

## SECTION 08911 - ALUMINUM CURTAIN WALLS AND ENTRANCE SYSTEMS

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section includes:

1. Conventionally aluminum curtain walls and entrance systems.
2. Field-glazed, two-sided structural-sealant-glazed curtain-wall assemblies
3. ~~Exterior and interior manual swing entrance doors and door frame units.~~
4. Fixed and operable windows.
5. Motorized operators for Clerestory operable windows.
6. Metal spandrel panels.
7. Sheet metal air moisture barriers.

B. The materials in this Section are part of the overall USGBC "Leadership in Energy and Environmental Design" LEED prerequisites and credits needed for Project to obtain LEED Silver certification based on LEED 2009 requirements. See Section 01352 LEED Requirements and this section for more information.

C. Related Sections:

1. Division 7 Section "Joint Sealants" for installation of joint sealants installed with aluminum curtain walls and entrance systems.
2. Division 8 Section "Balanced Glass Doors" for balanced glass doors to be installed in aluminum curtain wall framing.
3. Division 8 Section "Glass" for glass to be installed in aluminum curtain wall framing.
4. Division 16 Sections for electrical service and connections for motor operators, controls, limit switches, and other powered devices and for system disconnect switches for motorized window operators.

#### 1.2 DEFINITIONS

A. ADA/ABA Accessibility Guidelines: U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disability Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities."

B. Aluminum Curtain Wall and Entrance Systems: All component parts of the conventionally aluminum curtain walls, entrance systems, exterior and interior manual-swing entrance doors and door-frame units, fixed and operable windows, motorized operators for clerestory operable windows, and metal spandrel panels, unless specified otherwise.

C. Window performance grade number according to AAMA/WDMA 101/I.S.2/NAFS:

1. Design pressure number in pounds force per square foot used to determine the structural test pressure and water test pressure.

- D. Structural Test Pressure for Windows: For uniform load structural test, is equivalent to 150 percent of the design pressure.
- E. Minimum test size for windows is smallest size permitted for performance class (gateway test size). Products must be tested at minimum test size or at a size larger than minimum test size to comply with requirements for performance class.

### 1.3 PERFORMANCE REQUIREMENTS

- A. General Performance: Comply with performance requirements specified, as determined by preconstruction testing of manufacturer's aluminum curtain walls and entrance systems representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
  - 1. Aluminum curtain walls and entrance systems 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 also includes 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. Noise or vibration created by operation of motorized operators.
    - e. Loosening or weakening of fasteners, attachments, and other components.
    - f. Failure of operating units.
    - g. Failure of motorized operators.
- B. Delegated Design: Design aluminum-framed systems, including comprehensive engineering analysis by a Structural Engineer Registered in the State of Illinois, using performance requirements and design criteria indicated.
- C. Structural Loads:
  - 1. Wind Loads: Provide framing system capable of withstanding wind load design pressures of 30 psf acting inward and 30 psf acting outward.
- D. Structural-Test Performance: Test according to ASTM E 330 as follows:
  - 1. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
  - 2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.
  - 3. Test Durations: As required by design wind velocity, but not less than 10 seconds.
- E. Deflection of Framing Members: At design wind pressure, as follows:
  - 1. Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane not exceeding  $L/175$  of the glass edge length for each individual glazing lite

or an amount that restricts edge deflection of individual glazing lites to 3/4 inch, whichever is less.

2. Deflection Parallel to Glazing Plane: Limited to L/360 of clear span or 1/8 inch, whichever is smaller.
  - a. Operable Units: Provide a minimum 1/16-inch clearance between framing members and operable units.

F. Curtain Wall System Performance Requirements:

1. Air Infiltration - Fixed Wall Areas: The test specimen shall be tested in accordance with ASTM E 283. Air infiltration rate shall not exceed 0.06 cfm/ft<sup>2</sup> at a static air pressure differential of 6.24 psf (300 Pa).
2. Air Infiltration - Operable Windows and Doors: The test specimen shall be tested in accordance with ASTM E 283. Air infiltration rate shall not exceed 0.10 cfm/ft<sup>2</sup> at a static air pressure differential of 6.24 psf (300 Pa).
3. Water Resistance, (static): The test specimen shall be tested in accordance with ASTM E 331. There shall be no leakage at a static air pressure differential of 12 psf as defined in AAMA 501.
4. Uniform Load: A static air design load of 40 psf shall be applied in the positive and negative direction in accordance with ASTM E 330. There shall be no deflection in excess of L/175 of the span of any framing member at design load. At structural test load equal to 1.5 times the specified design load, no glass breakage or permanent set in the framing members in excess of 0.2% of their clear spans shall occur.

G. AAMA/NWWDA Performance Requirements for Windows: Provide aluminum windows of the performance class and grade indicated that comply with AAMA/NWWDA 101/I.S.2/NAFS.

1. Performance Class: AW.
2. Performance Grade: Minimum 50

H. Installation Performance Requirements:

1. Design the attachment of the windows at jambs, head, and sill and reinforce mullions to resist 30 psf load applied in any direction.

I. Thermal Movements: Allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures:

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
2. Test Interior Ambient-Air Temperature: 75 deg F.
3. Test Performance: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested according to AAMA 501.5.

J. Thermal Performance: Provide window units having maximum U-factor of 0.57 for fixed units and 0.67 for operable units as determined in accordance with NFRC 100 by a laboratory accredited by a nationally recognized accreditation organization such as the National Fenestration Rating Council and labeled and certified by the manufacturer; and assembly maximum solar heat gain coefficient (SHGC) for overall glazed area of 0.49 for north orientation and 0.39 for all other orientations as determined in accordance with NFRC 200 by a

laboratory accredited by a nationally recognized accreditation organization such as the National Fenestration Rating Council and shall be labeled and certified by the manufacturer. Shading coefficient of the center of glass multiplied by 0.86 shall be an acceptable alternate for determining compliance with the SHGC required for the overall glazed area. Shading coefficient shall be determined using special data file determined in accordance with NFRC 300. Shading coefficient shall be verified and certified by the glass unit manufacturer.

- K. Sound Transmission: Provide aluminum curtain walls and entrance systems with fixed glazing and framing areas having the following sound-transmission characteristics:
  - 1. Outdoor-Indoor Transmission Class: Minimum 26 when tested for laboratory sound transmission loss according to ASTM E 90 and determined by ASTM E 1332.
- L. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- M. Condensation-Resistance Factor (CRF): Provide aluminum windows tested for thermal performance according to AAMA 1503, showing a CRF of not less than 55.
- N. Thermal Break Construction: All components of the aluminum curtain walls and entrance systems, including head receptors shall be of thermally broken construction.

#### 1.4 PRECONSTRUCTION TESTING

- A. Preconstruction Sealant Testing: Perform sealant manufacturer's standard tests for compatibility with and adhesion of each material that will come in contact with sealants and each condition.
  - 1. Test a minimum five production-run samples each of metal, glazing, and other material.
  - 2. Prepare samples using techniques and primers required for installed assemblies.
  - 3. Perform tests under environmental conditions that duplicate those under which assemblies will be installed.
  - 4. For materials that fail tests, determine corrective measures necessary to prepare each material to ensure compatibility with and adhesion of sealants including, but not limited to, specially formulated primers. After performing these corrective measures on the minimum number of samples required for each material, retest materials.

#### 1.5 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. LEED Submittal:
  - 1. LEED Credit MR 4.1 and Credit MR 4.2: Submit product data for products having recycled content, documentation indicating percentages by weight of post-consumer and pre-consumer recycled content.
    - a. Include statement indicating costs for each product having recycled content.

2. LEED Credit MR 5.1 and Credit MR 5.2: Submit product data for products that have been extracted, harvested, or recovered, as well as manufactured within 500 miles of the Project site.
  - a. Include a statement indicating the percentage by weight which is extracted, harvested, or recovered within 500 miles of the Project site.
- C. Shop Drawings: Include plans, elevations, sections, details, hardware, attachments to other work, operational clearances, installation details, and the following:
  1. Submit complete shop drawings of all Work. Show framing profiles, method of joining, the thickness of metal and identify all materials. Provide complete information regarding joints and fastenings. Show and dimension the relative layout of all walls and openings. Show the required fabrication tolerances. Show the required erection tolerances. Include wall elevations at 1/4 inch scale, typical unit elevations at 1 inch scale, and full-size detail sections of typical framing members. Show flashing and drainage details.
  2. The Drawings shall indicate for all sealed and/or unsealed joints the minimum and maximum acceptable joint width at the time of installation and the anticipated temperature range at that time, to assure properly functioning joints. Also indicate, where applicable, the amount of: thermal expansion; structural deflection; tolerances provided; and adjustment of joint size due to change in ambient, surround and component temperatures.
  3. Include coordination drawings clearly indicating all information required to properly interface each of the component sub-systems within the building enclosure, including the following:
    - a. Thermal-break details.
    - b. Window System Operators: Show locations and details for installing operator components, switches, and controls. Indicate motor size, electrical characteristics, drive arrangement, mounting, and grounding provisions.
    - c. Wiring Diagrams: Power, signal, and control wiring.
- D. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.
- E. Delegated-Design Submittal: For aluminum curtain walls and entrance systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the Structural Engineer Registered in the State of Illinois responsible for their preparation.
- F. Welding certificates.
- G. Energy Performance Certificates: For aluminum curtain walls and entrance systems, accessories, and components, from manufacturer.
  1. Basis for Certification: NFRC-certified energy performance values for each glazed aluminum curtain wall.
- H. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified preconstruction testing agency, for aluminum curtain walls and entrance systems, indicating compliance with performance requirements.

- I. Maintenance Data: For aluminum curtain walls and entrance systems to include in maintenance manuals.
- J. Warranties: Sample of special warranties.

#### 1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A manufacturer capable of fabricating aluminum curtain walls and entrance systems that meet or exceed energy performance requirements indicated and of documenting this performance by certification, labeling, and inclusion in lists.
- B. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- C. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.
  - 1. Do not revise intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If revisions are proposed, submit comprehensive explanatory data to Architect for review.
- D. Welding Qualifications: Qualify procedures and personnel according to the following:
  - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
  - 2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
- E. Energy Performance Standards: Comply with NFRC for minimum standards of energy performance, materials, components, accessories, and fabrication. Comply with more stringent requirements if indicated.
  - 1. Provide NFRC-certified aluminum curtain walls and entrance systems with an attached label.
- F. Preinstallation Conference: Conduct conference at Project site. Review methods and procedures related to aluminum windows including, but not limited to, the following:
  - 1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
  - 2. Review, discuss, and coordinate the interrelationship of aluminum curtain walls and entrance systems with other exterior wall components. Include provisions for structural anchorage, glazing, flashing, weeping, sealants, and protection of finishes.
  - 3. Review and discuss the sequence of work required to construct a watertight and weathertight exterior building envelope.
  - 4. Inspect and discuss the condition of substrate and other preparatory work performed by other trades.

## 1.7 PROJECT CONDITIONS

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

## 1.8 WARRANTY

- A. Special Assembly Warranty: Standard form in which manufacturer and Installer agrees to repair or replace components of aluminum curtain walls and entrance systems that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
  - 1. 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. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
    - d. Water penetration through fixed glazing and framing areas.
    - e. Failure of operating components.
  - 2. Warranty Period: Five years from date of Substantial Completion.
- B. Special Finish Warranty: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.
  - 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.
  - 2. Warranty Period: 20 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Basis-of-Design Aluminum Curtain Walls and Entrance Systems: Subject to compliance with requirements, provide Kawneer North America 1600 System 1 and System 2, where indicated, or comparable product by one of the following:
  - 1. Vistawall Architectural Products; The Vistawall Group; a Bluescope Steel company.
  - 2. Wausau Window and Wall Systems.
- B. Basis-of-Design Aluminum Window Systems: Subject to compliance with requirements, provide Kawneer North America Glassvent, or comparable product by one of the following:

1. Vistawall Architectural Products; The Vistawall Group; a Bluescope Steel company.
2. Wausau Window and Wall Systems.

## 2.2 MATERIALS

- A. Recycled Content of Aluminum Products: Provide products with average recycled content of steel products such that postconsumer recycled content plus one-half of preconsumer recycled content is not less than 40 percent.
- B. 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/B 308M.
  5. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.
- C. Steel Reinforcement: 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.
  1. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
  2. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
  3. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.
- D. Metallic-Coated Steel Sheet: Restricted flatness steel sheet, metallic coated by the hot-dip process.
  1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 coating designation; structural quality.
  2. Surface: Smooth, flat.

## 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.
  1. Construction: Thermally broken with 2-1/2 inch sightline
  2. Glazing System: Retained mechanically with gaskets on four sides and structural-silicone glazed, where indicated.
  3. Glazing Plane: Front.
  4. Integration: Ability to fully integrate specified fixed and operable windows.
- B. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.



- C. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
  - 1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
  - 2. Reinforce members as required to receive fastener threads.
  - 3. Use exposed fasteners with countersunk Phillips screw heads, fabricated from 300 series stainless steel.
- D. 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.
  - 1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123/A 123M or ASTM A 153/A 153M requirements.
- E. Concealed Flashing: Dead-soft, 0.018-inch-thick stainless steel, ASTM A 240/A 240M of type recommended by manufacturer.
- F. Framing Sealants: Manufacturer's standard sealants.

## 2.4 WINDOWS

- A. Windows shall be project-out type designed for installation in specified curtain wall and as punched openings. There shall be no exterior framing sightline buildup. :
  - 1. Windows shall be performance tested in accordance with AAMA 501 at 50 psf.
  - 2. Windows shall be of thermally improved flush vent design.
  - 3. Windows shall have cast white bronze locking hardware.
  - 4. Windows shall have concealed stainless steel 4-bar hinges.

## ~~2.5 ENTRANCE DOOR SYSTEMS~~

- ~~A. Entrance Doors: Manufacturer's standard glazed entrance doors for manual swing operation.~~
  - ~~1. Door Construction: 1 3/4 inch overall thickness, with minimum 0.125 inch thick, extruded aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.~~
    - ~~a. Thermal Construction: High performance plastic connectors separate aluminum members exposed to the exterior from members exposed to the interior.~~
  - ~~2. Door Design: As indicated.~~
    - ~~a. Accessible Doors: Smooth surfaced for width of door in area within 10 inches above floor or ground plane.~~
  - ~~3. Glazing Stops and Gaskets: Beveled, snap-on, extruded aluminum stops and preformed gaskets.~~

~~a. Provide non removable glazing stops on outside of door.~~

~~B. Entrance Door Hardware: As specified in Division 8 Section "Door Hardware."~~

## 2.6 ELECTRIC OPERATORS FOR CLERESTORY WINDOWS

- A. Operation: Electric, with factory-assembled electric operator designed for operating windows of type, size, weight, construction, use, and operating frequency indicated.
1. Basis-of-Design Product: Subject to compliance with requirements, provide Functional Fenestration Inc., Supermaster Motor - Electric Chain Actuator by UCS, or a comparable product as acceptable to the Architect.
  2. Electric Operator: Provide operating system complying with NFPA 70; of size and capacity and with features, characteristics, and accessories suitable for Project conditions, recommended in writing by window manufacturer; complete with operating system indicated, electric motor and factory-prewired motor controls with limit switches, remote-control stations, power disconnect switches, enclosures protecting controls and all operating parts, and accessories required for reliable operation. Motor shall incorporate a double link chain with zinc-plated steel pivot points. Motors shall of quiet operation. Include wiring from motor controls to motor. Coordinate operator wiring requirements and electrical characteristics with building electrical system.
    - a. Control Equipment: Comply with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6.
    - b. Electric Motor: Comply with NEMA MG 1; with thermal-overload protection; sized to start and operate size and weight of window sash ventilators under any conditions; one per each gear box shaft.
      - 1) Motor Characteristics: Single phase, sized by electric operator manufacturer, 60 Hz.
    - c. Remote Controls: Electric controls with NEMA ICS 6, Type 1 enclosure and momentary-contact, single push-button-operated control which operates all windows as follows:
      - 1) All ventilators in the same tier, same façade should move simultaneously. Controls should be able to open the clerestory on one façade at a time, keeping another façade's windows closed to create a strong draft.
    - d. Limit Switches: Adjustable switches, interlocked with motor controls and set to automatically stop sash ventilators at fully opened and fully closed positions.

## 2.7 INSECT SCREENS FOR OPERABLE WINDOWS

- A. General: Design windows and hardware to accommodate screens in a tight-fitting, removable arrangement, with a minimum of exposed fasteners and latches. Fabricate insect screens to fully integrate with window frame. Locate screens on inside of window and provide for each operable exterior sash or ventilator.

1. Aluminum Tubular Frame Screens: Comply with SMA 1004, "Specifications for Aluminum Tubular Frame Screens for Windows," Monumental M-32 class.
  2. Comply with SMA 1004, "Specifications for Aluminum Tubular Frame Screens for Windows," for minimum standards of appearance, fabrication, attachment of screen fabric, hardware, and accessories unless more stringent requirements are indicated.
- B. Aluminum Wire Fabric: 18-by-16 (1.1-by-1.3-mm) mesh of 0.011-inch- (0.28-mm-) diameter, coated aluminum wire.
1. Wire-Fabric Finish: Charcoal gray.
- C. Wickets: Provide sliding or hinged wickets, framed and trimmed for a tight fit and for durability during handling.

## 2.8 GLAZING

- A. Glazing: Comply with Division 8 Section "Glazing."
- B. Gaskets: Glazing gaskets shall comply with ASTM C 864 and be extruded of a silicone compatible EPDM rubber that provides for silicone adhesion.
- C. Glazing Sealants: For structural-sealant-glazed curtain walls, as recommended by manufacturer for joint type, and as follows:
1. Structural Sealant: ASTM C 1184, chemically curing silicone formulation that is compatible with system components with which it comes in contact, specifically formulated and tested for use as structural sealant and approved by structural-sealant manufacturer for use in curtain-wall assembly indicated.
    - a. Provide sealants for use inside of the weatherproofing system that have a VOC content of 100 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
    - b. Color: As selected by Architect from manufacturer's full range of colors.
  2. Weatherseal Sealant: ASTM C 920 for Type S; Grade NS; Class 25; Uses NT, G, A, and O; chemically curing silicone formulation that is compatible with structural sealant and other system components with which it comes in contact; recommended by structural-sealant, weatherseal-sealant, and structural-sealant-glazed curtain-wall manufacturers for this use.
    - a. Provide sealants for use inside of the weatherproofing system that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
    - b. Color: Matching structural sealant.

## 2.9 SHEET METAL AIR MOISTURE BARRIERS

- A. Fabricate and install galvanized sheet metal air moisture barriers where indicated on the Drawings.

B. Fabrication:

1. General: Custom fabricate sheet metal sheet metal air moisture barriers to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, geometry, metal thickness, and other characteristics of item indicated. Fabricate items at the shop to greatest extent possible.
2. Fabricate sheet metal sheet metal air moisture barriers in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
3. Form sheet metal sheet metal air moisture barriers without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
4. Sealed Joints: Form expansion joints in metal to accommodate elastomeric sealant.

2.10 SPANDREL PANELS

- A. Aluminum Plate: ASTM B 209 (ASTM B 209M). Alloy and temper as recommended by manufacturer for application.

2.11 ACCESSORY MATERIALS

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

2.12 FABRICATION

- A. Form or extrude aluminum shapes before finishing.
- 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.
  4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
  5. Provisions for field replacement of glazing from exterior.
  6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
- D. Fabricate components that, when assembled, have the following characteristics:
1. Internal guttering system or other means to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum curtain wall to exterior.

- E. Curtain-Wall Framing: Fabricate components for assembly using outside glazed pressure plate format.
- F. Factory-Assembled Frame Units:
  - 1. Rigidly secure non movement joints.
  - 2. Seal joints watertight unless otherwise indicated.
  - 3. Install glazing to comply with requirements in Division 8 Section "Glazing."
- ~~G. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.~~
- ~~H. Entrance Doors: Reinforce doors as required for installing entrance door hardware.~~
- ~~I. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory installed entrance door hardware before applying finishes.~~
- J. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

## 2.13 WINDOW FABRICATION

- A. Fabricate aluminum windows in sizes indicated. Include a complete system for assembling components and anchoring windows.
- B. Fabricate aluminum windows that are reglazable without dismantling sash or ventilator framing.
- C. Thermally Improved Construction: Fabricate aluminum windows with an integral, concealed, low-conductance thermal barrier; located between exterior materials and window members exposed on interior side; in a manner that eliminates direct metal-to-metal contact.
  - 1. Provide thermal-break construction that has been in use for not less than three years and has been tested to demonstrate resistance to thermal conductance and condensation and to show adequate strength and security of glass retention.
  - 2. Provide thermal barriers tested according to AAMA 505; determine the allowable design shear flow per the appendix in AAMA 505.
  - 3. Provide hardware with low conductivity or nonmetallic material for hardware bridging thermal breaks at frame or vent sash.
- D. Weather Stripping: Provide full-perimeter weather stripping for each operable sash and ventilator.
- E. Weep Holes: Provide weep holes and internal passages to conduct infiltrating water to exterior.
- F. Provide water-shed members above side-hinged ventilators and similar lines of natural water penetration.
- G. Mullions: Provide mullions and cover plates as shown, matching window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections,

as indicated. Provide mullions and cover plates capable of withstanding design loads of window units.

- H. Subframes: Provide subframes with anchors for window units as shown, of profile and dimensions indicated but not less than 0.062-inch- thick extruded aluminum. Miter or cope corners, and weld and dress smooth with concealed mechanical joint fasteners. Finish to match window units. Provide subframes capable of withstanding design loads of window units.
- I. Glazing Stops: Provide snap-on glazing stops coordinated with Division 8 Section "Glazing" and glazing system indicated. Provide glazing stops to match sash and ventilator frames.

## 2.14 ALUMINUM FINISHES

- A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- B. High-Performance Organic Finish (2-Coat Fluoropolymer): AA-C12C40R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: conversion coating; Organic Coating: manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2605 and with coating and resin manufacturers' written instructions.
  - 1. Color and Gloss: PPG Duranar Sandstone No. UC45392.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work. Verify rough opening dimensions, levelness of sill plate, accurate locations of connections to building electrical system; and operational clearances. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure a coordinated, weathertight window installation.
  - 1. Masonry Surfaces: Visibly dry and free of excess mortar, sand, and other construction debris.
  - 2. Metal Surfaces: Dry; clean; free of grease, oil, dirt, rust, corrosion, and welding slag; without sharp edges or offsets at joints.
  - 3. 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 non-movement joints.
5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
6. Weld components in concealed locations to minimize distortion or discoloration of finish. Protect glazing surfaces from welding.
7. Seal joints watertight unless otherwise indicated.

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 drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum curtain wall, entrances, and windows to exterior.

D. Comply with Drawings, Shop Drawings, and manufacturer's written instructions for installing windows, hardware, accessories, and other components.

E. Install components level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction.

F. Connect automatic operators to building electrical system.

G. Adjust weather-stripping contact and hardware movement to produce proper operation.

H. Set continuous sill members and flashing in full sealant bed as specified in Division 7 Section "Joint Sealants" to produce weathertight installation.

~~I. Entrance Doors: Install doors to produce smooth operation and tight fit at contact points.~~

- ~~1. Field Installed Entrance Door Hardware: Install surface mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.~~

J. Install glazing as specified in Division 8 Section "Glazing."

### 3.3 ERECTION TOLERANCES

A. Erection Tolerances: Install aluminum curtain walls and entrance systems to comply with the following maximum tolerances:

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.
4. Location: Limit variation from plane to 1/8 inch in 12 feet; 1/2 inch over total length.

### 3.4 FIELD QUALITY CONTROL

- A. Field Tests: Contractor shall perform and pay for onsite tests of selected installed aluminum curtain wall and entrance system components. Test newly installed Aluminum Curtain Wall System products as directed by the Commission's Representative for air leakage and water penetration resistance.
  1. All aluminum curtain wall and entrance system products shall be field tested in accordance with AAMA 503-08 by an AAMA accredited laboratory as selected by the Commission's Representative, the Aluminum Curtain Wall System Manufacturer and engaged by the responsible Contractor.
    - a. Independent testing laboratory engaged to perform tests will meet all requirements of AAMA 204-98.
  2. Costs for all tests, both original and retest shall be paid for by the responsible Contractor. All unsuccessful tests, both original and retest, shall be paid for by the responsible Contractor.
  3. All testing work in accordance to AAMA 503-08 of installed aluminum curtain wall and entrance systems shall commence at initial aluminum curtain wall and entrance system installation and shall be completed prior to issuance of a certificate of substantial completion for aluminum curtain wall and entrance system work; and in no case more than six months after the date of substantial completion of the installation. Any field testing required six months beyond the date of completion of aluminum curtain wall and entrance system installation, will be done in accordance with AAMA 511-08.
  4. Testing Quantity for Aluminum Curtain Wall: Erect test chambers for aluminum curtain wall and entrance system assembly identified for testing. Test chamber for aluminum curtain wall and entrance system is to encompass one full bay, horizontally and vertically, of the framing system. Test a minimum of two (2) Aluminum Curtain Wall System products of each type for air infiltration and water penetration as specified in accordance to AAMA 503-08 after the initial aluminum curtain wall and entrance system products have been completely installed.
  5. Testing Quantity for Punched Aluminum Windows: Erect test chambers for each window product type identified on plans. Test three (3) Aluminum Window products of each type, or three (3%) percent of each type of Aluminum Window product installations, whichever is greater; for air infiltration and water penetration as specified in accordance to AAMA 502-08 after the Aluminum Window products have been completely installed.
  6. Test Parameters:



- a. Air infiltration field tests shall be conducted at the same uniform static test pressure as the laboratory test unit. The Maximum allowable rate of air leakage shall not exceed 1.5 times the laboratory test unit for hardware and glazing types consistent with the laboratory test unit. The field test air leakage rate shall not exceed 1.5 times the maximum allowable laboratory performance specified in the testing criteria listed in Section 1.H.1 & 2 above for any configuration.
  - b. Water penetration field tests shall be conducted at a static test pressure of 90% of the laboratory test performance values for hardware and glazing types consistent with the laboratory test unit. The field test water test pressure shall not be less than 90% of the minimum allowable laboratory performance specified in the testing criteria listed in Section 1.H.3 above for any configuration.
7. All work on aluminum curtain wall and entrance system that fails the field tests shall be re-executed until the installation passes the field testing. Modify methods of installation of subsequent work to incorporate required corrections identified by the testing process.

### 3.5 ADJUSTING, CLEANING, AND PROTECTION

- A. Adjust operating sashes and ventilators, screens, hardware, operators, and accessories for a tight fit at contact points and weather stripping for smooth operation and weathertight closure. Lubricate hardware and moving parts.
- B. Clean aluminum surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.
- C. Protect all aluminum surfaces from contact with contaminating substances resulting from construction operations. In addition, monitor window surfaces adjacent to and below exterior concrete and masonry surfaces during construction for presence of dirt, scum, alkaline deposits, stains, or other contaminants. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written recommendations.

### 3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain window operating systems.

END OF SECTION 08911