



MG McGrath
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MGU-8 UNITIZED GLASS CURTAIN WALL SPECIFICATION

SECTION 08 44 13
UNITIZED CURTAIN WALL ASSEMBLY

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Unitized Curtain Wall Assemblies, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.
 - 1. Related Sections:
 - a. 071000: Dampproofing and Waterproofing
 - b. 072000: Thermal Protection
 - c. 072500: Weather Barriers
 - d. 074000: Roofing and Siding Panels
 - e. 076000: Flashing and Sheet Metal
 - f. 078000: Fire and Smoke Protection
 - g. 079000: Joint Protection
 - h. 083213: Sliding Aluminum-Framed Glass Doors
 - i. 084113: Aluminum-Framed Entrances and Storefronts
 - j. 084313: Aluminum-Framed Storefronts
 - k. 084329: Sliding Storefronts
 - l. 084433: Sloped Glazing Assemblies
 - m. 085113: Aluminum Windows
 - n. 086300: Metal-Framed Skylights
 - o. 088000: Glazing
 - p. 122600: Interior Daylighting Devices

1.2 QUALITY ASSURANCE

- A. Manufacturer Qualifications:

Manufacturer acceptable to enclosure contractor and capable of specified components of exterior enclosure assemblies that meet or exceed testing and energy performance requirements indicated and documenting performance by certified test reports.
- A. Installer Qualifications/Submittals:
 - 1. Firm with not less than ten (10) years successful experience in erection and installation of curtain wall systems similar in design and scale of systems proposed for this project.
 - 2. Certified by curtain wall manufacturer in erection and installation of manufacturer's products.
 - 3. Submit a minimum of five (5) references of projects similar in size and scope.
 - 4. Submit results of monthly onsite inspections conducted by manufacturer's field service representative, to assure proper installation, to Architect.
 - 5. Upon completion of project, submit report from manufacturer's field service representative.
 - a. See Submittals, Contract Closeout Information, below.
- B. Specialty Structural Engineer:
 - 1. Engineer Unitized Curtain Wall Assembly to support superimposed loads, design moments, shears, and other forces.
 - 2. Comply with Section 01 71 21 (Verify correct section), Specialty Engineering

- Requirements.
3. Include headers and reinforcing members around openings.
 4. Incorporate details defining method of attachment throughout system and anchorage to primary structure.
- C. Field Testing Agency Qualifications:
1. In compliance with ASTM E329 Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection.
- D. Laboratory Mockup Testing Agency Qualifications:
In compliance with ASTM E329 and ASTM E699 for testing indicated and accredited by IAS or ILAC Mutual Recognition Agreement as complying with ISO/IEC17025.
- E. Product Components/Assemblies:
1. Drawings and Specifications establish requirements for aesthetic effect and performance characteristics of assemblies.
 2. Aesthetic effect is judged solely by Architect and determined by dimensions, arrangement, alignment and profiles of components and assemblies as they relate to sightlines, to one another, and adjoining construction.
 - a. Do not revise intended aesthetic effect without Architect's approval.
- F. Submit proposed revisions to Architect for review. Comply with Following Standards: Compliance with specified performance requirements shall be demonstrated by computer simulation per the guidelines of NFRC standards.
1. Aluminum Association (AA)
 2. American Architectural Manufacturers Association (AAMA)
 - a. In addition to specified AAMA standards, comply with applicable portions of the AAMA CW-DG-1, Curtain Wall Design Guide Manual.
 3. ASTM International (ASTM)
 4. American Welding Society (AWS)
 5. International Accreditation Service (IAS)
 6. International Laboratory Accreditation Corporation (ILAC)
 7. International Organization for Standardization (ISO)
 8. International Electrotechnical Commission (IEC)
 9. National Fenestration Rating Council (NFRC)
 10. Society for Protective Coatings (SSPC)
 11. Window & Door Manufacturers Association (WDMA)
- G. Welding and Welders:
1. Welders licensed in accordance with local building regulations.
 2. Perform welding in conformance with AWS Structural Welding Code.
 3. AWS-D1.1 Structural Welding Code - Steel.
 4. AWS-D1.2 Structural Welding Code - Aluminum.
 5. AWS-D1.6 Structural Welding Code - Stainless Steel.
- H. Pre-installation Conference:
1. See Section 01 31 19. (Verify correct section)
- I. Visual Mockups:
1. Construct mockup to verify selections made under sample submittals and to demonstrate aesthetic effects. Build wall assembly on site for Architect review at locations as directed by Construction Manager and agreed by Curtain Wall Contractor.
 - a. Refer to mockup on Drawings for dimensions, components, profiles, configurations, and adjacent construction.
 - 1) Panel Mockup: Panels and sizes to be determined.

- b. Mockup wall constitutes standard of quality for balance of cladding work.
- c. If not acceptable, reconstruct.
- d. Do not proceed with work until mockup walls are approved by Architect and Owner.

1.3 SUBMITTALS

- A. See Section 01 33 00 (Verify correct section) for requirements.
- B. Shop Drawings:
 - 1. Elevations, sections, and details for review of design intent and anchorage to building frame.
 - a. Include details addressing provision for expansion and contraction and draining moisture from within assembly.
 - b. Show adjoining materials based on approved shop drawings and provide interface detailing at head, sills and jambs, roofing, waterproofing and soffits.
 - c. Detail glazing, copings, perimeter flashing and trim, sealants and backer rod, air and moisture barrier and seals to framing, thermal insulation, back pans and fire protection.
 - d. Include detailed connections of mullion extensions to curtain wall system.
 - e. Show glass type designation on building elevations and glazing schedule including types to be installed.
 - f. Include door schedule showing hardware, automatic door and access control components, and reinforcing as recommended by manufacturer.
 - g. Show imposed loads on connection details to structure.
 - h. Reference structural calculations to details.
 - i. Submit structural calculations concurrent with Shop Drawings.
 - j. Include full size isometric details of each representative type of vertical to horizontal intersections. Include 50 full size isometric details of locations to be identified by the Architect.
 - 2. Visual Mockup:
 - a. Submit shop drawings for mockup wall assembly integrating shop drawings of each finish material.
 - b. Prior to construction of mockup wall, provide samples as specified in respective Specification Sections.
 - c. Submit structural loads transferred to back-up structure for mockup wall concurrent with drawings. Back-up structure provided by other trades.
 - 3. Performance Mockup:
 - a. Submit shop drawings for mockup wall assembly integrating shop drawings of each finish material.
 - b. Prior to construction of mockup wall, provide samples as specified in respective Specification Sections.
 - c. Submit structural calculations for mockup wall sealed by Specialty Structural Engineer concurrent with drawings.
 - d. Submit as-built record drawings.
 - e. Submit Test Reports identifying system compliance with performance criteria specified herein.
 - 4. Coordinate submission of the unitized curtain wall assembly shop drawings with submission of all other building enclosure wall shop drawings.
- C. 3D Model:
 - 1. LOD minimum of 300.
 - 2. Include comprehensive illustration of entire assembly.
- D. Thermal Modeling:

Provide thermal modeling submission to demonstrate assembly thermal performance and condensation resistance requirement has been met. Condensation resistance shall be demonstrated through computer simulation of typical and critical conditions.

1. Simulation Modeling reports during Preconstruction for evaluation of proposed details.
2. NFRC Simulation Report based on performance mock-up record details.
3. Provide Unitized Curtain Wall Assembly area weighted average thermal performance data. Include modeling of each unique configuration, including effects from penetrations through and attachments to the assembly.

E. Samples:

1. Prior to construction of mock-ups, provide material samples as specified in respective Specification Sections included as part of mock-up wall.
2. Include samples of all ancillary components of the custom-designed unitized curtain wall, including glass, cured sealants, fasteners, gaskets, setting blocks and related items.
3. Range samples of aluminum curtain wall finishes.
 - a. Manufacturer's (PPG or Akzo) finishes for color selection.
4. Assembly to be available prior to construction based on successful performance mockup. Assembly to include all components, including intersection of mullions.
 - a. As soon as practical after the custom extruded profiles become available, provide samples for Owner and Architect's review and acceptance.
 - b. Samples shall include all major system components, including aluminum, glass, sealants, gaskets, a stack joint, projections/trim, and cladding, as specified, in order to verify selections made under sample submittals and to demonstrate the quality of materials and assembly.
5. Provide full size glass sample to project site.
6. Sample size 48-inch minimum length or square.

F. Project Information:

1. Project-Specific Fabrication and Installation Quality Control Program: Contractor shall develop fabrication and installation quality control program and quality control reports, shop and field, specifically for this project which meet or exceed documentation of testing required for manufacture warranty requirements of components utilized in the fabrication or installation of the assembly.
2. Engineering calculations indicating design moments, shears, and other forces sealed by Specialty Structural Engineer.
 - a. Submit concurrent with Submittal (Shop) Drawings.
 - b. Calculations are to include analysis of all elements including those represented on the performance mock-up.
3. Engineering Submittal (Shop) Drawings to be reviewed and stamped by a professional engineer registered in the State the project is located.
4. Communicate special requirements, changes, or modifications to curtain wall and interface between curtain wall support system and building structural frame.
5. Sample of Special Warranty.
6. Meeting minutes from Pre-installation Conference.
7. Installer Qualifications per Quality Assurance, above.
8. Certified independent laboratory test reports verifying compliance with performance characteristics.
9. Field Quality Control Reports.

G. Contract Closeout Information:

1. Record Drawings: Following completion of the Testing Program, submit revised "as-built" submittal (shop) drawings and engineering analyses, incorporating all changes made to Performance Mockup during the course of the testing into

- Submittal (Shop) Drawings.
- 2. Maintenance data. See Section 01 78 23 (Verify correct section).
- 3. Special Warranty. See Section 01 78 36 (Verify correct section).
- 4. Minutes of Preinstallation Conference.

1.4 SPECIAL WARRANTY

- A. Fabricator/Installer's written two (2) year warranty, agreeing to repair or replace defective materials or workmanship, including noncompliance with specification requirements and industry standards, which result in failure of the curtain wall system, finish, glass or parts.
 - 1. Failure not meeting specifications includes but not limited to: Defects in materials, workmanship, water infiltration of assembly, air infiltration of assembly, glazing, sealant or defects which influence system capacity to perform as a weather tight envelope in conformance with specified performance criteria.
 - 2. Glass: Refer to Section 08 81 23 - Exterior Glass and Glazing. Submit pass-through warranties from glass manufacturer and glazing fabricators.
 - 3. Finish: Coatings Manufacturer and applicator to warrant paint for a period of 20 years against failure (cracking, flaking, blistering, or combination of finishes) of PVDF finish. Submit pass-through warranties from paint manufacturer and painters.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Custom Unitized Curtain Wall Assemblies: MG McGrath, Inc.,

1387 East Cope Ave; Maplewood, MN 55109; Tel:
651.704.0300; Fax: 651.704.9989; Email:
info@mgmcgrath.com; Web: www.mgmcgrath.com

2.2 PERFORMANCE/DESIGN CRITERIA

- A. Drawings and Specifications:
 - 1. Contract Documents provide Architectural diagrammatic drawings and performance specifications for design, fabrication, and installation of exterior glazing system.
 - 2. Architectural details shown are intended as a guide for aesthetic and interface requirements of various components of exterior walls and adjacent work.
 - 3. Requirements shown establish basic system concept of glazing system.
 - 4. Drawings are not to be construed as engineering design, or adequate to meet engineered design requirements.
- B. Contractor Responsibilities:
 - 1. Single source responsibility for building envelope design, engineering, fabrication, transportation, erection and testing of Unitized Curtain Wall Assembly.
 - 2. Design and engineering of curtain wall systems within Architect's aesthetic parameters of system and specified performance criteria and code required provisions.
 - 3. Engineering and design and interface detailing of components and materials, factory fabrication, assembly, sealing and glazing of unitized curtain wall.
 - 4. Develop conditions through envelope contractors Submittal (Shop) Drawings including interface detail with other trades to same level of aesthetics in

compliance with performance criteria as indicated for detailed areas. Cross-coordinate submittals of details from all adjacent and penetrating trades.

5. Minor deviations in dimensions and profiles may be considered provided they do not change design concept or system performance.

C. System Design:

1. Unitized curtain wall types: See Architectural drawings.
2. Components:
 - a. Provide gaskets, sealant, glazing, elastomeric and aluminum flashing, aluminum air/water barrier panel, back pans, insulation, trim, copings, closure plates, metal plate wall panels, interior aluminum window sills, extruded aluminum applications and aluminum finish system closures as required for work under this section.
 - b. Spandrel Conditions (inside to outside):
 - 1) Prefinished aluminum back pan vapor barrier.
 - 2) Stiffeners for fire containment system assembly at slab lines.
 - 3) Mineral wool insulation tight to the back pan and with 1 IN air gap between interior face of IGU and mineral wool mechanically pinned in sealed cavity between vapor barrier aluminum air/water barrier and panel.
 - 4) Aluminum air/water barrier panel (shadow box).
 - 5) Aluminum or glass face cladding assembly.
 - c. Split mullions to accommodate movement in horizontal and vertical directions.
 - d. Glaze system and furnish specified glass units.
 - 1) Provide tempered, heat-treated or laminated glass units as code or stress analysis requires.
 - e. Support insulation and fire stopping system within aluminum curtain wall framing and entrance systems.
 - f. Interior Aluminum Window Sills: Shall support a 300 LB human load. Load caused by personnel standing on sill for maintenance or other purposes.

D. Thermal Expansion and Structural Movement: **Confirm w/ Structural Engineer**

1. Expansion and contraction, caused by changes in surface temperature equal to delta T.
 - a. Delta T for this project: 200 DEGF. Temperature range may be assumed to be minus 20 to 180 DEGF. Temperature range will vary based on color selections and project location.
 - b. Thermal contraction/expansion in this range shall not cause buckling, stresses on glass, failure of joint seals, undue stress on structural elements, damaging loads on fasteners, reduction of performance, or other detrimental effects over this temperature range.
 - c. Operating doors shall function normally over this temperature range.
2. Structural movements of building structure
 - a. Inter-story drift caused by wind forces.
 - 1) $h/400$ or 1 IN maximum.
 - b. Live load plus superimposed dead load deflection of the supporting members.
 - c. $L/360$ or 1/2 IN maximum.
 - d. Perimeter beam and/or slab deflection due to superimposed curtain wall dead load.
 - 1) 1/2 IN maximum.
 - e. Structural tolerance of curtain wall assembly: +/- 1 IN in all directions.

E. Thermal Transmittance (U-Value):

1. Calculate U-Value for system by thermal modeling utilizing Therm Windows 7.3.
2. U-Values:
 - a. Curtain Wall:

<u>Wall System</u>	<u>Vision</u>	<u>Spandrel</u>	<u>Overall</u>	<u>(IG Gas Fill)</u>
Typical CW	0.33 Btu/hr-ft ² -F	0.06 Btu/hr-ft ² -F	0.1 Btu/hr-ft ² -F	Argon

3. Interior Design Condition: Confirm w/ Programming / Engineer

- a. Temperature: 74 DEGF.
- b. Relative humidity: 35 percent.

4. Exterior Design Conditions: Update w/ ASHRAE values per project requirements

- a. Temperature: 6 Deg F.
 - b. Exterior wind speed: 15 miles per hour.
5. Condensation is not permitted on any interior surface under the specified conditions.
- F. Condensation: Defined as water, ice, or frost occurring inboard of the air barrier line of the unitized curtain wall, or water that is not collected and managed by drainage or evaporation in a gutter system. Gutter systems shall not compromise the air infiltration, water penetration, or thermal performance of the unitized curtain wall.
- G. Provide a sealed assembly at floor lines, including within vertical chambers of curtain wall framing, to prevent air leakage between floors. Provide mullion plugs at top of units at parapets and at bottom cantilevers at soffit conditions. Provide closure plate at bottom of system transition to soffits as shown.
- H. Air Infiltration Limits:
1. Fixed glazing: Less than 0.06 CFM/FT² when tested at 6.24 PSF.
 2. Operable doors:
 - a. Less than 0.50 CFM/FT² when tested at 6.24 PSF.
- I. Not Permitted: Excessive vibration due to harmonics, noises caused by thermal movement, and thermal movement transmitted to other building components which either independently or jointly cause the loosening, weakening, or fracturing of fasteners or system components.
- J. Gravity Deflection Limits: **Confirm w/ Structural Engineer**
1. Deflection of member in direction parallel to plane of wall, when carrying its full dead load, not exceeding an amount which will reduce glass bite below 75 percent of design dimension.
 2. Limit dead load deflection to L/360 or 1/8 IN, whichever is less.
 3. Provide minimum 1/8 IN clearance between member and top of fixed panel, glass, or other fixed part immediately below.
 4. Clearance between member and operable door, minimum 1/16 IN.
- K. Load Requirements:
1. Design curtain wall systems and anchorage to meet Design Loads.
 - a. Wind loads: Use most restrictive of following:
 - 1) Wind pressures as required per local building code based on wind speed, exposure factor and importance factor noted in the Structural Drawings.
 - 2) Wind tunnel pressures per Engineer report; See Section 00 31 00 (Verify correct section).
 - b. Deflection values: Use most restrictive of the following:
 - 1) Limit deflection to comply with Building Code as locally adopted and amended.
 - 2) Tower: Deflection of framing member in direction normal to plane of wall not exceeding 1/175 of clear span or 3/4 IN whichever is least.
 - a) Maximum deflection at cantilevers not to exceed 2L/175.
 - 3) Maximum glass deflection:
 - a) Maximum glass deflection due to wind load: 1 IN (25 mm).
 - b) Maximum glass deflection due to building code guard rail loads for glazing units adjacent to walking paths both interior and exterior as

- identified by Architect: 0.59 IN (15 mm).
- c) Use a 200 LB point load over a 1 FT x 1 FT area applied at glazing centers up to 42 IN above the walking surface or a 50 LB per LF load at same height.
 - 4) Deflection of metal panel short direction not exceeding 1/60 of span.
- L. Structural Requirements:
1. Uniform design load:
 - a. Conduct in accordance with ASTM E330.
 - b. Test at 100 percent design test pressure, both positive and negative, acting normal to plane of wall.
 - 1) Pass criteria: Deflection shall not exceed design deflection limits per Wind Load Requirements above.
 - 2) Positive and Negative Test Load: +32 psf / -59 psf. **Confirm w/ Structural Engineer**
 - c. Test at 1.5 times design test pressure, both positive and negative, acting normal to plane of wall.
 - 1) Pass criteria:
 - a) No glass breakage; permanent damage to fasteners, hardware parts, or anchors.
 - b) No damage to make curtain wall insert vents inoperable.
 - c) No permanent deformation of any main frame member in excess of 0.2 percent of its clear span.
 - d. Deflection of framing member in direction normal to plane of wall not exceeding 1/175 of clear span or 3/4 IN whichever is least.
 - 1) Maximum deflection at cantilevers not to exceed 2L/175.
 - e. Maximum glass deflection for other glazing units 1 IN.
 - f. Deflection of exposed metal panel short direction not exceeding 1/60 of span.
 - g. Measure deflection from gauges located on vertical mullions and horizontal members.
 2. Water test performance:
 - a. No uncontrolled water leakage at 15 PSF static pressure differential, when tested in accordance with ASTM E331.
 - b. No uncontrolled water leakage at 15 PSF dynamic pressure differential, when tested in accordance with AAMA 501.1. No uncontrolled water leakage: Defined as no visible water intrusion to, or visible water on, interior surfaces.
 - c. All extrusions to be utilized as part of the assembly must be included in the mockup test report.
 3. **Vertical interstory movement**: Vertically displace intermediate level support 5/8 IN up and down three complete cycles leaving wall in open position to repeat static water testing, then return wall to nominal position. **Confirm w/ Structural Engineer**
 4. Air infiltration: Test specimens in accordance with ASTM E283.
 - a. Pass criteria: Performance mockup air infiltration shall be less than 0.06 CFM/FT² when tested at a pressure differential of 6.24 PSF.

2.3 MATERIALS

- A. Aluminum Components:
1. Alloy and temper as recommended by manufacturer for strength, corrosion resistance, and application of required finish.
 2. Extrusions: ASTM B221.
 3. Sheet/plate: ASTM B209.
 4. Structural profiles: ASTM B308/B308M.
 5. Extruded structural pipe and tubes: ASTM B429.
 6. Welding rods and bare electrodes: AWS A5.10/A5.10M.

7. Thicknesses to comply with structural loading requirements (increase thickness as required by structural calculation), but not less than:
 - a. Principal extrusions: Minimum 0.125 IN.
 - b. Extruded trim: As structurally required.
 - c. Formed trim: Minimum 0.125 IN.
 8. Submit calculations for alternate alloys or tempers verifying structural adequacy for alloy provided.
- B. Steel Components:
1. Smooth and free from surface blemishes.
 2. Structural shapes, plates, and bars: ASTM A36, ASTM A992, ASTM A572 or ASTM A529 as required by manufacturer's design and engineering.
 3. Cold-formed hollow structural sections: ASTM A500, ASTM A53 or ASTM A1085 as required by manufacturer's design and engineering.
 4. Cold-rolled sheet and strip: ASTM A1008.
 5. Hot-rolled sheet and strip: ASTM A1011.
 6. Provide steel reinforcements as required to meet performance requirements.
 7. Finish exposed reinforcing steel to match the glazing system.
- C. Framing Members:
1. Manufacturer's extruded or formed aluminum framing members of thickness required and reinforced to support imposed loads.
 - a. Sharp, straight profiles free of defects or deformations.
 2. Framing members, transition members, mullions and mountings shall be of extruded aluminum grade as required for structural and finish requirements.
 3. Minimum thickness of structural portions of members shall be 0.125 IN.
 4. Male/Female vertical mullions: per approved profiles and details.
 5. Horizontal transom: per approved profiles and details.
 6. Horizontal expansion transom minimum: per approved profiles and details.
 7. Design shall include a method of weepage to the exterior for any condensation or leakage.
 8. Construction for fixed framing shall consist of vertical and horizontal aluminum extruded mullions designed to allow replacement of vision shadow box lites and spandrel panels from exterior.
 9. Door frames shall be provided with snap on type door stop with inserts for door silencing.
 10. The systems shall be unitized and shop glazed to the extent possible.
- D. Brackets and Reinforcements:
1. High strength aluminum units.
 2. Nonmagnetic stainless steel, 300 series.
 3. Hot dip galvanized steel.
 - a. Comply with ASTM A386.
 4. 1/4 IN thick minimum stainless-steel plates at threaded fasteners, where the threaded fastener is required to engage the stainless-steel plate.
 5. Non-staining, nonferrous shims.
- E. Embedments: Adjustable connections between curtain wall and building structure: per curtain wall manufacturer design and approved details.
- F. Fasteners:
1. Screws and bolts connecting aluminum parts in wet areas: ASTM A666 type 300 series stainless steel.
 - a. Interior screws connecting curtain wall components: Alloy steel fasteners with Stalgard coating (100SD, 178SD, 300SD, 600TF, 702TF) or equal.
 - b. Interior bolts connecting curtain wall components: Zinc plated steel bolts, nuts, and washers (505HC, 507HC, 602HC, 607HC).

2. Tee bolts, steel parts, or aluminum and steel parts connecting to embedment:
 - a. ISO 898 Grade 4.6 minimum hot dip galvanized steel.
 - b. Acceptable Manufacturer: Halfen, Jordahl or equal.
 - c. At unique conditions/locations, connections shall be SAE grade 5 per curtain wall contractor's design and engineering. Curtain wall contractor to call-out unique locations to Structural Engineer of Record for evaluation prior to installation. Remaining fasteners and connection parts: ASTM A666 type 304 or 316 stainless steel.
 3. Fastener alloys and coatings:
 - a. Compatible with adjacent materials to prevent galvanic action and corrosion.
 - b. Minimize use of self-drilling screw fasteners to connections where access cannot be arranged to place a bolt.
 4. Use exposed fasteners only where unavoidable for application of hardware.
 - a. Match finish of adjoining metal.
 - b. Countersink flat head machine screws for exposed fasteners.
 5. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
 6. Reinforce members as required to receive fastener threads.
- G. Anchors:
1. Six way adjustable: Up, down, in, out, left, right.
 2. Minimum adjustment of 1 IN all directions.
 3. Finish compatible with adjoining materials and recommended by manufacturer.
- H. Concrete and Masonry Inserts:
1. Hot-dip galvanized.
 - a. Comply with ASTM A123/A123M or ASTM A153/A153M requirements.
 2. Stainless steel.
- I. Glass:
1. See Section 08 81 23 for glass to be installed under this section.
 2. Provide heat strengthened and tempered glass where necessary to withstand loads or comply with local codes.
- J. Glazing and Gasket Materials:
1. Non-shrinking, weather resistant, and compatible with contacting materials.
 2. Setting blocks/edge blocking:
 - a. Silicone.
 - b. Provide in sizes and locations recommended by GANA Glazing Manual.
 3. Back bedding tape, expanded cellular glazing tape, toe bead, heel bead and cap bead:
 - a. Provide in accordance with AAMA 800.
 4. Glazing gaskets: Silicone.
- K. Flashing:
1. Minimum 0.125 IN extruded aluminum where glazed into curtain wall.
 - a. Formed aluminum Flashings, see Section 07 62 00.
 - b. Extruded aluminum Copings, see Section 07 62 00.
 - 1) Comply with ANSI ES-1 Testing of Shop-Fabricated Edge Metal.
 2. Sizes and shapes indicated.
 3. Finish to match wall system if exposed.
 4. Mill finish if concealed.
 5. Provide dissimilar metals protection at points of masonry contact.
- L. Weatherstripping: Manufacturer's standard replaceable stripping.
- M. Back Pans:
1. Minimum 22 GA galvanized steel with stiffeners as required for firesafing retention.

2. Profile: Coordinate with application,
 3. Insulation:
 - a. Mineral wool, R-value per performance requirements. (Verify)
 - b. 3.5 LBS/FT3 density. (Verify)
 - c. Comply with ASTM C612.
 4. Provide at spandrel glass panels.
- N. Doors:
1. Extrusions aluminum sections assembled with tension rods.
 2. Member wall thickness, minimum: 0.125 IN.
 3. Member depth: 2-1/4 IN.
 - a. Thermal Break: Glass fiber reinforced polyamide nylon providing minimum 3/8 IN thermal separation.
 4. Vertical Stiles and Top Rail, width: 5 IN.
 5. Bottom Rail: 10 IN.
 6. Provide manufacturer's standard weatherstripping at edges and door bottom.
 7. Reinforce doors and frames to receive hardware specified in Section 08 71 00 and Section 08 71 13 (Verify correct sections).
- O. Structural Silicone Sealant:
1. See Section 07 92 13 (Verify correct section).
 2. Exposed sealant color: Black.
 3. Provide sealants and caulking required within and around work of this section, in accordance with manufacturer's recommendations.
- P. Structural –Sealant Glazing: Refer to Section 08 81 23 (Verify correct section) - Exterior Glass and Glazing.
- Q. Zinc-Rich Primer for Ferrous Metal Surfaces: Tnemec-Zinc 90-97 by Tnemec Company, Inc.
- R. Bituminous Coatings:
1. Cold applied asphalt mastic.
 2. Comply with SSPC-PS 12.
 3. Compounded for 30 mil thickness per coat.
 4. Mastic for expansion joints:
 5. Manufacturer's standard.
 6. Provide options for PVC tape and plastic separators. Contingent upon review by Architect.
- S. Transition Boot:
1. Manufacturer's standard system.
 2. Pre-cured low modulus silicone extrusion.
 3. Size to fit joint widths indicated.
 - a. Product: At exposed conditions:
 - 1) 123 Silicone Seal by Dow Corning Corporation.
 - 2) UltraSpan US1100 by GE Advanced Materials - Silicones.
 - 3) Sil-Span by Pecora Corporation.
 - 4) Or approved equal.
 - b. Product: At concealed conditions only: STS transition sheet by Dow Corning or approved equal.
 - c. Adhesive/sealant: As recommended by transition boot manufacturer.
- T. Perimeter Fire Containment System:
1. See Section 07 84 53 (Verify correct section).

2.4 FINISHES

- A. General: Finish exposed areas of aluminum curtain wall components in accordance

with AAMA Voluntary Guide Specification.

1. Color Retention: 5 delta E's as recommended by AAMA 2605-17a Section 8.9.1.2 .
- B. Color Uniformity: 2 delta E's as recommended by AAMA 2605-17a Section 8.1.Exterior Finish:
 1. Standard: AAMA 2605.
 2. 70 percent PVDF, Hylar 500 or Kynar 500, resin. Finish to allow Zero VOC's emitted into facility of application.
 3. Pre-treatment process: Manufacturer's standard.
 4. Factory applied, oven baked.
 5. Specular Gloss, ASTM D523: 30 +/- 5 measured at 60 degree meter setting coil coating and medium gloss for extrusion coating.
 6. Base Product: Duranar Sunstorm (2-coat system) by PPG or equal.
 - a. Primer, DFT: 0.15 mil coil coat; 0.20 mil extrusion coat.
 - b. Color/Metallic coat, DFT: 0.70 coil color coat; 1.0 mil extrusion color coat.
 7. Primer: **TBD**
 8. Color/Metallic Coat: **Custom color, TBD.**
- C. Interior Finish:
 1. Standard: AAMA 2603.
 2. Thermosetting acrylic resin.
 3. Pre-treatment process: Manufacturer's standard.
 4. Factory applied, oven baked.
 5. Specular Gloss, ASTM D523:
 - a. 8-80+ measured at 60 degree meter setting.
 6. Primer:
 - a. Topcoat manufacturer's standard.
 - b. DFT: 0.2 to 0.4 mils.
 7. Topcoat:
 - a. One coat at all locations.
 - b. Dry Film thickness (DFT): 1.0 mil +/- 0.2 with 0.8 mil minimum.
 - c. Base Product: Duracron system by PPG.
 8. Color: **TBD**

2.5 FABRICATION

- A. Coordinate major framing members and components and factory assemble into rectangular units and erect as complete system under single responsibility.
 1. To greatest extent possible, complete fabrication, assembly, finishing, sealing, glazing, hardware application, and other work prior to shipment.
 2. Form or extrude tubular and solid extruded aluminum mullions and horizontal rail shapes with sharp well-defined corners and flush sight lines. Back cutting of formed aluminum shapes is not required.
 3. Make joints neatly, tight fitting hairline joints with ends coped or mitered securely welded, fastened, or joined to develop full structural value of members.
 4. Complete cutting, remove arises, fitting, drilling, and grinding prior to cleaning, surface treatment, and application of finishes.
 5. Do not drill and tap for surface mounted hardware items until time of installation at project site.
 6. Mark components to identify location in Project according to Submittal (Shop) Drawings.
 7. Disassemble components only as necessary for shipment and installation.
 8. All components exposed in the finish work shall be free from warping, oil-canning effects. Also free from, the telegraphing of welds, studs and other fasteners, streaks, tool and die marks.
- B. Provide internal guttering system or other means to drain water passing joints,

condensation occurring within framing members, and moisture migrating within unitized aluminum curtain wall assembly to exterior.

- C. Reinforce work as necessary for performance requirements, and for support to structure.
- D. Provide interlocking stack joints on adjacent vertical grid frame members to allow expansion and contraction of frame units.
- E. Fabricate with provision for thermal and mechanical movements of glazing and framing.
 - 1. Separate metal surfaces at moving joints, anchors and clips with plastic inserts or other non- abrasive concealed inserts.
- F. Conceal fasteners, anchors, and connection devices from view to greatest extent possible.
 - 1. Use no bolts, screws or other hardware components, metallic fastenings that impair condensation resistance or specified U-values.
- G. Weld by methods recommended by manufacturer and AWS standards.
 - 1. Avoid discoloration.
 - 2. Grind exposed welds smooth and restore mechanical finish.
 - 3. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
- H. Provisions for field replacement of glazing from exterior for vision glass and exterior for spandrel glazing.
- I. Fabricate and seal back pans to provide air seal.
- J. Physical and thermal isolation of glazing from framing members.
- K. Separate dissimilar metals with bituminous paint or preformed separators to prevent corrosion.
- L. Fully degrease and clean members prior to assembly or application of sealing compounds or protective coatings.
- M. Make joints exposed to weather watertight by welding, sealing, or both.
 - 1. Seal joints watertight unless otherwise indicated.
- N. Tolerances for Manufacture:
 - 1. +/- 1/32 IN for extrusion fabrication or as necessary for fit and function.
- O. Tolerances for Component Assembly:
 - 1. Assembly: The physical fitting together of any assembly of sub-elements shall be properly allowed for in the Detailed Design of the corresponding sub-elements.
 - 2. Curtain Wall Unit assembly:
 - a. +/- 1/16 IN for overall unit assembly and +/- 1/8 IN for diagonal unit assembly check.
 - b. Gap between removable members: Not more than 1/16 IN or not more than 1/32 IN at end of single member.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General:
 - 1. Comply with manufacturer's written instructions.
 - 2. Maintain accurate relation of planes and angles, with hairline fit of contacting members.
 - 3. Conceal joinery sealant.
 - 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. Seal joints, gaps, penetrations, buttered surfaces and other surfaces watertight unless otherwise indicated.
 - 7. Provide steel reinforcing, supports, braces, bolts, nuts, shims, and other components required to properly erect, align, and secure Work of this Section.
 - 8. Weld components in concealed locations to avoid distortion or discoloration of finish.
- B. Protect glazing surfaces from welding. Installation Tolerances, conform to the following non-cumulative tolerances:
- 1. Variation for Vertical Members: Not more than 1/4 IN in 25 FT.
 - 2. Variation for Horizontal Members: Not more than 1/4 IN in 25 FT.
 - 3. Limit offsets in end-to-end and edge-to-edge alignment:
 - a. 1/16 IN where surfaces are flush or less than 1/2 IN out of flush and separated by not more than 2 IN.
 - b. 1/8 IN for surfaces separated by more than 2 IN.
 - 4. Step in Face: 1/16 IN maximum.
 - 5. Jog in Alignment: 1/16 IN maximum.
 - 6. Variations in Plane: One of the following.
 - a. Not more than 1/8 IN in 10 FT at any location.
 - b. Not more than 3/8 IN over entire face in any length of wall.
- C. Install components plumb and true in alignment with established lines and grades, without warp or rack of framing members, doors, or panels.
- D. Provide separation of aluminum materials from sources of corrosion or electrolytic action contact points.
- E. Use nylon or neoprene washers to allow thermal movement and at points of attachment to structure.
- F. Install flashing and sealants within and at perimeter with splices and end dams for weathertight installation.
- G. Glazing:
- 1. Glass shall be outside glazed.
 - 2. Structural silicone glazed lites: Bond and seal glass to aluminum mullions with silicone adhesive.
- H. Water Drainage:
- 1. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum curtain wall to exterior.
 - 2. Compartmentalize each light of glass using joint plugs and silicone sealant to divert water to horizontal weep locations.

3.2 FIELD QUALITY CONTROL

- A. Quality Benchmarks: Provide Quality Benchmark installations of the first complete system erected on site to verify final selections made under sample submittals and mockups, to demonstrate aesthetic effects and set quality standards for materials and execution.
- 1. Erect Initial Installation 2 stories high in stair-step fashion, minimum 2 bays wide at upper story.
 - a. Initial Installation Quality Benchmark is intended to permit review of appearance, quality of workmanship, coordination, compatibility, and relationships with adjacent materials.
 - 2. Install complete with glass, glazing, insulation, spandrels, anchors, panels and flashings other components required to create finished assembly.

3. Initial Installation Quality Benchmark shall be retained in place as permanent part of building as a standard for workmanship.
 4. Protect the Quality Benchmark during construction.
- B. Unitized Aluminum Curtain Wall Assemblies shall be considered defective if they do not pass tests and inspections.
1. Unit failure of a systemic nature determines status of units supplied to the project site.
 2. Unit failure of a localized nature is not to be construed to reflect upon the units supplied for remainder of project.
 3. Correct compromised unit and retest until tests reflect specified criteria.
 4. Repair is only acceptable if repair samples are provided and confirmed, and guarantee offered by Contractor.
- C. Testing Services:
1. Owner will engage testing agency to perform field testing, see Section 01 45 23 (Verify correct section).
 2. Testing and inspect unitized aluminum curtain wall assemblies as installation proceeds to determine compliance with requirements.
 3. Prepare test and inspection reports.
 4. Water Spray Test:
 - a. Conduct prior to installation of interior finishes in areas designated by Architect. Coordinate scheduling of test with Testing Agency approved by A/E and Contractor.
 - 1) Test ___ linear feet for water spray and ___ number of chamber tests.
 - b. Conform to AAMA 501.2, except as modified herein.
 - c. Water passing through system constitutes failure requiring resolution.
 - d. For each failure condition discovered, make corrective repairs and retest until the leakage is eliminated. Add an additional test for all failed tests at contractor expense. All failures shall be considered systemic failures requiring corrective work at all similar conditions. Remedial measures shall maintain standards of aesthetics, quality and durability and are subject to review by the Architect.
 5. Static Pressure Chamber Tests:
 - a. Water penetration test:
 - 1) Conduct tests in accordance with ASTM E1105.
 - a) Test ___ linear feet for water spray and ___ number of chamber tests.
 - 2) No uncontrolled water leakage is permitted when tested at a static test pressure per Test Requirements in Part 2 above.
 - b. For each failure condition discovered, make corrective repairs and retest until the leakage is eliminated. Add an additional test for all failed tests at contractor expense. All failures shall be considered systemic failures requiring corrective work at all similar conditions. Remedial measures shall maintain standards of aesthetics, quality and durability and are subject to review by the Architect.
 6. Sealant Adhesion Testing:
 - a. Test sealant according to recommendations in ASTM C1521, Destructive Procedure, Method A.
 - 1) Test a minimum of 4 locations on each façade, unless additional testing is required by the manufacturer.
 - 2) Repair locations damaged by testing.
 - 3) Where Architect/Engineer determines that sealant has failed adhesively from testing or does not comply with requirements, additional testing shall be performed to determine extent of non-conforming sealant. Neatly cut out and remove non- conforming sealant, prepare and prime surfaces, and install new sealant. Perform field adhesion tests on new sealant. Additional testing and replacement of non- conforming sealant shall be at Contractor's expense.

- 4) Document testing with photographs and record results.
7. Embedded Anchor Testing:
 - a. Representatives of each anchor type embedded into concrete or reinforced masonry shall be field tested in accordance with ASTM E488 Test Method for Strength of Anchors in Concrete and Masonry Elements.
 - 1) Provide embeds for testing, approximately five (5) total.
 - b. A minimum of 1 percent but no less than 5 anchors of each anchor type shall be tested.
 - c. Each anchor type shall be tested for shear and tension combined to 1.5 times the design load.
 - d. There shall be no failure or permanent deformation.

3.3 PROTECTION AND CLEANING

- A. Adjust operating hardware to function properly and provide tight fit at contact points and weatherstripping.
- B. Remove excess glazing and sealant compounds, dirt, and other substances from aluminum surfaces inside and out.
- C. Remove excess compounds, dirt, and other substances from aluminum and adjacent surfaces.
- D. Remove protective films as required by manufacturer's recommendations.
- E. Institute protective measures, films and hard board on horizontal surfaces, and precautions required to protect work from damage or deterioration, other than normal weathering.

END OF SECTION