall be sandwich type, metal faced both sides, and bonded to form stable and composite unit. Nonexposed face shall be [galvanized steel] [____]. Exposed face shall be [porcelain enamel] [aluminum] [bronze] [stainless steel] [weathering steel] [____] of thickness indicated, with continuous laminated backing or internal stiffening ribs or breaks spaced as required to meet flatness specified. The nonexposed face shall be [galvanized steel] [____] of the thickness indicated. Maximum slope of exposed face surface at any point, measured from nominal plane, shall not exceed the following:

- a. 1.0 percent for high reflectivity finish.
- b. 1.25 percent for medium reflectivity finish.
- c. 1.5 percent for low reflectivity finish.

2.1.16.3 Nonmetallic Panels

- a. Panels shall be glass-faced on the side that will be exposed to view. Glass shall be spandrel glass with ceramic coating on its nonweathering surface and [smooth] [____] finish on the exposed surface [; backing shall be adhesively bonded to nonweathering surface]. Backing shall be [____] and shall include [galvanized steel] [____] on surface nearest the building. Color of glass when viewed from the surface that will be exposed after installation shall be [____]. Where indicated, glass panels shall be backed up with [____].

- b. Adhesively bonded insulated panels shall be nonmetallic faced, sandwich type, [_____] [tempered hardboard] on exposed face and on nonexposed face. Apply coating of [epoxy] [polyester] [_____] followed by application of [inert aggregate] [_____] to exposed face in the [factory] [field]. [Inert aggregate] [_____] shall be [natural stone chips] [crushed marble] [_____] [with minimum and maximum sizes of [_____] and [_____]]. Color of [_____] shall be [_____].
- c. Nonmetallic panels, [_____] surfaced: [_____] [tempered hardboard] [_____] board base with applied [factory] [or] [field] finish of [[_____] resins and decorative natural stone chips] [_____] . Apply [epoxy] [polyester] coating of [_____] followed by application of [inert aggregate] [_____] to exposed face in the [factory] [field]. [Inert aggregate] [_____] shall be [natural stone chips] [crushed marble] [_____] [with minimum and maximum sizes of [_____] and [_____]]. Color of [_____] shall be [_____].

2.1.17 Metal Windows

NOTE: Insert appropriate Section number and title
in blank below using format per UFC 1-300-02.

[Fixed] [Operating] [Fixed and operating]. Comply with requirements of [_____] , [Steel] [Aluminum] Windows [_____] [AAMA 101] [SWI SGSW] as modified herein. Provide inside glazing with removable metal glazing beads [except for windows having structural gaskets]. Comply with glass clearance dimensions and sealant dimensions recommended by glass manufacturer.

2.1.17.1 Frames

Frames for fixed glazed panels and window units shall be [aluminum] [bronze] [stainless steel] [steel].

2.1.17.2 Operating Windows

Operating windows shall be [double-hung] [projected] [horizontally pivoted] [vertically pivoted] [top-hinged inswinging] [horizontal sliding] [casement] [_____] type. [Operating windows shall be complete with hardware, weatherstripping, and accessories.] Hardware shall comply with [AAMA 101] [SWI SGSW] modified as follows:

- a. Metal and finish for hardware shall be [_____].
- b. [_____].

2.1.17.3 Window Construction

Weld or mechanically join and seal corners of frames and ventilators for water-tight construction. Remove excess metal from welded joints and dress smooth on exposed and contact surfaces so that no objectionable discoloration or roughness will be visible after finishing. Apply sealing compound in interior surfaces of corners and frame intersections.

2.1.18 Insect Screens

NOTE: Where metal accessories mentioned herein
occur in connection with metal curtain walls, the
kind and gage of metal should be shown or specified.

NOTE: Insert appropriate Section number and title
in blank below using format per UFC 1-300-02.

Provide insect screens for ventilators of [_____] windows [_____] in accordance with [_____] [Steel] [Aluminum] Windows [_____] [AAMA 101] [SWI SGSW]. Screens for double-hung windows shall be [full length, top-hung type] [double vertical sliding type] [half-length fixed type]. Screens for [projected] [casement] [_____] windows shall be [_____] type. Screens shall be mounted on [inside] [outside] of windows. Screens shall be rewirable, easily removable from inside the building, and interchangeable for same size ventilators of similar type windows. Provide hardware, guides, stops, clips, bolts, and screws as necessary for a secure and tight attachment to window. [Where sliding or hinged wickets are required in screens to permit operation of window hardware, the frame around the wicket opening shall be of similar material and strengths as the screen frames.]

- a. Frames: Construct screen frames of similar material and finish as specified for the windows to which attached. Screen frame construction shall consist of closed tubular shapes standard with the manufacturer, either extruded or roll formed. Frames shall be mitered, electrically flash welded, then dressed smooth; or shall have internal reinforcing or blocks at corners and mechanically connected corners. Screen frames shall have removable splines of aluminum, stainless steel, or vinyl.
- b. Screening: Weave of screening shall be parallel with frames and sufficiently tight to present a smooth appearance. Conceal edges of screening in spline channel of frames.
- c. Hardware: Screen hardware shall be manufacturer's standard type and finish, unless otherwise indicated.

2.1.19 Metal Accessories

[Gravel stops and fascias,] [Flashings,] [Metal sills,] [Metal stools,] [Louvers,] [Venetian blind pockets,] [Closures,] [and soffits] [_____] . Fabricate accessories of sizes and shapes indicated from similar materials and finish as specified for wall system.

PART 3 EXECUTION

3.1 FABRICATION

The curtain wall components shall be of the materials and thickness indicated or specified. The details indicated are representative of the required design and profiles. Acceptable designs may differ from that shown if the proposed system components conform to the limiting dimensions indicated and the requirements specified herein. Unless specifically indicated or specified otherwise, the methods of fabrication and assembly

shall be at the discretion of the curtain wall manufacturer. Perform fitting and assembling of components in the shop to the maximum extent practicable. Anchorage devices shall permit adjustment in three directions. Exposed fastenings used on finished surfaces shall be truss head, flat head, or oval head screws or bolts.

3.1.1 Joints

Provide welded or mechanical fasteners as indicated or specified. Match joints in exposed work to produce continuity of line and design. Bed-joints or rabbets receiving calking or sealing material shall be minimum 20 mm 3/4 inch deep and 10 mm 3/8 inch wide at mid ambient temperature range.

3.1.2 Welding

Conform to AWS D1.1/D1.1M. Use methods and electrodes recommended by manufacturers of base metal alloys. Welding rods shall be of an alloy that matches the color of the metal being welded. Protect glass and other finish from exposure to welding spatter. Ground and finish weld beads on exposed metal surfaces to minimize mismatch and to blend with finish on adjacent parent metal. If flux is used in welding aluminum, completely remove it immediately upon completion of welding operations. Do not use exposed welds on aluminum surfaces.

3.1.3 Soldering and Brazing

Provide as recommended by suppliers. Solder only for filling or sealing joints.

3.1.4 Ventilation and Drainage

Provide internal ventilation drainage system of weeps or based on principles of pressure equalization to ventilate the wall internally and to discharge condensation and water leakage to exterior as inconspicuously as possible. Flashings and other materials used internally shall be nonstaining, noncorrosive, and nonbleeding.

3.1.5 Protection and Treatment of Metals

3.1.5.1 General

Remove from metal surfaces lubricants used in fabrication and clean off other extraneous material before leaving the shop.

3.1.5.2 Galvanic Action

Provide protection against galvanic action wherever dissimilar metals are in contact, except in the case of aluminum in permanent contact with galvanized steel, zinc, stainless steel, or relatively small areas of white bronze. Paint contact surfaces with one coat bituminous paint or apply appropriate calking material or nonabsorptive, noncorrosive, and nonstaining tape or gasket between contact surfaces.

3.1.5.3 Protection for Aluminum

Protect aluminum which is placed in contact with, built into, or which will receive drainage from masonry, lime mortar, concrete, or plaster with one coat of alkali-resistant bituminous paint. Where aluminum is contacted by absorptive materials subject to repeated wetting or treated with

preservative noncompatible with aluminum, apply two coats of aluminum paint, to such materials and seal joints with approved calking compound.

3.2 INSTALLATION

Installation and erection of glazed wall system and all components shall be performed under direct supervision of and in accordance with approved recommendations and instructions of wall system manufacturer or fabricator.

3.2.1 Bench Marks and Reference Points

Establish and permanently mark bench marks for elevations and building line offsets for alignment at convenient points on each floor level. Should any error or discrepancy be discovered in location of the marks, stop erection work in that area until discrepancies have been corrected.

3.2.2 Verifying Conditions and Adjacent Surfaces

After establishment of lines and grades and prior to system installation examine supporting structural elements. Verify governing dimensions, including floor elevations, floor to floor heights, minimum clearances between curtain wall and structural frames, and other permissible dimensional tolerances in the building frame.

3.2.3 Panels

Install panels [in framing member openings] [into framed pre-assembled units] [_____] using [sealants] [gaskets] [gaskets and sealants] [_____] as indicated or specified.

3.2.4 Windows

Install windows in accordance with details indicated and approved detail drawings.

3.2.4.1 Sealing

Seal exterior metal to metal joints between members of windows, frames, mullions, and mullion covers. Remove excess sealant.

3.2.4.2 Ventilators and Hardware

After installing and glazing windows, adjust ventilators and hardware to operate smoothly and to be weathertight when ventilators are closed and locked. Lubricate hardware and moving parts.

3.2.4.3 Weatherstripping

Install to make weathertight contact with frames when ventilators are closed and locked. Do not cause binding of sash or prevent closing and locking of ventilator.

- a. Provide for ventilating sections of all windows to insure a weather-tight seal meeting the infiltration tests specified. Use easily replaceable factory-applied weatherstripping of manufacturer's stock type. Use molded vinyl, molded or molded-expanded neoprene for weatherstripping for compression contact surfaces. For sliding surfaces, use treated woven pile or wool, polypropylene or nylon pile with nylon fabric and metal or

plastic backing strip weatherstripping. Do not use neoprene or polyvinyl chloride weatherstripping where they will be exposed to direct sun light.

3.2.5 Joint Sealants

3.2.5.1 Surface Preparation

Surfaces to be primed and sealed shall be clean, dry to the touch, free from frost, moisture, grease, oil, wax, lacquer, paint, or other foreign matter. Enclose joints on three sides. Clean out grooves to proper depth. Joint dimensions shall conform to approved detail drawings with a tolerance of plus 3 mm 1/8 inch. Do not apply compound unless ambient temperature is between 4 and 32 degrees C 40 and 90 degrees F. Clean out loose particles and mortar just before sealing. Remove protective coatings or coverings from surfaces in contact with sealants before applying sealants or tapes. Solvents used to remove coatings shall be of type that leave no residue on metals.

3.2.5.2 Applications

Match approved sample. Force compound into grooves with sufficient pressure to fill grooves solidly. Sealing compound shall be uniformly smooth and free of wrinkles and, unless indicated otherwise, shall be tooled and left sufficiently convex to result in a flush joint when dry. Do not trim edges of sealing material after joints are tooled. Mix only amount of multi-component sealant which can be installed within four hours, but at no time shall this amount exceed 19 liters 5 gallons.

3.2.5.3 Primer

Apply to masonry, concrete, wood, and other surfaces as recommended by sealant manufacturer. Do not apply primer to surfaces which will be exposed after calking is completed.

3.2.5.4 Backing

Tightly pack in bottom of joints which are over 13 mm 1/2 inch in depth with specified backing material to depth indicated or specified. Roll backing material of hose or rod stock into joints to prevent lengthwise stretching.

3.2.5.5 Bond Prevention

Install bond preventive material at back or bottom of joint cavities in which no backstop material is required, covering full width and length of joint cavities.

3.2.5.6 Protection and Cleaning

Remove compound smears from surfaces of materials adjacent to sealed joints as the work progresses. Use masking tape on each side of joint where texture of adjacent material will be difficult to clean. Remove masking tape immediately after filling joint. Scrape off fresh compound from adjacent surfaces immediately and rub clean with approved solvent. Upon completion of calking and sealing, remove remaining smears, stains, and other soiling, and leave the work in clean neat condition.

3.2.6 Glass

Install in accordance with manufacturer's recommendations as modified herein. [Install insulating glass units made with heat absorbing glass with heat absorbing pane on exterior side.]

3.2.6.1 Inspection of Sash and Frames

Before installing glass, inspect sash and frames to receive glass for defects such as dimensional variations, glass clearances, open joints, or other conditions that will prevent satisfactory glass installation. Do not proceed with installation until defects have been corrected.

3.2.6.2 Preparation of Glass and Rabbets

Clean sealing surfaces at perimeter of glass and sealing surfaces of rabbets and stop beads before applying glazing compound, sealing compound, glazing tape, or gaskets. Use only approved solvents and cleaning agents recommended by compound or gasket manufacturer.

3.2.6.3 Positioning Glass

Set glass from inside the building unless otherwise indicated or specified. Maintain specified edge clearances and glass bite at perimeter. Maintain position of glass in rabbet and provide required sealant thickness on both sides of glass. For glass dimensions larger than 1270 united millimeters 50 united inches, provide setting blocks at sill and spacer shims on all four sides; locate setting blocks one quarter way in from each jamb edge of glass. Where setting blocks and spacer shims are set into glazing compound or sealant, butter with compound or sealant, place in position, and allow to firmly set prior to installation of glass.

3.2.6.4 Setting Methods

NOTE: Select methods applicable to the project conditions and details. Delete non-applicable methods. Methods listed are typical for many glass and sealant manufacturers; other suitable methods may also be included.

Apply glazing compound, glazing sealant, glazing tape, and gaskets uniformly with accurately formed corners and bevels. Remove excess compound from glass and sash. Use only recommended thinners, cleaners, and solvents. Strip surplus compound from both sides of glass and tool at slight angle to shed water and provide clean sight lines. Secure stop beads in place with suitable fastenings. Do not apply compound or sealant at temperatures lower than 4 degrees C 40 degrees F, or on damp, dirty, or dusty surfaces. After glazing, fix ventilators in sash so they cannot be operated until compound or sealant has set.

- a. Use sealant glazing to completely fill channel on edges and on both sides of glass for [_____].
- b. Use sealant and tape glazing, with glazing sealant for cap bead above glazing tape against fixed exterior stops and glazing tape full height against removable interior stops for [_____].

- c. Use sealant and tape glazing, with glazing sealant full height against removable exterior stops with heel bead or glazing sealant and glazing tape full height against fixed interior stops for [_____].
- d. Use sealant and tape glazing, with glazing sealant cap beads above glazing tape against both exterior and interior stops for [_____]. Removable stops may be on either exterior or interior side of glass.
- e. Use tape, sealant, and compound glazing, with glazing tape full height against fixed exterior stops, glazing compound as a cap bead above heel bead sealant and against removable interior stops for [_____].
- f. Use tape, sealant, and gasket glazing, with glazing tape full height against fixed exterior stops, glazing sealant as a heel bead at edge of glass, and preformed vision strip gasket against removable interior snap-on stops for [_____].
- g. Use compression gasket glazing, with compression gaskets both sides of glass and adjustable or snap-on interior stops for [_____].
- h. Use lock-strip gasket glazing, with lock-strip glazing gaskets for [_____]. Install gaskets in accordance with manufacturer's instructions using special tools and lubricants. When lock-strip type gaskets are used for glazing insulating glass units, follow glass manufacturer's recommendations regarding horizontal wall supports between vertical units, setting blocks, weep holes, and the use of supplementary wet sealants.

3.2.6.5 Void Space

Heat absorbing, insulating, spandrel, and tempered glass, and glass of other types that exceed 2540 united millimeters 100 united inches in size: Provide void space at head and jamb to allow glass to expand or move without exuding the sealant.

3.2.6.6 Insulating Glass

Provide adequate means to weep incidental water and condensation away from the sealed edges of insulated glass units and out of the wall system. The weeping of lock-strip gaskets should be in accordance with the recommendation of the glass manufacturer.

3.2.6.7 Insulating Glass With Edge Bands

Insulating glass with flared metal edge bands set in lock-strip type gaskets: Follow glass manufacturer's recommendations and add supplementary wet seal as required; when used with glazing tape, use tapered tape.

3.2.7 Firestopping

Provide firestopping [, where indicated,] in openings between wall system and floor at each story to prevent passage of flame and hot gases from floor to floor under extended fire exposure. Installed fire stopping shall remain in place under extended fire exposure despite distortions that may occur in wall system components. Securely attach anchoring or containment

devices to building structure and not to wall system. Place [concrete]
[mineral fiber] [_____] on [steel plates attached to bottom of floor slab]
[impaling chips embedded in edge of floor slab] [_____].

3.2.8 Field Applied Insulation

NOTE: Where project specifications do not include a
separate section for field applied insulation, add
here and delete cross-reference to other section.
Where field applied insulation is specified in
another section, keep cross-reference and coordinate
fire rating and U-value with the other section. See
paragraph entitled "Fire Resistance Tests" for fire
rating requirements of insulation.

NOTE: Insert appropriate Section number and title
in blank below using format per UFC 1-300-02.

Provide insulation with minimum R-value of [_____] , on clean, dry, properly
prepared surfaces of [masonry] [concrete] [_____] back-up wall in
accordance with [_____] INSULATION using approved accessories and methods
as recommended by insulation manufacturer unless indicated or specified
otherwise. Cover and protect each day's application until protection is
provided by completed work.

3.3 FINISHES

3.3.1 Galvanizing

Conform to ASTM A 123/A 123M, ASTM A 153/A 153M, and ASTM A 653/A 653M, as
applicable.

3.3.1.1 Repair of Zinc-Coated Surfaces

Repair zinc coated surfaces damaged by welding or other means with
galvanizing repair paint or by application of stick or thick paste material
specifically designed for repair of galvanizing, as approved.

3.3.2 Shop Cleaning and Painting

3.3.2.1 Cleaning

Clean steel and iron work by power wire brushing or other approved manual
or mechanical means, for removal of rust, loose paint, scale, and
deleterious substances. Wash cleaned surfaces which become contaminated
with rust, dirt, oil, grease, or other foreign matter, with solvents until
thoroughly clean. Cleaning steel embedded in concrete is not required.

3.3.2.2 Painting Steel or Iron Surfaces

[Apply one coat of primer.] [Apply primer to a minimum dry film thickness
of 0.025 mm 1.0 mil.] Apply additional shop coat of specified paint, to
which a small amount of tinting material has been added, on surfaces that
will be concealed in the finished construction or that will not be
accessible for finish painting. Accomplish painting in dry weather or under

cover, and on steel or iron surfaces that are free from moisture and frost. Do not paint surfaces of items to be embedded in concrete. Recoat damaged surfaces upon completion of work. Prime coat steel immediately after cleaning. Do not apply bituminous protective coatings to items to be finish painted.

3.3.2.3 Painting Weathering Steel

Clean and paint surfaces which will not be exposed to the weather with one shop or field coat of specified primer, or other approved rust-inhibitive primer. Clean and strip-paint weathering steel contact surface to be covered by structural or compression gaskets or sealants with one coat to insure positive seal.

3.4 FIELD TESTS

Conduct field check test for water leakage on designated wall areas after erection. Conduct test on [two] [_____] wall areas, two bays wide by two stories high where directed. Conduct test and take necessary remedial action as described in AAMA 501.

3.5 CLEANING AND PROTECTION

3.5.1 Glass

Upon completion of wall system installation, thoroughly wash glass surfaces on both sides and remove labels, paint spots, putty, compounds, and other defacements. Replace cracked, broken, and defective glass with new glass at no additional cost to the Government.

3.5.2 Aluminum Surfaces

Protection methods, cleaning, and maintenance shall be in accordance with AAMA 609/610 and AAMA 609/610.

3.5.3 Other Metal Surfaces

After installation, protect windows, panels, and other exposed surfaces from disfiguration, contamination, contact with harmful materials, and from other construction hazards that will interfere with their operation, or damage their appearance or finish. Protection methods shall be in accordance with recommendations of product manufacturers or of the respective trade association. Remove paper or tape factory applied protection immediately after installation. Clean surfaces of mortar, plaster, paint, smears of sealants, and other foreign matter to present neat appearance and prevent fouling of operation. In addition, wash with a stiff fiber brush, soap and water, and thoroughly rinse. Where surfaces become stained or discolored, clean or restore finish in accordance with recommendations of product manufacturer or the respective trade association.

3.6 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>
Glass	1/4 inch	6 mm

-- End of Section --