

BuildingName
The Description of the Project
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SPECIFICATION DIVISION 8

NUMBER SECTION DESCRIPTION

DIVISION 08 OPENINGS

SECTION 084413 - GLAZED ALUMINUM CURTAIN WALLS

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DIVISION 08 OPENINGS

SECTION 084413 - GLAZED ALUMINUM CURTAIN WALLS

SEPTEMBER 2011

DETERMINE EARLY IN DESIGN WHETHER TO USE UNITIZED OR STICK-BUILT CONSTRUCTION. UNITIZED PROVIDES BETTER QUALITY CONTROL AND FASTER ERECTION (MUCH LESS SITE LABOR REQUIRED) BUT IS CONSIDERABLY MORE EXPENSIVE AND DIFFICULT TO OBTAIN ON SMALLER PROJECTS. CONSIDER UNITIZED CONSTRUCTION IF THERE IS 40,000 SQ. FT. OR MORE OF CURTAIN WALL (NOT FLOOR AREA) AND ELEVATION IS A REGULAR PATTERN WHICH LENDS ITSELF TO PREFABRICATED COMPONENTS.

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including Standard General Conditions, Supplemental General Conditions, Division 01 Specification Sections, and other applicable Specification Sections, apply to this Section.
- B. Related Sections:

FIRST TWO SECTIONS BELOW ARE NOT PART OF AEC MASTERSPEC. DELETE UNLESS SECTIONS ARE ADDED TO PROJECT SPECIFICATIONS.

- 1. Division 07 Section: Air Barriers.
- 2. Division 07 Section: Flashing and Sheet Metal.
- 3. Division 07 Section "Penetration Firestopping"

1.2 SUMMARY

SYSTEM SPECIFIED BELOW IS TYPICAL. EDIT IF CUSTOM ASSEMBLIES ARE REQUIRED.

- A. Section includes:
 - 1. Conventionally glazed pressure equalized aluminum curtain walls installed as [unitized] [stick-built] assemblies.
 - 2. Delegated Design: Curtain walls shall be designed by the manufacturer to comply with specified performance requirements and design criteria.

EDIT APPLICABLE SECTIONS TO SUIT PROJECTS.

- B. Work Provided Under This Section But Specified Under Other Sections:
 - 1. The Work of this Section and applicable portions of the work of the following Sections that are related to this Section, shall be performed by a Prime contractor providing window and curtain wall products, to establish single source responsibility for glazed aluminum curtain walls and associated components.
 - a. Division 07 Section "Joint Sealants."

- b. Division 08 Section "Aluminum-Framed Entrances and Storefronts."
- c. Division 08 Section "Aluminum Windows."
- d. Division 08 Section "Door Hardware."
- e. Division 08 Section "Glazing."

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: Include plans, elevations, sections, full-size details, adjacent construction and attachments to other work.
 - 1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
 - 2. Include full-size isometric details of each vertical-to-horizontal intersection of curtain walls, showing the following:
 - a. Joinery, including concealed welds.
 - b. Anchorage.
 - c. Expansion provisions.
 - d. Glazing.
 - e. Flashing and drainage.

CURTAIN WALL IS REQUIRED TO WITHSTAND THE DESIGN LOADS WHICH ARE DETERMINED BY THE STRUCTURAL ENGINEER. RESPONSIBILITY FOR THE DESIGN OF CURTAIN WALL SYSTEM MEETING THOSE DESIGN LOADS AND OTHER PERFORMANCE CRITERIA HAVE BEEN DELEGATED TO THE CURTAIN WALL MANUFACTURER.

- C. Delegated-Design Submittal: Submit analysis data signed and sealed by the qualified Professional Engineer employed by the curtain wall manufacturer who is responsible for their preparation.
 - 1. Show section moduli of wind-load-bearing members and calculations of stresses and deflections. Provide material properties and other information needed for structural analysis including computations.
 - 2. Submit statement by the Professional Engineer attesting that all materials provided under this section, and related Sections, meet specified requirements.
- D. Samples for Initial Selection: Indicating factory-applied color finishes.

DELETE "SAMPLES FOR INITIAL SELECTION" PARAGRAPH ABOVE IF COLORS AND OTHER CHARACTERISTICS ARE PRESELECTED AND SPECIFIED OR SCHEDULED. ALWAYS RETAIN FOLLOWING 2 PARAGRAPHS WITH OR WITHOUT ABOVE PARAGRAPH.

- E. Samples for Verification: For each type of exposed finish required, in minimum 8-inch lengths.
 - 1. Include 3 or more units in each sample set showing the extreme limits of variations expected in color and texture of finish.

RETAIN PARAGRAPH BELOW TO VERIFY DETAILS OF ASSEMBLY.

- F. Fabrication Sample: Of each vertical-to-horizontal intersection of assemblies, made from 12-inch lengths of full-size components and showing details of the following:

REVISE LIST BELOW TO SUIT PROJECT.

- 1. Joinery, including concealed welds.
 - 2. Anchorage.
 - 3. Expansion provisions.
 - 4. Glazing.
 - 5. Flashing and drainage.
- G. Qualification Data for curtain wall installer demonstrating that installer is qualified for the Project.
 - H. Qualification Data for curtain wall manufacturer's preconstruction testing agency indicating specified certifications and experience.
 - I. Qualification Data for the Professional Engineer employed by the curtain wall manufacturer who is responsible for curtain wall design.

RETAIN PARAGRAPH BELOW IF RETAINING PROCEDURES FOR WELDER CERTIFICATION IN "QUALITY ASSURANCE" ARTICLE.

- J. Certificates for AWS certified welders.
- K. Energy Performance Certificates: For curtain walls, accessories, and components, from manufacturer.
 - 1. Basis for Certification: NFRC-certified energy performance values for each glazed aluminum curtain wall.

RETAIN PARAGRAPH BELOW FOR STANDARD ASSEMBLIES TO VERIFY COMPLIANCE WITH PERFORMANCE REQUIREMENTS. REVISE FOR CUSTOM ASSEMBLIES.

- L. Product Test Reports: Indicating compliance with structural and performance requirements based on comprehensive tests performed by preconstruction testing agency, on curtain wall units matching the system proposed for this Project.
- M. Field quality-control reports are submitted by Owner's Independent testing Agency.
- N. Warranties: Signed original warranty documents from the curtain wall manufacturer indicating the specified terms and conditions for each curtain wall and component.
- O. Maintenance Data for Curtain walls to include in maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Manufacturers and Products: The products and manufacturers specified in this Section establish the standard of quality for the Work. Subject to compliance with all requirements, provide specified products from the manufacturers named in Part 2.

- B. Reference Standards: Products in this section shall be built, tested, and installed in compliance with the specified quality assurance standards; latest editions, unless noted otherwise.
1. Glass Association of North America (GANA) "Glazing Manual."
 2. Applicable standards of the American Architectural Manufacturers Association (AAMA), including but not limited to:
 - a. AAMA 1503 Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections
 - b. AAMA 2605 Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.
 - c. AAMA 611 Voluntary Specification for Anodized Architectural Aluminum.
 3. Standards of ASTM International which are referenced in other Articles of this Section.
 4. National Fenestration Rating Council (NFRC) Documents and Rating System, including, but not limited to:
 - a. NFRC 100 Procedure for Determining Fenestration Product U-factors
 - b. NFRC 200 Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence
 - c. NFRC 500-2010 Procedure for Determining Fenestration Product Condensation Resistance Values
- C. Delegated Design: A qualified Professional Engineer registered in Michigan, employed by the curtain wall manufacturer, shall design curtain wall assemblies, including aluminum windows where applicable, doors, glazing and all accessories for this project. The curtain wall assembly shall be manufactured, assembled and installed to withstand the structural load requirements as specified in this Section, the Building Code, and expected loads calculated for the building, based data indicated on the Drawings. Refer to Part 2 Performance Requirements for additional information.
- D. Manufacturer's Preconstruction Testing Agency Qualifications: Qualified according to ISO/IEC 17025 and accredited by ICC-ES for preconstruction testing indicated.
- E. Curtain Wall Manufacturer Qualifications: A manufacturer capable of fabricating curtain walls that meet or exceed specified energy performance requirements and of documenting this performance.
- F. Curtain Wall Installer Qualifications: Installer who has had successful experience with installation of the same or similar systems required for the project and other projects of similar size and scope.

RETAIN PARAGRAPH BELOW IF WELDING IS REQUIRED. IF RETAINING, ALSO RETAIN "WELDING CERTIFICATES" PARAGRAPH IN "SUBMITTALS" ARTICLE.

- G. Welding Qualifications: Qualify procedures and personnel according to the following:

RETAIN APPLICABLE SUBPARAGRAPHS BELOW.

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."

PARAGRAPH AND SUBPARAGRAPHS BELOW DESCRIBE MOCKUPS WHICH ARE CONSTRUCTED AS PART OF THE BUILDING. IF A SEPARATE MOCKUP IS NEEDED REVISE LANGUAGE BELOW.

- H. Mockups: Build mockups in the building wall to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.

INDICATE PORTION OF WALL REPRESENTED BY MOCKUP ON DRAWINGS OR DRAW MOCKUP AS SEPARATE ELEMENT. COORDINATE REQUIREMENTS WITH THOSE IN OTHER SECTIONS SPECIFYING GLAZING AND CLADDING MATERIALS INSTALLED WITH CURTAIN WALLS.

1. Build mockup of wall area as shown on Drawings.
2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

RETAIN SUBPARAGRAPH EITHER ABOVE OR BELOW AS APPROPRIATE FOR PROJECT.

3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner and Architect specifically approve such deviations in writing.

RETAIN PARAGRAPH BELOW IF WORK OF THIS SECTION IS EXTENSIVE OR COMPLEX ENOUGH TO JUSTIFY A PREINSTALLATION CONFERENCE.

- I. Preinstallation Conference: Conduct conference at Project site. Coordinate meeting with Owner's representative.
- J. Field Testing: The Owner's Testing Laboratory will validate testing of installed curtain wall in the building walls.
- K. Source Limitations for Glazed Aluminum Curtain Walls and other Work provided under this section: Obtain from single source from single manufacturer.

1.5 MANUFACTURER TESTING

REVISE EXAMPLE TEST METHODS AND SEQUENCE IN SUBPARAGRAPH BELOW TO SUIT PROJECT AND COORDINATE WITH TESTS REQUIRED IN "PERFORMANCE REQUIREMENTS" ARTICLE. CONSULT MANUFACTURERS AND TESTING AGENCIES FOR GUIDANCE ON APPROPRIATE REQUIREMENTS FOR PROJECT.

- A. Preconstruction Testing Program: Perform tests specified in "Performance Requirements" Article on manufacturer's laboratory samples in the following order:
1. Structural-performance preloading at 50 percent of the specified wind-load design pressure when tested according to ASTM E 330.
 2. Air infiltration when tested according to ASTM E283.
 3. Water penetration under static pressure when tested according to ASTM E 331.

4. Structural performance at design load when tested according to ASTM E 330.
5. Repeat air filtration when tested according to ASTM E 283.
6. Repeat water penetration under static pressure when tested according to ASTM E 331.
7. Structural performance at maximum 150 percent of positive and negative wind-load design pressures when tested according to ASTM E 330.

1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of structural supports for curtain walls by field measurements before fabrication, and indicate measurements on Shop Drawings.

1.7 WARRANTY

VERIFY AVAILABLE WARRANTIES AND WARRANTY PERIODS FOR CURTAIN WALLS WITH MANUFACTURERS LISTED IN PART 2 ARTICLES. INSTALLER WARRANTIES ARE USUALLY LIMITED TO TWO YEARS; VERIFY AVAILABILITY FOR LONGER PERIODS.

- A. Assembly Warranty Terms: Provide a complete parts and labor warranty for a minimum of 10 years from the date of Substantial Completion according to the following terms.
 1. Manufacturer agrees to repair or replace components of curtain walls that do not comply with requirements or that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, the following:
 - a. Structural failures including, but not limited to, excessive deflection.
 - b. Noise or vibration created by wind and thermal and structural movements.
 - c. Water penetration through fixed glazing and framing areas.
 - d. Failure of operating components.
 - e. Glazing failure, including gasket shrinkage.
- B. Fluoropolymer Finish Warranty: Manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied fluoropolymer finishes within specified warranty period.

COORDINATE COLOR FADING AND CHALKING LIMITS WITH FINISHES RETAINED IN PART 2.

1. Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

VERIFY AVAILABLE WARRANTIES AND WARRANTY PERIODS FOR FINISHES WITH MANUFACTURERS LISTED IN PART 2 ARTICLES. FLUOROPOLYMER FINISHES ARE ELIGIBLE FOR 10 YEAR WARRANTIES.

2. Warranty Period: 10 years from date of Substantial Completion.

- C. Anodized Finish Warranty: Manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied anodized finishes within specified warranty period. Any forming or welding must be done prior to finishing.

COORDINATE COLOR FADING AND CHALKING LIMITS WITH FINISHES RETAINED IN PART 2.

1. Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Delta-E Hunter units (square root of the sum of square Delta L, Delta a, and Delta b) as determined by ASTM D 2244.
 - b. Chalking in excess of a No.8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, flaking, or blistering.
2. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

SELECT CURTAIN WALL PRODUCTS BASED ON SYSTEM TYPE AND PERFORMANCE WITHIN THE LISTED MANUFACTURERS. NOTE THAT THE FOLLOWING MANUFACTURERS HAVE VARYING PERFORMANCE LEVELS IN THEIR PRODUCT LINES, NOT ALL OF WHICH MEET SECTION PERFORMANCE REQUIREMENTS. BE SURE TO SELECT ONLY THOSE PRODUCT LINES THAT ARE PRESSURE EQUALIZED, UNITIZED CONSTRUCTION.

- A. Curtain Wall Manufacturers:

1. EFCO
2. Graham Architectural Products.
3. Harmon, Inc.
4. Kawneer North America; an Alcoa company.
5. Oldcastle BuildingEnvelope.
6. Wausau Window and Wall Systems.

- B. Fluoropolymer Coating Manufacturers:

1. PPG Industries.
2. Valspar Corp.
3. Akzo Nobel.

2.2 MATERIALS

- A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

1. Sheet and Plate: ASTM B 209.
2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221
3. Extruded Structural Pipe and Tubes: ASTM B 429.
4. Structural Profiles: ASTM B 308.

RETAIN SUBPARAGRAPH BELOW FOR WELDING.

- B. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.

RETAIN PARAGRAPH BELOW FOR INTERNAL STEEL REINFORCEMENT OF ALUMINUM FRAMING MEMBERS; REVISE TO SUIT PROJECT.

- C. Steel Reinforcement components: Provide steel reinforcement as necessary to meet specified performance requirements. Finish steel reinforcement as specified in the "Finishes" article.
 - 1. Structural Shapes, Plates, and Bars: ASTM A 36.
 - 2. Cold-Rolled Sheet and Strip: ASTM A1008.
 - 3. Hot-Rolled Sheet and Strip: ASTM A1011.
- D. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum, or nonmagnetic stainless steel units.
- E. Provide nonstaining, nonferrous shims for installation and alignment of curtain wall work.
- F. Fasteners and Accessories: Provide manufacturer's standard non-corrosive fasteners and accessories compatible with materials used in the framing system and with exposed portions, when unavoidable, that match finish of the curtain wall system. Where movement is expected, provide slip-joint linings of sheets, pads, shims, or washers of fluorocarbon resin or a similar material recommended by the manufacturer.
 - 1. Where fasteners anchor into aluminum less than 0.125-inch thick, provide noncorrosive pressed-in splined grommet nuts or other type reinforcement to receive fastener threads.
- G. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.

RETAIN SUBPARAGRAPH BELOW IF APPLICABLE, OR REVISE TO SUIT PROJECT.

- 1. Concrete and Masonry Inserts: Hot-dip galvanized steel inserts complying with ASTM A 123 or ASTM A 153 requirements.

2.3 FRAMING

- A. Framing Members: Manufacturer's standard extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.
- B. Construction:
 - 1. Thermally broken.
 - 2. Pressure equalized.
 - 3. Glazing System:
 - a. Retained mechanically with gaskets on four sides.
 - b. Glazing Plane: Front.

SELECT EITHER UNITIZED OR STICK-BUILT AFTER EVALUATING WHICH IS MORE SUITABLE FOR PROJECT. SEE EDITOR'S NOTES AT BEGINNING OF SECTION.

4. Fabrication Method: [Field-fabricated stick system]
[Factory-fabricated unitized system.]

C. Pressure Caps: Manufacturer's standard aluminum components that mechanically retain glazing.

1. Include snap-on aluminum trim that conceals fasteners.

D. Concealed Flashing: Dead-soft, 0.018-inch (0.457-mm) thick stainless steel, ASTM A 240 of type recommended by manufacturer.

E. Framing Sealants: Manufacturer's standard sealants according to the Joint Sealants section.

REVIEW PERFORMANCE WITH RESPECT TO U OF M DESIGN GUIDELINES FOR DESIGN AND CONSTRUCTION SID-D "ENERGY AND WATER CONSERVATION" AND RELATED STANDARDS. VALUES INDICATED ARE MINIMUM VALUES FROM ASHRAE 90.1-2007.

2.4 PERFORMANCE REQUIREMENTS

A. General Performance: Provide curtain walls that are designed, manufactured and installed to comply with specified performance requirements. The independent testing laboratory employed by the curtain wall manufacturer shall test curtain walls representing those indicated for this Project in the laboratory. There shall be no failure due to defective manufacture, fabrication, installation, or other defects in construction.

1. Curtain wall shall withstand movements of supporting structure indicated on Drawings, including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.

2. Failure includes but is not limited to the following:

a. Thermal stresses transferring to building structure.

b. Glass breakage.

c. Noise or vibration created by wind and thermal and structural movements.

d. Loosening or weakening of fasteners, attachments, and other components.

e. Failure of operating units.

NOTE THAT THE FOLLOWING INFORMATION AS DETERMINED BY PROJECT'S STRUCTURAL ENGINEER MUST BE SHOWN ON DRAWINGS.

B. Structural Loads: As indicated on Drawings.

VERIFY THAT MANUFACTURERS HAVE TESTED ASSEMBLIES ACCORDING TO SPECIFIED TEST METHODS AND CAN MEET CRITERIA SPECIFIED. ASSEMBLIES SHALL BE TESTED FOR STRUCTURAL PERFORMANCE, AIR INFILTRATION, AND WATER PENETRATION UNDER STATIC PRESSURE.

C. Structural Performance

1. Structural-Test Performance: Test according to ASTM E 330 as follows:

a. No evidence of deflection exceeding specified limits when tested at positive and negative wind-load design pressures.

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- b. No evidence of material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span when assemblies, including anchorages, are tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage.

VERIFY DURATION OF TEST PERFORMANCE WITH STRUCTURAL ENGINEER.

- c. Test Duration: As required by design wind velocity, but not less than 10 seconds.

BASED ON PROJECT CONDITIONS, MORE STRINGENT DEFLECTION CRITERIA THAN SPECIFIED IN SUBPARAGRAPHS BELOW MAY BE REQUIRED.

- 2. Deflection of Framing Members: At design wind pressure, as follows:
 - a. Deflection Normal to Wall Plane: No deflection of any unsupported span L of test specimen (framing rails, muntins, mullions, etc.) in excess of L/175 when tested according to ASTM E330 (maximum L/240 plus 1/4 inch at spans over 13 feet 6 inches; 2L/175 at unsupported cantilevers).

OPTION IN SUBPARAGRAPH BELOW IS BASED ON TYPICAL DEFLECTION CRITERIA FOR GLASS.

- b. Deflection Parallel to Glazing Plane: Limited to L/360 of clear span or 1/8 inch, whichever is smaller.

DELETE SUBPARAGRAPH BELOW IF NO OPERABLE WINDOWS OR DOORS.

- c. Operable Units: Provide a minimum 1/16-inch clearance between framing members and operable units.

RETAIN PARAGRAPH BELOW IF REQUIRED BY PROJECT. WIND EVENTS MAY CREATE OVERTURNING MOMENTS THAT CAUSE DIFFERENTIAL LATERAL DISPLACEMENT (DEFLECTION) OF MULTISTORY BUILDINGS. STRUCTURAL ENGINEER SHALL CALCULATE DESIGN DISPLACEMENT AND INDICATE ON THE DRAWINGS.

- 3. Story Drift: Accommodate design displacement of adjacent stories indicated.
 - a. Design Displacement: As indicated on structural Drawings.

REVISE SUBPARAGRAPH BELOW TO SUIT PROJECT.

- b. Test Performance: Meeting criteria for passing based on building occupancy type when tested according to AAMA 501.4 at design displacement and 1.5 times the design displacement.

RETAIN PARAGRAPH BELOW FOR STATIC-PRESSURE METHOD, WHICH IS MOST FREQUENTLY SPECIFIED. BOTH STATIC AND DYNAMIC TESTING MAY BE REQUIRED OR DESIRED FOR CERTAIN DESIGNS, PARTICULARLY THOSE INCORPORATING SPECIAL WATER-DRAINAGE FEATURES SUCH AS RAIN SCREEN WALLS. REVIEW AND EDIT PRESSURE LIMITS BASED ON PROJECT CONDITIONS AND WALL DESIGN.

D. Energy Performance

1. Water Penetration under Static Pressure: No evidence of water penetration through fixed glazing and framing areas, as defined in AAMA 501, when tested according to ASTM E 331 at a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 12 pounds per square foot
2. Thermal Movements: Allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures:
 - a. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
 - b. Test Interior Ambient-Air Temperature: 75 deg F.
3. Solar Heat Gain Coefficient (SHGC): No greater than 0.40 for the assembly as determined according to NFRC 200.

CR SHOWN BELOW IS VALUE USED ON RECENT HOSPITAL PROJECT. ESTABLISH CR BASED ON BUILDING OCCUPANCY FACTORS ACCORDING TO MECHANICAL DESIGN GUIDELINES.

4. Condensation Resistance: Provide units tested for thermal performance according to AAMA 1503 showing a condensation resistance factor (CR) of 60.

SELECT ABOVE OR BELOW. ABOVE PUTS RESPONSIBILITY ON DESIGNER. BELOW PUTS RESPONSIBILITY ON MANUFACTURER. ESTABLISH CR (ABOVE) OR DESIGN VALUES (BELOW) BASED ON BUILDING OCCUPANCY FACTORS ACCORDING TO MECHANICAL DESIGN GUIDELINES.

5. Condensation Resistance: Provide units tested for thermal performance according to AMMA 1503 showing a condensation resistance (CR) such that there shall be no formation of condensation in any form on glazing and framing.

INSERT PROJECT SPECIFIC DESIGN VALUES BELOW. CONSULT WITH MECHANICAL ENGINEER FOR PROJECT TEMPERATURE AND HUMIDITY REQUIREMENTS.

- a. Design temperature:
 - 1) Winter: []
 - 2) Summer: []
- b. Humidity:
 - 1) Winter: []
 - 2) Summer: []
6. Thermal Transmittance (U-factor) for Assembly:
 - a. Fixed glazing and framing areas: U-factor of not more than 0.45 Btu/sq. ft. x h x deg F as determined according to NFRC 100.
 - b. Operable window glazing and framing areas: U-factor of not more than 0.55 Btu/sq. ft. x h x deg F as determined according to NFRC 100.
7. Air Infiltration: Air infiltration shall not exceed 0.06 cfm per sq. ft. of wall area when tested in accordance with ASTM E 283 at a minimum pressure differential of 6.24 psf.

RETAIN PARAGRAPH AND SUBPARAGRAPH BELOW ONLY IF REQUIRED FOR PROJECT. NOT NECESSARY FOR MOST PROJECTS.

8. Sound Transmission: Provide curtain wall with fixed glazing and framing areas having the following sound-transmission characteristics:

EDIT TO BE PROJECT SPECIFIC - VALUES ARE EXAMPLES ONLY.

- a. Outdoor-Indoor Transmission Class: Minimum [26] [30] [34] <Insert number> when tested for laboratory sound transmission loss according to ASTM E 90 and determined by ASTM E 1332.

2.5 GLAZING

- A. General: Comply with the Division 08 Section "Glazing".

WET/DRY GLAZING SYSTEM IS PREFERRED FOR SUPERIOR WEATHER PERFORMANCE.

- B. Provide manufacturer's standard glazing system which has been tested to meet performance requirements
 - 1. Glazing Gaskets:
 - a. Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.
 - b. Non-shrinking, weather-resistant, and compatible with all materials in contact.

2.6 SPANDRELS

- A. Provide spandrel glass in insulating units as specified in the Division 08 Section "Glazing".

2.7 OPERABLE WINDOWS AND DOORS

RETAIN THIS ARTICLE IF OPERABLE WINDOWS OR ALUMINUM ENTRANCE DOORS ARE REQUIRED BY PROJECT.

- A. Operable Windows: Comply with Division 08 Section "Aluminum Windows."
- B. Aluminum Entrance Doors: Comply with Division 08 Section "Aluminum-Framed Entrances and Storefronts."

2.8 ACCESSORY MATERIALS

- A. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil (0.762-mm) thickness per coat.

2.9 FABRICATION

- A. Form or extrude aluminum shapes before finishing.

RETAIN PARAGRAPH BELOW FOR WELDING.

- B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
- C. Fabricate components that, when assembled, have the following characteristics:

1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Physical and thermal isolation of glazing from framing members. If a poured thermal break is utilized, install back-up mechanical attachment of the two halves of the frame.
4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
5. Provisions for field replacement of glazing for vision glass and spandrel glazing.

REVISE SUBPARAGRAPH BELOW FOR SAFETY RAILINGS, IF ANY. INCLUDE LOAD REQUIREMENTS. INDICATE ON DRAWINGS.

6. Provisions for safety railings mounted [on interior face of mullions] [between mullions at interior].
7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

D. Fabricate components that have the following characteristics:

1. Pressure-equalized system with primary air and vapor barrier at interior side of glazed aluminum wall and secondary seal weeped and vented to exterior.

E. Curtain-Wall Framing: Fabricate components for assembly using manufacturer's pressure plate with snap-on covers.

DELETE PARAGRAPH AND SUBPARAGRAPHS BELOW IF STICK-BUILT SYSTEM IS SELECTED.

F. Factory-Assembled Frame Units:

1. Rigidly secure nonmovement joints.
2. Seal joints watertight unless otherwise indicated.
3. Install glazing to comply with requirements in the "Glazing" Section.

G. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

INSERT INTEGRAL STABILIZATION REQUIREMENTS FOR DESCENT-CONTROL EQUIPMENT USED FOR MAINTENANCE, IF ANY.

2.10 FINISHES, GENERAL

A. Comply with referenced AAMA Voluntary Specifications for detailed finish requirements.

COORDINATE THE FOLLOWING PARAGRAPH WITH THE ALUMINUM ENTRANCES AND STOREFRONTS AND ALUMINUM WINDOWS SECTIONS. SPECIFY FINISH REQUIREMENTS FOR ALUMINUM ENTRANCES AND STOREFRONTS, AND ALUMINUM WINDOWS, IN THIS SECTION. DELETE IF THERE ARE NO ENTRANCES AND STOREFRONTS, OR ALUMINUM WINDOWS.

B. Finish aluminum windows and entrances to match the curtain wall system. Division 08 Sections "Aluminum-Framed Entrances and Storefronts" and "Aluminum Windows" shall comply with this Section for finish requirements.

2.11 FLUOROPOLYMER ALUMINUM FINISHES

RETAIN FINISHES IN PARAGRAPHS BELOW TO SUIT PROJECT. FLUOROPOLYMER FINISHES ARE PREFERRED BY THE U OF M.

IF RETAINING MORE THAN ONE, INDICATE LOCATION OF EACH ON DRAWINGS BY TYPE. COORDINATE WITH DESIGNATIONS IN THIS SECTION. ALUMINUM-FRAMING SYSTEMS ARE AVAILABLE WITH DUAL FINISHES, ALLOWING DIFFERENT INTERIOR AND EXTERIOR COLOR FINISHES. REFER TO CURTAIN WALL MANUFACTURER'S DATA FOR ADDITIONAL INFORMATION.

RETAIN ONE OF TWO PARAGRAPHS BELOW; IF BOTH ARE REQUIRED, INDICATE LOCATION OF EACH SYSTEM ON DRAWINGS, IN SCHEDULES, OR BY INSERTS. IF SPECIFIC PRODUCTS ARE REQUIRED, NAME COATING MANUFACTURERS AND PRODUCTS.

- A. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to metal surfaces to comply with coating and resin manufacturers' written instructions.

TYPICALLY, ONLY USE THREE-COAT FLUOROPOLYMER FINISH WITH METALLIC FINISHES.

- B. High-Performance Organic Finish: three-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturer's written instructions.

RETAIN COLOR BELOW, OR SELECT OTHER COLOR AS APPROVED BY THE OWNER.

- C. Color and Gloss: Non-metallic solid color, dark bronze; low gloss, as selected by Architect from manufacturer's standards.
- D. Field Touch-Up Materials: Fluoropolymer coating produced specifically for field touch-up work by same manufacturer as shop applied coating.

2.12 ANODIC ALUMINUM FINISHES

- A. Class I Clear Anodized Finish: Anodic Coating: Class I Architectural, clear film thicker than 0.7 mil, complying with AAMA 611.

RETAIN THE PARAGRAPH ABOVE IF CLEAR FINISH IS REQUIRED, OR THE PARAGRAPH BELOW IF A COLOR ANODIZED FINISH IS DESIRED.

- B. Class I Color Anodized Finish: Class I Architectural, film thicker than 0.7 mil with integral color or electrolytically deposited color, complying with AAMA 611.

SELECT COLOR BELOW OR MODIFY WHEN APPROVED BY THE OWNER.

- 1. Color: Dark bronze.
- C. Perform any forming or welding prior to applying finishes.

2.13 STEEL FINISHES

- A. Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.

PART 3 - EXECUTION

3.1 EXAMINATION AND PREPARATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General:
 - 1. Comply with manufacturer's written instructions.
 - 2. Do not install damaged components.
 - 3. Fit joints to produce hairline joints free of burrs and distortion.
 - 4. Rigidly secure nonmovement joints.
 - 5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration, and to prevent impeding movement of moving joints.
 - 6. Seal joints watertight, unless otherwise indicated or required by installation conditions.
- B. Metal Protection:
 - 1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape or installing nonconductive spacers as recommended by manufacturer for this purpose.
 - 2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
- C. Install components to provide continuous water and condensate drainage to exterior.
- D. Install components plumb and true in alignment with established lines and grades and located in reference to column lines and floor levels.

RETAIN PARAGRAPH BELOW FOR OPERABLE UNITS (DOORS AND WINDOWS).

- E. Install operable units level and plumb, securely anchored, and without distortion. Adjust weather-stripping contact and hardware movement to produce proper operation.

RETAIN PARAGRAPH BELOW ONLY IF SOME OR ALL OF THE CURTAIN WALL WILL BE FIELD GLAZED. FACTORY GLAZING IS COVERED IN PART 2.

- F. Install glazing as specified in the Division 08 Section "Glazing" and as recommended by the Curtain Wall Manufacturer. Install glazing gaskets without gaps to eliminate shrinkage.

3.3 ERECTION TOLERANCES

- A. Erection Tolerances: Install curtain wall to comply with the following maximum tolerances:

ERECTION TOLERANCES IN SUBPARAGRAPHS BELOW ARE EXAMPLES ONLY THAT ARE BASED ON VARIOUS AAMA REFERENCES. COORDINATE WITH TOLERANCES FOR SUPPORT SYSTEMS AND REVISE TO SUIT PROJECT.

1. Plumb: 1/8 inch in 10 feet); 1/4 inch in 40 feet.
2. Level: 1/8 inch in 20 feet; 1/4 inch in 40 feet.
3. Alignment:
 - a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch wide, limit offset from true alignment to 1/16 inch.
 - b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch wide, limit offset from true alignment to 1/8 inch.
 - c. Where surfaces are separated by reveal or protruding element of 1 inch wide or more, limit offset from true alignment to 1/4 inch.
 - d. Location: Limit variation from plane to 1/8 inch in 12 feet; 1/2 inch over total length.

3.4 FIELD QUALITY CONTROL

RETAIN PARAGRAPHS BELOW TO DESCRIBE TESTS AND INSPECTIONS PERFORMED BY THE INDEPENDENT TESTING AGENCY EMPLOYED BY THE OWNER. RETAIN "FIELD QUALITY-CONTROL REPORTS" PARAGRAPH IN "SUBMITTALS" ARTICLE.

- A. Testing Agency: Owner will engage a qualified testing agency for witnessing field testing, determining that the tests are performed correctly and making the final determination whether the curtain wall has successfully passed the tests.
- B. Testing Activities: Testing and inspection of representative areas of curtain wall as installation proceeds to determine compliance of installed assemblies with specified requirements. Owner will determine locations and timing of testing.
- C. Contractor shall coordinate with Testing Agency and provide the materials, equipment and labor necessary to complete the testing.

EDIT TEST AREAS AS REQUIRED.

- D. The following tests will be performed in accordance with the methods and standards specified in the Performance Requirements article in Part Two of this Section:

1. Air Infiltration Tests.
2. Water Penetration Tests.

3. Water Spray Test: Before installation of interior finishes has begun.
- E. Test Area: Three locations as determined by Owner; one bay wide, but not less than 30 feet, by one story of glazed aluminum curtain wall.
- F. Curtain walls will be considered defective if they do not pass tests and inspections.
- G. If test area fails to meet the specified air infiltration or water penetration requirements, Contractor shall submit description of proposed remedial work for Owner and Architect's information.
 1. Remedial work shall be incorporated into the test specimen for retesting.
 2. For each area which fails field testing, one additional area of equal size shall be tested for both air infiltration and water penetration.
 3. Cost of testing of additional areas shall be responsibility of Contractor.
- H. Remedial work which results in successful retesting of test specimen shall be incorporated in installed system for entire Project.
- I. Testing agency shall submit copies of test reports to Owner, Architect and Contractor within 48 hours after date of test.
- J. The Owner reserves the right to select additional test areas as required, without limitation, subject to correction and remediation as specified herein.

3.5 COMMISSIONING

- A. Perform the commissioning activities as outlined in the Division 01 Section "Full Project Commissioning" or "Project Commissioning for Small Projects" and other requirements of the Contract Documents.

3.6 ADJUSTING, CLEANING, PROTECTION

- A. Clean the completed system, inside and out, promptly after erection and installation of glass and sealants, allowing for nominal curing of liquid sealants. The installer shall advise the Contractor of proper and adequate procedures for protection and cleaning during the remainder of the construction period so that the system will be without damage and deterioration at the time of acceptance.
- B. At the time of Final Acceptance, clean curtain wall system thoroughly and polish glass. Demonstrate proper cleaning methods and materials to the Owner's maintenance personnel.
- C. Protect completed curtain wall system throughout construction period through Final Acceptance.

END OF SECTION 084413