SECTION 08 44 13 - GLAZED ALUMINUM CURTAIN WALLS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes glazed aluminum curtain wall assemblies for the entire project. The aluminum curtain wall assemblies work includes the following:

1. Aluminum curtain wall and storefront framing.
2. Swinging entrance doors and framing, including hardware, stripping and thresholds.
3. Aluminum metal panels, shadow box metal panels, condensate gutter, sill extensions, and louvers.
4. Aluminum trim, snap in sealant stops, flashings, parapet copings, and similar items in conjunction with aluminum curtain wall assemblies.
5. Painting and coating in conjunction with the above aluminum items.
6. Internal steel and aluminum reinforcements.
7. Internal and perimeter sealing, joint fillers, weeps, vents and gasketing systems.
8. Anchors, embedments, shims, fasteners, inserts, expansion devices, accessories, support brackets, attachments, and grout.
9. Exterior wall insulation, firesafing, and firestopping.
10. Glass and glazing for the curtain walls, entrances and storefronts.
11. Curtain wall, entrance and storefront sample installations.
12. Curtain wall field testing.
13. Security system components will be incorporated into the door and frame openings of all entrance work. Cooperate and coordinate with the ecurity system contractors to incorporate security system components during the course of the Work.
14. The responsibility for all exterior wall air and water systems design and the on-site control for alignment of all exterior wall components inclusive of those under the metal panel and brick cladding subcontractor's responsibility.

B. The Owner will engage an independent testing and inspection agency to verify the adequacy of the Contractor's quality control; refer to Section 01 45 25 "Testing and Inspection by Owner." Before concealing the window, window wall and curtain wall work obtain the required inspections of same from a representative of the Owner's independent testing and inspection agency.

C. Related Requirements:

1. Section 01 91 19 "Building Enclosure Commissioning."•
2. Section 08 71 00.14 "Door Hardware Schedule" for hardware schedules for doors.
3. Section 08 80 00 "Glazing" for glass products.
4. Appendix B - Testing, Inspection, and Observation by Owner.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Architectural and Design Drawings: The architectural drawings are to be considered representative and indicative of the design intent showing the overall size, profile, intent and location of various wall components in relation to adjacent construction and together with the specified "Performance Requirements" impose the requirements to be conformed to by the Contractor's proposed system.

1.3 ACTION SUBMITTALS

A. Product Data: Submit manufacturer's specifications and installation instructions for each glazed aluminum curtain wall component specified.

B. Shop Drawings: Submit shop drawings showing scaled elevations, plans, and sections of the glazed aluminum curtain wall work. Full scale sections shall be prepared and submitted for details of the assemblies that cannot be shown in the elevations or sections. Include with shop drawings metal thickness of all metal components, glass thicknesses, metal finishes, location and installation requirements of door hardware and reinforcements, and all other pertinent information as necessary or requested by the Architect to indicate compliance with the Contract Documents. Details of field connections, anchorage, and their relationship to the work of others shall be clearly indicated for the coordination of the work by other building trades. Details of fastening and sealing methods and product joinery shall be shown to ensure proper performance of the field installation. No work shall be fabricated until shop drawings for that work have been approved by Architect for fabrication.

1. Hardware Schedule: Organize schedule into sets based on hardware specified. Include name of item and manufacturer, and complete designation of every item required for each entrance door.
2. Indicate routing of electrical conduit and dimensions and locations of cutouts in doors and frames to accept electric hardware devices.
3. Show direction of coil coating applied to metal panel faces.
4. Submit with the shop drawings edge of slab firestopping test reports and project specific engineering judgments demonstrating compliance with the requirements.

C. Structural Calculations: Provide structural calculations prepared in compliance with these specifications. Where these specifications and codes differ, more severe requirements shall govern. Test reports are not an acceptable substitute for calculations. Calculations shall include the following information:

1. Analysis for all applicable loads on framing members and attachment hardware, including but not limited to:

    a. Panel framing and reinforcing per structural performance as well as transport and hoisting
    b. Cladding such as brick, glass and metal panel
    c. Perimeter sealants and other accessory components
    d. Glass deflection analysis
    e. Metal panel deflection and stiffener analysis

2. Seal and signature on calculations of Professional structural engineer currently registered in State in which the project is located. The Engineer shall be experienced in providing engineering services on a minimum of 3 projects for the type of curtain wall work indicated. The engineer shall provide evidence of their design methodology, analysis, including all assumptions.

D. Samples: Submit samples of the following before any work is fabricated:

1. Seven (7) paired sets of samples for each exposed metal finish required. Sample finishes shall be on the specified alloy, temper, and thickness of metal required for the work. Where finishes involve color and texture variations, include sample sets showing the full range of variations expected. Furnish samples in either 12 inch (300 mm) lengths of rails, or 12 inch (300 mm) squares of sheet.
2. Submit seven (7) samples of 18 by 24 inch (450 by 600 mm) cut away samples of metal panels. The metal panel samples shall demonstrate welded corner joints, reinforcements, and stiffeners

E. Product Test Reports: Submit RECENT certified product test reports based on tests performed by an AAMA Accredited Laboratory clearly describing in written form, and in shop drawing form, compliance of each glazed aluminum curtain wall assembly (each window, curtain wall, entrance doors and storefront) with requirements indicated based on comprehensive testing.

F. Thermal simulation and Analysis using LBNL Therm or similar, for each primary detail type and condition, verifying energy performance and condensation resistance.

G. Welding Certifications, qualifications and procedures (WPS) for all processes.

H. Preconstruction sealant adhesion, stain and compatibility test reports for all sealants and substrates.

I. Field re-glazing and panel repair procedures.

J. Field Test Reports.

K. Quality control and assurance plan.

L. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Louver Harmonics Resonance and Vibrations Analysis: Perform and submit wind induced harmonics resonance and vibrations analysis of louvers.

B. Thermal Break Testing: Test results of structural and heat transmission values of the proposed thermal break construction are mandatory for thermally broken extrusion designs prior to mockup and testing.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Instructions: Submit copies of an assembled and bound maintenance manual, describing the devices and procedures to be followed in cleaning, adjusting, and maintaining the curtain wall work. Include information for maintaining operable doors, operating hardware, and replacing weather stripping. Include structural silicone quality control plan for on-site reglazing of structural silicone glass units.

B. Requirements defined by Section 01 91 19 "Building Enclosure Commissioning," Maintenance Manual / BECx Close Out Report.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Award the fabrication of glazed aluminum curtain wall components to a single firm specializing in the fabrication of glazed aluminum curtain wall components who has successfully produced work similar in design and extent to that required for the project, in not less than three projects of similar scope to the satisfaction of the Architect, and whose work has resulted in construction with a record of successful in-service performance for a period of 5 years. The fabricator shall have sufficient production capacity, have organized quality control and testing procedures, and published written and illustrated installation manuals, to produce and properly install the glazed aluminum curtain wall assemblies required without causing delay in progress of the Work.

1. The manufacturer and installer may be one and the same entity.
2. Implement a clear, project specific, system to track information flow and to check that the work is being engineered, and fabricated, to the most up to date revisions of the Contract Documents.
3. Quality Control Plan: Submit a project specific quality control plan demonstrating how quality management will be implemented from award to final completion.

B. Installer Qualifications: Subcontract the glazed aluminum curtain wall work to a firm which is specialized in the erection of curtain walls and who has successfully installed work similar in design and extent to that required for the Project, in not less than three projects of similar scope to the satisfaction of the Architect, and whose work has resulted in construction with a record of successful in-service performance for a period of 10 years.

1. Implement a clear, project specific, system to track information flow and to check that the work is being engineered, fabricated, and installed to the most up to date revisions of the Contract Documents.
2. Quality Control Plan: Implement a project specific quality control plan demonstrating how quality management will be implemented from award to final completion.

C. Testing laboratories shall be specifically qualified, and AAMA accredited, to conduct laboratory and field performance tests required by these specifications and acceptable to the Owner and the Architect. The glazed curtain wall subcontractor's own test facilities will not be acceptable.

1. The following laboratories are known to comply with the requirements:

a. Construction Consulting Lab (CCL), Carrollton, TX
b. Architectural Testing Inc. division of Intertek, York, PA.
c. Architectural Testing Inc. division of Intertek, Riviera Beach, FL.
d. Construction Research Laboratory, Inc., Miami, FL.
e. Construction Consulting Lab West, 4751 W State St., Suite B, Ontario, CA.

2. Pre-Test Mockup Meeting: Prior to the start of construction of each mockup assembly at the test facility, and at the Architect's direction, meet to review methods and sequence of each mockup construction. The meeting shall include the Architect, the Contractor, and the subcontractor/system designer/manufacturer awarded the portion of the Work related to each mockup, related subcontractors, the testing and inspection agent, and any other subcontractors whose work requires coordination with this work. Include in the meeting individual foremen who will be supervising both the work of the mockups as well as the construction of the final Work on the Project.
3. Testing: Conduct tests of each specified mockup under the direction of the Owner's Independent Testing and Inspection Agency in the presence of the Architect, the Contractor, various component manufacturers and fabricators and the Installer for each specified system to be mocked-up and tested. Proceed with each test only after acceptance of the detailed outline of test procedure.

D. Pre-Construction Sealant Compatibility and Adhesion Testing: Test results confirming compatibility and adhesion are mandatory for all concealed and exposed sealant materials in contact with exterior glazing, stone, precast, other sealants, flashings, metal framing, and shims prior to full size sample installation construction. Refer to Section 07 92 00 "Joint Sealants" for specific testing requirements, and anticipated lead-time necessary to perform testing.

E. Standards: Comply with the applicable provisions and recommendations of the following standards below, where standards conflict the more stringent shall apply:

1. Aluminum Association (AA):

a. "Aluminum Standards and Data", Latest Edition.
b. "The Aluminum Design Manual", Latest Edition.

2. American Architectural Manufacturers Association (AAMA):

a. AAMA "Metal Curtain Wall Manual."
b. AAMA "Aluminum Curtain Wall Design Guide Manual," Volumes 1-9.
c. AAMA "Curtain Wall Manual #10."
d. AAMA "Aluminum Store Front and Entrance Design Guide Manual."
e. AAMA 501.1, "Specification for Method of Test for Metal Curtain Walls for Water Penetration Using Dynamic Pressure."
f. AAMA 501.2, "Specification for Field Check of Metal Curtain Walls for Water Leakage."
g. AAMA 501.4, "Recommended Static Testing Method for Evaluating Curtain Wall and Storefront Systems Subjected to Seismic and Wind Induced Inter-story Drift.
h. AAMA 501.5, "Test Method for Thermal Cycling of Exterior Walls."
i. AAMA 501.7, "Recommended Static Testing Method for Evaluating Windows, Window Wall, Curtain Wall and Storefront Systems Subjected to Vertical Inter-story Movements."

j. AAMA 503, "Field Testing of Metal Store Fronts, Curtain Walls and Sloped Glazing Systems."
k. AAMA 611, "Anodized Architectural Aluminum."
l. AAMA 1801, "Acoustical Rating of Windows, Doors, and Glazed Wall Sections."
m. AAMA 2603, "Voluntary Performance Requirements and Test Procedures for Pigmented Organic Coatings on Extruded Aluminum."
n. AAMA 2605, "Specification for Superior Performing Organic Coatings on Architectural Extrusions and Panels."
o. AAMA TIR-A8, "Structural Performance Poured and Debridged Framing Systems."
p. AAMA TIR-A9-201004, "Design Guide for Metal Cladding Fasteners."
q. AAMA QAG-1, "Quality Assurance Processing & Monitoring Guide for Poured and Debridged Polyurethane Thermal Barriers."
r. AAMA QAG-2, "Quality Assurance Processing & Monitoring Guide for Polyamide Thermal Barriers."

3. American Institute of Steel Construction (AISC), "Steel Construction Manual," Current Edition.
4. American Society for Testing and Materials (ASTM):

a. ASTM C 1401, "Standard Guide for Structural Sealant Glazing."
b. ASTM E 283, "Test Method for Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors under Specified Pressure Differences Across the Specimen."
c. ASTM E 330, "Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference."
d. ASTM E 331, "Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference."
e. ASTM E 488, Standard Test Methods for Strength of Anchors in Concrete Elements.
f. ASTM E 783, "Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors."
g. ASTM E 1105, "Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform or Cyclic Static Air Pressure Difference."
h. ASTM E 1300, "Standard Practice for Determining Load Resistance of Glass in Buildings."
i. ASTM E 1886, "Test Method for Performance of Exterior Windows, Curtain Walls, Doors and Storm Shutters Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials."
j. ASTM E 1996, "Standard for Performance of Exterior Windows, Glazed Curtain Walls, Doors and Storm Shutters Impacted by Windborne Debris in Hurricanes."

5. American Society of Civil Engineers (ASCE), ASCE 7 Minimum Design Loads for Buildings and Other Structures.
6. American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE), ASHRAE Fundamentals Handbook.
7. National Association of Architectural Metal Manufacturers (NAAMM), "Metal Finishes Manual."

8. Steel Structures Painting Council (SSPC): "Steel Structures Painting Manual, Vol. 2, Systems and Specifications."
9. ANSI Z97.1 and Federal Standard 16 CFR 1201, Consumer Product Safety Commission (CPSC): "Safety Standard for Architectural Glazing Materials," as published in the Code of Federal Regulations (CFR). Comply with the applicable requirements of the laws, codes, ordinances and regulations of Federal and Municipal authorities having jurisdiction, wherever requirements conflict the more stringent shall be required. Obtain approvals from all such authorities. As a minimum provide safety glazing complying with ANSI Z97.1 for Category A performance and 16 CFR Part 1201 for Category II performance.
10. Welding Standards: Welding shall be performed by skilled and qualified mechanics. Welding shall be performed in accordance with the applicable provisions of AWS D1.1 "Structural Welding Code - Steel" and AWS D1.2, "Structural Welding Code--Aluminum."
11. Builders Hardware Manufacturers Association (BHMA):

    a. ANSI/BHMA A156.10, "Power Operated Pedestrian Doors."
    b. ANSI/BHMA A156.19, "Power Assist and Low Energy Power Operated Doors."
    c. ANSI/BHMA A156.27, "Power and Manual Operated Revolving Pedestrian Doors."

12. Underwriters Laboratories (UL): Provide power door operators that comply with UL 325.
13. National Fenestration Rating Council (NFRC):

    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 300, "Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems."

F. Sample Installations: After the construction and acceptance of testing mockup(s), construct sample installations of the final exterior wall assemblies where shown on the Drawings.

1. General: Sample installations will be used as a standard for judging acceptability of work for the Project. Replace unsatisfactory work as directed. Maintain sample installations during construction as a standard for judging acceptability of the exterior wall work. Properly finished, maintained, and performing sample installations shall be retained as a portion of the completed work.
2. Size: Provide full sized sample installations to the extent indicated on the Drawings, or if not indicated, as directed by the Architect. Sample installations shall be built on site complete with all glass, aluminum framing, adjacent cladding materials, anchors, connections, flashings, sealants, and joint fillers as accepted on the final shop drawings. Do not take special precautions or use techniques that do not represent those to be used on the work. Do not enclose the interior side of the wall with interior finishes and insulation materials.
3. Refer to the following Sections for related materials and requirements for their incorporation into the sample installation(s):

    a. Section 04 20 00 "Unit Masonry."

b. Section 04 21 13 "Adhered Brick Masonry Veneer."
c. Section 04 43 13.16 "Adhered Stone Masonry Veneer."
d. Section 07 42 13.16 "Metal Plate Wall Panels."
e. Section 07 42 13.23 "Metal Composite Material Wall Panels."
f. Section 07 62 00 "Sheet Metal Flashing and Trim."
g. Section 07 92 00 "Joint Sealants."
h. Section 08 80 00 "Glazing."
i. Section 08 91 19 "Fixed Louvers."

G. Field Test for Anchor Pull Out Strength: Prior to curtain wall fabrication, perform anchor pull out tests at the existing structural framing elements identified to receive curtain wall anchorages. The data obtained from the pull out testing shall be correlated with the structural load calculations with the actual existing substrate's capability to resist wind and gravity load distributions from the anchorages.

H. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00 "Project Management and Coordination." Prior to the start of the curtain wall work, and at the Contractor's direction, meet at the site and review the construction schedule, availability of materials, installers personnel qualifications, equipment and facilities needed to make progress and avoid delays, installation procedures, testing, inspecting, and certification procedures, and coordination with other work. Meeting shall include Contractor, Owner, curtain wall installer, sealant installer, as well as any other subcontractors or material technical service representatives whose work, or products, must be coordinated with the curtain wall work.

1.7 IDENTIFICATION, DELIVERY, STORAGE, AND HANDLING

A. General: Comply with the applicable provisions of AAMA "Curtain Wall Manual #10" for the care and handling of curtain wall work from shop to site.

B. All components of the curtain wall work shall be identified after fabrication by marks clearly indicating their location in the building. Packaging of components shall be so selected to protect the components from damage during shipping and handling.

C. Storage on Site:

1. Store curtain wall components in a location and in a manner to avoid damage to the components. Stacking shall be done in a way that will prevent bending, excessive pressure, abrasion or other permanent damage of the component and its finished surfaces.
2. Store curtain wall components and materials in a clean, dry location, away from uncured concrete, masonry work, sprayed on fireproofing work, and other construction activities. Cover with non-staining waterproof paper, tarpaulin, or polyethylene sheeting in a manner that will permit circulation of air inside the covering.

D. Keep handling on site to a minimum. Exercise particular care to avoid damage to finishes of metals.

1.8 FIELD CONDITIONS

A. Field Measurements: Verify dimensions of supporting structure by field measurements before fabrication so that the curtain wall work will be accurately designed, fabricated and fitted to the structure. Indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work. Use Contractor's lines and benchmarks as a basis for measurements.

B. Electrical System Roughing-in: Coordinate layout and installation of electrified door hardware with connections to, power supplies, fire alarm system and detection devices, access control system, security system, building control system.

1.9 WARRANTY

A. Special Warranty: Submit a 5-year written warranty, beginning from date of substantial completion, and executed by the Contractor, manufacturer and the curtain wall installer agreeing to repair or replace components of curtain wall systems that develop defects in materials or workmanship, design and engineering, within the specified warranty period. Defects include, structural failures, sealant failures, deterioration of metals, metal finishes, and other materials beyond normal weathering, failure of operating components to function properly, uncontrolled water leakage, uncontrolled air leakage, and any other evidence of failure or deterioration of the curtain wall work to meet performance requirements.

B. Warranty, High Performance Organic Coatings: Submit a warranty for a period of 20 years, warranting the integrity of film and permanence of color of the high performance organic coatings for the following:

1. Color fade not to exceed 5 delta E units (Hunter) as calculated in accordance with ASTM D 2244 on exposed surfaces cleaned with clean water and a soft cloth.
2. Degree of chalking not to exceed rating No. 8 when measured in accordance with ASTM D 4214 on exposed unwashed surfaces.
3. Will not crack, check or peel.

PART 2 - PRODUCTS

2.1 MANUFACTURERS (CW14.001)

A. Basis of Design: Subject to compliance with requirements, provide **KAWNEER; "1600 System 1**."

B. Alternate Manufacturers: Subject to compliance with project requirements, unless otherwise specified, glazed aluminum curtain walls and accessories equivalent to the Kawneer products specified by one of the following alternate manufacturers may be provided:

1. EFCO Corporation; Monett, MO; (800) 221-4169.
2. Tubelite, Inc.; Reed City, MI; (800) 866-2227.
3. Oldcastle Building Envelope (Vistawall), Santa Monica, CA, (866) 653-2278.]

C. Source Limitations: Obtain glazed aluminum curtain walls and aluminum framed entrances and storefronts from single source from single manufacturer.

D. System Requirements:

1. Provide curtainwall system with a capability of being engineered to allow for installation of doors (at a later date) in areas that are currently scheduled to receive vision lites or to allow of vision lites (at a later date) in areas that are currently scheduled to receive doors.
2. Modifications to existing curtainwall and storefronts under warranty: For all modifications to existing curtainwall and storefront system, including addition or relocation of entrances, General Contractor to engage the original installer of the existing curtainwall and storefront systems for new/modification work, to ensure continuation of warranty of existing and new work.

2.2 PERFORMANCE REQUIREMENTS

A. Wind Load Design Requirements: All exterior wall systems and/or components shall be capable of withstanding wind pressures per the local building code and ASCE 7-16, or per project wind tunnel study at the discretion of the Owner and design team.

B. Wind Loads Requirements: Wind loads on all exterior wall systems and/or components shall be referred to as the "Design Wind Pressure" in this section.

1. Design Wind Pressure: Shall be in accordance with ASCE 7-16.

2. Net Permanent Deflection: With a pressure of "Design Wind Pressure," the "net permanent deflections" of framing members must not exceed 1/1000 of span length, and components must not experience failure or permanent distortion.

a. At "connection points" of framing members to anchors, anchor deflection in any direction shall not exceed 1/8" and permanent set shall not exceed 1/16".
b. Where "connection points" are not clearly defined, maximum anchor point deflection and permanent set which are used to determine span of element shall not exceed 1/8" or 1/16" respectively.

3. Stresses shall not exceed the "allowable values" established by the design requirements.

a. For load combinations, a reduction in load increase in "allowable stress" (but not both) may be used only if permitted by code.

4. Glass Panels: Shall not be assumed or used to provide diaphragm action or provide any support of loads or bracing of mullions in the direction parallel to wall.

C. Anchorage and Structural Support Framing:

1. Anchors and supports indicated and/or noted on drawings are schematic and do not necessarily indicate the exact and/or required scope, type, shape or profile.

a. Additional anchorage and structural support framing shall be added or complemented as required.

2. Points of Support for Assemblies: Shall be properly braced in three orthogonal directions (vertical, transverse and longitudinal) to resist loads from any direction, including, but not necessarily limited to, the "positive and negative wind pressures."
3. Anchorage and Support Framing: Shall be designed to accommodate thermal and building movements without harmful effect to exterior wall systems, including glass and glazing materials, and sealant applications.

D. Allowable Stresses:

1. Allowable stresses for aluminum components shall not exceed minimum standards published in the Aluminum Association's Aluminum Construction Manual "Specifications for Aluminum Structures," Latest Edition, and other applicable codes and regulations.
2. Allowable stresses from steel components shall not exceed minimum standards published in the AISC Manual of Steel Construction, Latest Edition, and other applicable codes and regulations.
3. Coordinate with design requirements for this Project.

E. Aluminum-Framed Swinging And Revolving Door Entrances:

1. Structural Performance:

a. Shall be as noted above, except deflection normal to the plane of the wall shall not exceed 1/175 of its clear span or 3/4", whichever is less, for spans less than 13'-6"; and L/240 + 1/4" for spans greater than 13'-6".

2. Air Infiltration and Exfiltration Requirements:

a. ASTM E 283: 6.24 psf.
b. Maximum air infiltration and exfiltration: 0.37 CFM/ft. of crack length for doors.
c. Maximum air infiltration and exfiltration: 0.06 CFM/sq. ft. for fixed areas.

3. Water Penetration Requirements:

a. ASTM E 331.
b. No water penetration for 15 minutes when subjected to a rate of 5 gallons per hour per square foot with differential pressure of 6.24 psf for doors and 12 psf for fixed areas.

F. Glazed Curtain Wall:

1. Structural Performance Requirements, General:

a. Curtain wall system shall be designed for fabrication in compliance with applicable portions of the building code and contract documents specified in this section, including windload requirements.
b. Codes and regulations of other Governing Agencies applicable to curtain wall system shall apply to work of this Section.
c. When applicable Codes or specified requirements differ, the more stringent conditions which provide the most unfavorable conditions shall govern.

d. Curtain wall system shall be designed for axial, flexural, shear and torsional stresses and any combination thereof due to wind, thermal and gravity loads.
e. The "vertical deflection" of any horizontal member supporting glass, when carrying its fully designed dead load, shall not exceed 1/360 of clear span of member, or 1/8", whichever is less.

2. Wind Loads Requirements: Wind loads on curtain wall system shall be referred to as the "Design Wind Pressure" in this Section.

a. Design Wind Pressure: As indicated on Structural drawings.

b. The "wind-induced deflection" of any member in a direction parallel to plane of wall shall not exceed 1/8" at any light or panel or 50% of design clearance dimension between member and edge of a panel, glass or any other part immediately adjacent to it, whichever is less. No disengagement allowed.

1) This deflection is associated with "Design Wind Pressure" with a factor of 1.00.

c. The "wind-induced deflection" of any member in a direction normal to plane of wall shall not exceed 1/200 of its clear span or 3/4", whichever is less, for spans less than 13'-6"; and L/240 + 1/4" for spans greater than 13'-6".

1) For cantilevered elements, 2L/175 where L = length of cantilever. Component deflection may also be limited by the adjacent constructions such as soffits, parapet caps, etc.
2) This deflection is associated with "Design Wind Pressure" with a factor of 1.00.

d. The "vertical deflection" of any horizontal member supporting glass, when carrying its fully designed dead load, shall not exceed 1/360 of clear span of member, or 1/8", whichever is less.

1) This deflection is associated with "Design Wind Pressure" with a factor of 1.00.

e. Sag (dead weight of glass) shall not be more than 1/8" or 25% of design edge clearance of light of glass below, whichever is less. Maximum full deadload deflections, parallel (in-plane) to wall plane, of framing members shall not reduce glass bite or glass coverage, to less than 75 percent of the design dimension.
f. Glass Panels: Shall not be assumed or used to provide diaphragm action or provide any support of loads or bracing of mullions in the direction parallel to wall.

3. Building Dynamics:

a. Is defined as any building movements or deflections caused by the effects of wind, thermal, live or impact loads.
b. Curtain Wall Assemblies: Shall accommodate the building dynamics, and the following, including the tolerances of related work. The following deflections shall be taken concurrently:

1) Refer to Structural Drawings for information related to beam deflection criteria, drift limit, maximum allowable load from cladding and erection tolerances for structural elements.
2) Axial Lengthening and Shortening of Building Columns: 0.08" per floor due to building deflection.
3) Story Drift: Connections shall permit movement in the plane of the panel for "story drift" and shall be properly designed sliding connections using slotted or oversized holes or may be connections which will permit movement by bending of steel or other connections providing equivalent sliding and ductility capacity.

4. Structural Design Loads:

   a. "Allowable stresses" for aluminum curtain wall elements shall not exceed minimum standards published in the Aluminum Association's Aluminum Construction Manual "Specifications for Aluminum Structures," Latest Edition, and other applicable codes and regulations.
   b. Coordinate with design requirements for this Project.

5. Anchorage and Structural Support Framing:

   a. Anchors and supports indicated and/or noted on drawings are schematic and do not necessarily indicate the exact and/or required scope, type, shape or profile.
   b. Additional anchorage and structural support framing shall be added or complemented as required.
   c. Points of Support for Assemblies: Shall be properly braced in three orthogonal directions (vertical, transverse and longitudinal) to resist loads from any direction, including, but not necessarily limited to, the "positive and negative wind pressures."
   d. Anchorage and Support Framing: Shall be designed to accommodate thermal and building movements without harmful effect to curtain wall system, including glass and glazing materials, and sealant applications.
   e. Anchors (bracing, inserts, clips, bolts, etc.): Shall be designed for same loads as curtain wall in addition to all other forces to ensure that the stresses do not exceed the yield point or elastic buckling, whichever is lower.
   f. Holes: Shall not be burned or field drilled in any structural steel members unless approved in writing by Architect.

6. Sills and copings (sheet, plate or extruded) shall be designed to support a 250 lb. point load and to return to original position without being damaged. Deflection under load shall not be more than 1/16 inch (1.6 mm).
7. Limit deflections of metal members spanning door openings to 1/300. The clearance between the member and an operable door shall be no less than 1/16 inch (1.5 mm).
8. Twisting (rotation) of the horizontals due to the weight of the glass shall not exceed 1 degree, measured between ends and center of each span.
9. Tie-Back Requirements: Curtain wall system shall be designed to support exterior maintenance equipment 600 lbs. in any direction simultaneously with 6.24 psf wind pressure inward or outward from grade.

a. Anchorage for the exterior wall maintenance equipment shall be designed, fabricated, and installed to resist forces transmitted from the exterior wall maintenance equipment and as a minimum shall comply with ANSI/IWCA I 14.1. All performance criteria for the exterior wall maintenance equipment, including forces generated by maintenance equipment, anchorage, and equipment selection, shall be furnished by the building maintenance system consultant.

10. Operational (Traffic) Loads: Design and fabricate entrances to withstand the operating loads which result from heavy traffic conditions using the specified hardware, without measurable permanent deflection. Limit elastic deflections so as to provide the normal degree of rigidity required to avoid glass breakage, air leaks and other objectionable results of excessive flexibility. Provide weatherstripping at stiles, sill and head rails of door leaves, to minimize air, water and sound leaks.
11. Thermal/Air/Water Penetration Requirements:

    a. General: Coordinate with "Field Testing" specified in this Section.

12. Water Penetration and Moisture Control Requirements:

    a. Provide systems with no uncontrolled water penetration as defined in the test method when tested in accordance with ASTM E 331 at an inward test pressure differential of 12 psf.
    b. Water penetration is defined as the appearance of water, other than condensation, on the interior or room side of any part of the curtain wall assembly offering protection from the exterior elements to interior building space.
    c. Provisions shall be made to drain to exterior of wall, water entering at joints or glazing reveals, any condensation occurring within the assemblies, any condensation occurring within the assemblies, adjacent secondary wall systems, and similar conditions.

13. Pressure Equalized Design Requirements:

    a. Exterior rain barrier not tightly sealed but capable of protecting openings to the exterior.
    b. Backup air space to equalize to exterior air pressure.
    c. Airtight and watertight structural barrier to the interior.
    d. Second line of weathertight sealant to the interior inside of thermal barrier system shall have the same capacity as exterior barrier.

14. Air Infiltration and Exfiltration Requirements:

    a. ASTM E 283: 6.24 psf.
    b. Maximum air infiltration 0.06 CFM/sq. ft.

15. Condensation Resistance: Design, fabricate and install the curtain wall systems to prevent excessive condensation on the indoor exposure of the wall with the mechanical system functioning under normal operating conditions. A computer-generated thermal analysis for each primary curtain wall system showing temperature gradients through each component of the glazed aluminum curtain wall and the location of the dewpoint shall be submitted with the shop drawing package. Excessive condensation is defined as

water, ice, or frost on more than 5% of the interior or internal surface of any module or component of the wall or the accumulation of uncontrolled flow of water from condensation or melted frost on the wall at any location. An interior or internal surface of any module is any surface other than an exterior surface.

16. Thermal Transmittance: Design, fabricate and install the aluminum framed curtain wall assemblies with the assembly U-factor maximum to comply with ASHRAE 90.1-2007 per the City of Bentonville and Arkansas Energy Code for the project specific geographic location of the building project when tested according to NFRC 100. A computer generated thermal analysis (for each primary curtain wall system; showing temperature gradients through each component of the glazed aluminum curtain wall and the location of the dewpoint shall be submitted with the shop drawing package. Indoor humidity, and indoor and outdoor temperature parameters for the project are available from the mechanical engineer.
17. Solar Heat-Gain Coefficient: Unless otherwise indicated in the glass schedules, provide glass for aluminum framed curtain wall assemblies with a assembly SHGC maximum to comply with ASHRAE 90.1-2007 per the City of Bentonville and Arkansas Energy Code for the project specific geographic location of the building project as determined according to NFRC 200 procedures.
18. Glass Statistical Factor: Glass thicknesses when shown on the drawings, or specified, are for convenience of detailing only and are to be confirmed by the Contractor and/or glass manufacturer. All glass for the size openings shown will be provided in thicknesses such that the probability of breakage at the design "Wind Load" will not exceed 8 lights per 1000 lights (S.F. 2.5) based on a 3 second gust wind load duration, and reflectance and shading indicated. The glass manufacturer shall provide, on request, substantiating glass breakage data if such data is not otherwise available as manufacturer's published data.

    a. The nominal glass thickness permitted shall be 6.0 mm.
    b. All exterior glass shall be assumed to be non-vented due to the use of interior sun screening devices such as shades and horizontal venetian blinds.

G. Louvers (**LV14.001**): As follows, determined by testing units 48 inches (1200 mm) wide by 48 inches (1200 mm) high per AMCA 500:

1. Basis of Design: Refer to Section 08 91 19 "Fixed Louvers."
2. AMCA Seal: Mark units with the AMCA Certified Ratings Seal.
3. Design, fabricate, and install louver assemblies to prevent objectionable noises when installed assembly is subjected to the minimum to the maximum required wind loads.
4. At locations where ductwork is connected to a louver for either intake or exhaust purposes, ductwork shall be installed, sloped, and connected to the louver so that all water entering the ductwork and louver assembly is controlled to positively drain onto the exterior exposure of the exterior wall cladding materials.
5. Include insulated blank-off panels for areas where ductwork is not connected.
6. Included bird screens with finish to match adjacent curtain wall or framing.

H. Glazing System Design: Exterior wall interior glazing channel dimensions, shall be sized to provide bite on glass, minimum edge and face clearances, with reasonable tolerances, and to receive both dry gaskets, and recessed 2 and 4-side structural silicone beads that are below the sill, head, and jamb framing sight lines.

I. Structural-Sealant Glazing: Comply with ASTM C 1401 for design and installation of 2 and 4 side structurally glazed curtain wall assemblies.

J. Design Modifications:

1. Submit design modifications necessary to meet the performance requirements and field coordination.
2. Variations in details or materials shall not adversely affect the appearance, durability or strength of components, nor shall such variations cause excessive stress, or deflections, to the building structural frame.
3. Maintain the general design concept without altering size of members, profiles and alignment.

2.3 MATERIALS

A. Aluminum: Conform to the requirements published in AA "Aluminum Standards and Data," referenced ASTM standards and the following. All aluminum extrusions shall be manufactured to dimensional tolerances so as to eliminate edge projection or misalignment at joints. Unless otherwise specified, provide alloy and temper as required to suit performance requirements and finish(es) indicated. Provide concealed extruded bars, rods, shapes and tubes in alloys as recommended by the fabricator to join or reinforce assembly of exposed aluminum components.

1. Alloys:

a. Sheet and Plate: Alloy 5005 and ASTM B 209 (ASTM B 209M), 'Anodizing Quality.'
b. Extruded Bars, Rods, Shapes, and Tubes: Alloy 6063 and ASTM B 221 (ASTM B 221M), 'Anodizing Quality.'
c. Bars, Rods, and Wire: ASTM B 211 (ASTM B 211M).
d. Sand Castings: ASTM B 26 (ASTM B 26M).
e. Permanent Mold Castings: ASTM B 108.

2. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.
3. Shapes and Thickness: Provide shapes as shown and as required to suit the performance requirements but with wall thickness of not less than the following:

a. Minimum Wall Thickness for Structural Extrusions: 1/8 inch (3 mm).
b. Minimum Wall Thickness for Non-Structural Extrusions: 1/16 inch (1.5 mm).

B. Carbon Steel: For carbon steel components required to join, reinforce or support the assembly of aluminum components provide carbon steel conforming to ASTM A 36/A 36M for structural shapes, plates, and bars; ASTM A 1008/A 1008M for cold-rolled sheet and strip; or ASTM A 1011/A 1011M for hot-rolled sheet and strip; ASTM A 500 or ASTM A 501 for steel tubing.

C. Anchors and Fasteners: Fastener design for aluminum components shall be in accordance with the applicable provisions of the Aluminum Association Aluminum Design Manual AA-ADM1.

1. Material:

a. Wet Zones: Series 300 stainless steel.
b. Dry Zones: Carbon steel complying with either ASTM F 3125 or SAE Grade 5.

2. Anchor and Fastener Metal Alloy Types, Designations and Standards: Alloys as selected by fabricator to prevent corrosion resistance with the components fastened. Do not use self-drilling, self-tapping type fasteners.
3. Where fasteners are subject to loosening or turn out from thermal and structural movements, wind loads, or vibration, use self-locking devices.

D. Cast-In-Place Concrete Inserts: Anchor channel type, with filler strips, manufactured from formed hot or cold rolled carbon steel channels with flange edges returned toward web, having a minimum of two (2) stud, or I, anchors shop welded to the back of each channel, complying with ASTM A 570. Provide channels, bolts, washers, and shims hot-dip galvanized per ASTM A 153/A 153M. Width, depth, and metal thickness as required to suit performance requirements. Manufacturers of specialty inserts include the following:

1. Hilti.
2. Jordahl.
3. Halfen.

E. Concealed Flashing: Dead-soft, 0.018 inch (0.457 mm) thick stainless steel, complying with ASTM A 666, Type 304.

F. Door Hardware: Provide hardware indicated and as scheduled. Finish exposed parts to match butt or pivot finish, unless otherwise indicated. Refer to Section 08 71 00 "Door Hardware."

G. Sound Deadening for Metal Panels: Type as recommended by panel manufacturer for application shown.

2.4 SEALING, GLASS AND GLAZING MATERIALS

A. Concealed Sealing Materials: All sealing materials concealed within the glazed aluminum curtain walls (i.e. glass pockets, end dams, fastener heads, and internal gutters) shall be silicone, compatible with and adherent to each material it will be in contact with, as recommended by the manufacturer to fulfill performance requirements.

1. Each concealed sealant shall be identified on the shop drawings.
2. Splice details shall be designed using silicone. Splice details shall be designed to accommodate the anticipated movement of the joint.
3. All internal sealants which come in contact with the exposed sealants shall be compatible with and adherent to the exposed sealant.

B. Exposed Sealing Materials: All sealing materials exposed at glazed aluminum curtain wall perimeter joints in contact with adjacent cladding materials: Silicone, refer to Section 07 92 00 "Joint Sealants."

C. Glass and Glazing Materials: Refer to Section 08 80 00 "Glazing."

2.5 OTHER GLAZED ALUMINUM CURTAIN WALL COMPONENTS

A. Metal Panels and Copings:

1. Supports: Metal panel and coping supports shall be custom fabricated so that the panels, copings are an integral part of the framing for the canopy and the glazed aluminum curtain wall system; are secure yet accommodate expansion and contraction; and that individual panels, copings may be installed or removed with a minimum amount of disturbance to adjacent components.
2. Fabrication:

    a. Metal panels, copings shall be custom fabricated from minimum 1/8 inch (3.18 mm) thick, ASTM B 209, aluminum sheet. Provide concealed anchorage devices and reinforcements as required to erect metal panels, copings to the exterior wall framing systems and as required to maintain the specified flatness tolerances.
    b. Edge Construction and Profiles: Edge construction shall be as required to secure metal panels, copings to the exterior wall framing systems and provide an air and water tight seal complying with the performance requirements. All metal panel, coping shall be welded and ground smooth prior to final finishing. Metal panel, coping profiles are indicated on the drawings.
    c. Flatness Tolerances: Oil canning shall not be permitted; in addition anchorage devices, cover stiffeners (if any), and reinforcements shall not be visible in the finished (exposed) faces of metal panels and copings.

3. Finishing: After forming metal panels, copings but before finishing, remove abrasions, scratches, die markings, and dents.
4. Apply sound deadening (dielectric separator) on the back side of metal panels.

B. Condensate Gutters: Provide shop fabricated (preformed) extruded aluminum units of the type, size, and profiles required to form a complete and continuous waterproof and weatherproof gutter system complete with prefabricated corner units, expansion joints, and anchoring devices.

C. Shadow Box Metal Back Panels: Custom fabricate metal back panels of shadow box enclosures from minimum 0.08 inch (2.032 mm) thick, ASTM B 209, aluminum sheet metal. Assemble back panels to accommodate expansion and contraction. Oil canning shall not be permitted in metal back panels; in addition, metal back panel anchorage devices (if any), stiffeners (if any), and reinforcements shall not be visible in the finished (exposed) faces of metal back panels. After forming metal back panels, but before finishing, remove abrasions, scratches, die markings, and dents. Finish exposed surfaces of metal back panels using coating and color as selected by Architect from the visual mock-ups. Provide metal back panels with an interior air seal that is concealed from view from building exterior. If interior air seal utilizes tapes, seals, or gaskets, use types that will not release volatiles, nor leave visible deposits or residues on inside of spandrel glass unit or metal back panel.

D. Sheet Metal Partition Filler Panels: Form sheet metal filler panels from 0.05 inch (1.27 mm) thick aluminum sheet for closing ends of gypsum wallboard partitions. Produce flat, flush surfaces without cracking and grain separation at bends. Incorporate reveals, trim, and concealed anchorages for attachment to adjacent surfaces. Adhesively attach vinyl foam sealant tape to filler panel edges which abut adjacent surfaces to form a continuous seal. Use

vinyl foam sealant tape material set onto edge of filler panel. Uncompressed tape thickness shall be sized to fit 3/4 inch (19 mm) wide joint indicated with an additional thickness as required to provide a minimum 15 percent foam compression. Laminate layers of tape as recommended by the manufacturer to provide a single tape thickness for the joint indicated. Fill interior of panel with sound deadening mineral fiber insulation permanently attached to inside panel faces.

1. Vinyl Foam Sealant Tape: Adhesive-backed, closed-cell, compressible, non-extruding, sound transmission reducing, vinyl foam tape strips with approximately 13 Shore 00 hardness that allow fastener penetration without foam displacement, 0.90-inch- (23-mm-) thick, in width 1/2-inch- (12.7-mm-) less than window mullion width. Subject to compliance with specified requirements, furnish and install products by one of the following, or approved equal:

    a. VL8229E Norton Sealant Tape; gray color.
    b. V7324 Norton Sealant Tape; gray color.
    c. Inseal 3109 Single Sided Foam Tape; black.
    d. McMaster-Carr 8694 Series Weather-Resistant Neoprene Foam; black.

E. Thermal Isolators: Provide rigid plastic or nylon isolators of profile and hardness as recommended by the glazed aluminum curtain wall fabricator, and fabricated to a cross sectional profile to interlock with aluminum extrusions for thermal isolation of exterior window frame snap caps to interior window framing.

F. Thermal Break Construction: Fabricate curtain walls with an integrally concealed, poured in place, urethane thermal break, located between extrusions exposed to the exterior or contacting exterior finish materials and window members exposed on the interior or contacting interior finish materials, in a manner which eliminates direct metal to metal contact between exterior and interior metal components of the curtain wall assemblies. Provide thermal breaks of low thermal conductive materials, which satisfy the performance requirements. Urethane material for thermal breaks shall have been designed for window, window wall, and curtain wall construction and have been tested to demonstrate resistance to thermal conductance and condensation. Urethane materials shall be selected which have been in successful use for a minimum of 5 years. All thermal breaks shall be formed under typical plant conditions in extrusions designed for the project and tested to confirm that the product will meet or exceed the performance requirements.

G. Fiberglass Pressure Caps: Provide fiberglass exterior pressure caps where required to meet energy code or project thermal performance requirements.

H. Slip and Separator Gaskets:

1. Bolted Slip Joints: Non-metallic, low friction material bearing temperature and moisture resistances and low abrasion properties as required to suit performance requirements.
2. Non-Bolted Slip Joints: Non-corrosive, non-toxic impregnated felt, or butyl tape with a pressure sensitive adhesive on one surface that is formulated for proper adhesion to metals indicated; gasket shall bear temperature and moisture resistance properties as required to suit performance criteria; thickness and width as required.

I. Wiper and Other System Gaskets: Continuous extruded rubber with cross sectional profile, physical properties, and tolerances as recommended by the curtain wall manufacturer, and as required, to comply with the performance requirements specified.

1. Wiper Gasket Color: Black.

J. Baffle Material: Reticulated foam baffle material with a pore count (ppi) as required by assembly fabricator to suit performance requirements.

K. Insulation: Foil-faced, slag-wool-/rock-wool-fiber rigid board insulation for curtain walls; refer to Section 07 21 00 "Thermal Insulation" for insulation to be used in glazed curtain wall assemblies.

L. Firesafing and Firestopping: Unfaced mineral wool safing insulation topped with smoke stopping material, refer to Section 07 84 43 "Joint Firestopping" for firesafing and firestopping to be used in conjunction with glazed curtain wall assemblies.

1. Design of the firesafing and firestopping system shall be the responsibility of the glazed aluminum curtain wall fabricator and installer.
2. The firesafing and firestopping system shall have been either tested by approved testing laboratories such as UL, or the firesafing and firestopping system shall bear an engineering judgment. In either case the firesafing and firestopping system shall be submitted by the glazed aluminum curtain wall fabricator and installer.
3. Glass and glazing connections to the underside of slab shall be protected with safing mechanically fastened in place.

M. Snap In Sealant Stops: Provide rigid PVC or aluminum sealant stops of profile and hardness as recommended by the window fabricator, and fabricated to a cross sectional profile to interlock with aluminum extrusions at all window perimeters.

N. Louvers: Refer to Section 08 91 19 "Fixed Louvers."

O. Floor Cover Plates: Thickness of floor cover plates to be 3/16 inch (4.5 mm), profiles as indicated on the drawings, or if not indicated, as accepted by the Architect on the shop drawings.

P. Window Sill Extensions: Thickness to match non-structural extrusions, profiles as indicated on the Drawings.

2.6 FABRICATION

A. General: Fabricate the glazed aluminum curtain walls to the designs, shapes, and sizes shown using the materials specified and shown to produce assemblies that meet or exceed the performance requirements. To the greatest extent possible complete fabrication, assembly, finishing, hardware applications and other work before shipment to Project site.

1. Door Stile and Rail Dimensions:

a. Bottomrails: Provide minimum 10 inch (254 mm) high one piece bottomrail unless otherwise indicated on the Drawings.

b. Stiles and Top Rail Dimensions: As indicated on Drawings.
c. Door Thickness: 1-3/4 inch (44.5 mm).
d. Preglaze door units to greatest extent possible, in coordination with installation and hardware requirements. Glazing, whether in factory or in field, shall be performed in accordance with Section 08 80 00 "Glazing."
e. Fabricate all doors and frames to accommodate the swing direction shown.

2. Provide extruded aluminum entrance door inserts at door frames designed with bosses sized to receive selected door gasket.

B. Glazing Stops and Gaskets: Provide continuous interior glazing stops with concealed fasteners for all doors and frames. Provide stops with hairline joints at corners. Provide stops with beveled, not square, shouldered profile unless otherwise shown.

C. Glass Components: Provide holes and cutouts in glass to receive hardware and accessories before tempering glass. Drill, countersink, and chamfer holes using tooling, materials and methods which are selected and applied to prevent spalling of the cut glass surfaces at holes and cutouts. The internal surface of holes and cutouts shall be smooth with minimal roughness from drilling operations. Do not cut, drill, or make other alterations to glass after tempering.

1. Fully temper glass using horizontal (roller-hearth) process and fabricate so, when installed, roll-wave distortion is parallel with bottom edge of door or lite.
2. Heat Soaking: After tempering, expose 100% of all fabricated glass units to European Standard EN14179 heat soaking process to reduce the potential for inclusion related glass breakage.
3. Factory assemble components and factory install hardware to greatest extent possible.

D. Metal Components: Doors and frames shall be cut, reinforced, drilled and tapped in strict accordance with the printed door hardware manufacturer's templates and instructions. Provide solid stainless steel hardware reinforcements, securely fastened to doors and frames where door hardware is to be attached.

1. Security system components may be incorporated into the door and frame openings of all entrance doors and frames. Provide all cutouts required by the Owner's security system vendor and all prewiring for vendor provided security system devices. Wherever storefront and entrance framing components are to receive wiring provide unobstructed clear paths free of burrs and sharp objects with pull strings to facilitate wiring.

E. Joints in Metal Work: All exposed work shall be carefully fitted and matched to produce continuity of line and design, with all joints, being accurately fitted for hairline contact and rigidly secured. Where additional rigidity or strength is required to satisfy the performance requirements reinforce curtain wall components with aluminum or carbon steel shapes, bars, and plates.

F. Shop Assembly: As far as practicable, all fitting and assembly work shall be done in a fabrication shop.

1. Framing members attaching curtain wall components to building supports shall provide for 3-way adjustment to accommodate fabrication and construction tolerances, and allow for thermal and building movements.

2. Provide vents, weepholes and internal water passages in the glazing framing recesses as recommended by the respective glass and framing manufacturers to conduct infiltrating water to the exterior, and to avoid condensation at glass spandrel unit air spaces. Provide weep baffles secured to inside of frame behind vents and weepholes.
3. At shadow box enclosures provide vents, weepholes and internal water passages in the glazing framing recesses from the shadow box interior space to outside air to conduct infiltrating water to the exterior, and to avoid condensation within the interior air space between the glass spandrel unit and the shadowbox enclosure. Provide weep baffles secured to inside of frame behind vents and weepholes.
4. Provide flush endcaps for all mullion extension cap extrusions.
5. Provisions for reglazing from interior for vision glass and exterior for spandrel glazing or panels.

G. Exposed Fasteners: Not permitted.

H. Protection of Metals: Wherever dissimilar metals are in contact, except in the case of aluminum in contact with galvanized steel, zinc, separate such surfaces with a coating of zinc rich primer, bituminous paint, or separation gaskets as the condition requires. Wherever aluminum comes in contact with concrete surfaces separate such surfaces with a coating of zinc rich primer, bituminous paint, or separation gaskets as the condition requires.

I. Welding: Complete the welding of exposed surfaces prior to finishing.

1. All welding shall be in accordance with the recommendations of the AWS and shall be performed with electrodes and/or by methods recommended by suppliers of the metal being welded. Fabricate welded aluminum assemblies so that fraying surfaces are free rinsing and will not trap coating solutions.
2. Welds behind finished surfaces shall be so performed as to eliminate distortion, and discoloration, on the finished side. Plug, puddle, and spot welding are not permitted. Provide low heat filled welds using a chill bar on finished side to eliminate dimpling, distortion, and/or discoloration on the finished side. If weld heads appear on the finished surface, the weld head shall be ground, and polished to match and blend with the finish on adjacent parent metal. Weld spatter and welding oxides on finished surfaces shall be removed immediately.
3. At joints where welding cannot be performed use concealed stainless steel fasteners to join assembly.

J. Shop Painting of Carbon Steel: Ungalvanized steel items shall be thoroughly cleaned of all loose scale, filings, dirt, and other foreign matter, in accordance with SSPC SP3 "Power Tool Clean," and painted with coating as specified for carbon steel surfaces.

2.7 ALUMINUM FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish Application:

1. Apply high performance organic coatings to all exposed surfaces of glazed aluminum curtain wall components.

    a. All exposed/cut ends shall be post fabricated/finished to inhibit filofilm corrosion.

2. Adhesion and Compatibility Testing: Test samples of aluminum coatings on aluminum will be required for compatibility and adhesion testing of all sealants proposed for use on framing components. Refer to Section 07 92 00 "Joint Sealants."

C. Appearance of Finished Work: During production, maintain large size color range samples for use in comparing against production material. Variations in appearance of abutting or adjacent pieces are acceptable if they are within the range of approved samples. Noticeable variations in the same piece are not acceptable.

D. Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.

E. High-Performance Organic Coating Finish: AA-C12C42R1x and the following:

1. Polyvinylidene fluoride finish coating containing not less than 70 percent of "Kynar 500" or "Hylar 5000" fluorocarbon resin specially formulated for spray application to extrusions and preformed aluminum metal shapes. Coating films shall be uniform and visibly free from flow lines, streaks, blisters, sags or other surface imperfections in the dry-film state on all surfaces.

    a. Metal Preparation and Pretreatment: Pretreatment of aluminum surface and application of the finish shall be performed under specifications issued by the licensed formulator to approved applicator and the following as a minimum:

        1) The products used to form the chemical conversion coating on aluminum extrusions shall conform with ASTM D 1730, Type B, Method 5 (Amorphous Chromium Phosphate Treatment), Method 7 (Amorphous Chromate Treatment), or Trivalent Chrome Treatment.

            a) All aluminum framing surfaces indicated to receive structural glazing compounds shall be amorphous chromate phosphate wash-coat pretreatment; (a.k.a. Alodine treated) as a minimum; mill finishes are prohibited.

        2) The coating weight of the chemical conversion coating shall be a minimum of 40 mg. per ft.2 on exposed surfaces as specified in ASTM B 449, Section 6, Class I. Processing shall conform with that specified in ASTM B 449, Section 5.

    b. Thickness:

        1) Fluoropolymer 3-Coat Coating System: Minimum 1.6 mil total dry film thickness (0.25 mil primer +/- 0.05 mil and 1.35 mil topcoat).

    c. Coating Performance Criteria: Meets or exceeding AAMA 2605.
    d. Color: One custom color to be determined by Architect.

e. Manufacturer, Coating System:

1) Three Coat, Opaque System; one of the following:

a) PPG Paints; Duranar XL.
b) Sherwin-Williams (formally Valspar, Inc.); Fluropon Classic.

2) Three Coat, Metal Flake System; one of the following:

a) PPG Paints; Duranar XL.
b) Sherwin-Williams (formally Valspar, Inc.); Fluropon Classic.

2.8 COATINGS FOR CONCEALED METAL SURFACES

A. General: The following protective coatings shall be applied to surfaces of metals which are to be concealed in the construction:

1. Coating for Carbon Steel: Hot dip galvanized, complying with ASTM A 123.
2. Coating for Aluminum, and Carbon Steel: Where aluminum or carbon steel surfaces are to be in contact with each other or in contact with dissimilar materials such as masonry or concrete, and where hot dip galvanizing of carbon steel is incompatible with component parts because of galvanic action or component fabrication tolerances provide one of the following:

a. Bituminous Paint: Cold-applied, non-sagging, bituminous paint complying with ASTM D 1187. Apply in two coats for an overall minimum dry film thickness of 25 mils.
b. Zinc Rich Primer: Organic zinc-rich primer, complying with SSPC-Paint 20.

PART 3 - EXECUTION

3.1 PREPARATION

A. Coordinate glazed aluminum curtain wall work with the work of other Sections and provide items to be placed during the installation of other work at the proper time to avoid delays in the work.

B. Templates and Diagrams: Furnish templates, diagrams, and other data to fabricators and installers of related work, as necessary for coordinating entrance and storefront installation.

C. Place such items, including concealed overhead framing, accurately in relation to the final location of glazed aluminum curtain wall components.

3.2 EXAMINATION

A. Examine the substrates, adjoining construction, and conditions under which the Work is to be installed. Proceed with installation only after unsatisfactory conditions have been corrected.

1. Before beginning installation of the glazed aluminum curtain wall work examine all parts of the existing building structural frame and the existing building cladding indicated to support the glazed aluminum curtain wall work. Notify Contractor in writing, of any dimensions, or conditions, found which will prevent the proper execution of the glazed aluminum curtain wall work, including specified tolerances. Use Contractor's offset lines and bench marks as basis of measurements.

3.3 INSTALLATION

A. General: Comply with manufacturer's written instructions for protecting, handling, and installing glazed aluminum curtain wall systems. Do not install damaged components. Fit frame joints to produce hairline joints free of burrs and distortion. Rigidly secure non-movement joints. Loose particles present or resulting from fabrication or field cutting and drilling shall be removed by blowing out joints with oil free compressed air, or by vacuuming joints. Remove protective coatings, oils from cutting and drilling operations, and residue on metallic surfaces with solvents that leave no residue. Do not allow solvent to air dry without wiping. Use only lint free towels for wiping of surfaces. Wipe metal surfaces with IPA (isopropyl alcohol) or xylene unless otherwise required by compatibility and adhesion testing results. Seal joints watertight. Clean excess joint sealants from finished surfaces.

1. Cut and trim component parts of the glazed aluminum curtain wall work during erection only with the approval of the manufacturer or fabricator, and in accordance with his recommendations. Restore finish completely to protect material and remove all evidence of cutting and trimming. Remove and replace members where cutting and trimming has impaired strength or appearance, as directed by Architect.
2. Set components within the erection tolerances with uniform joints. Place components on shims and fasten to supporting substrates using bolts and similar fasteners. Use stainless steel shims at structural connections only. U-shaped shims at structural connections are not permitted. Use aluminum, stainless steel, or high impact polystyrene shims at other connections.
3. Do not erect components that are warped, deformed, bowed, dented, defaced or otherwise damaged as to impair its strength or appearance. Remove and replace members damaged in the process of erection.
4. Coat concealed surfaces of dissimilar materials, and any ferrous metal components, with a heavy coating of bituminous paint, zinc rich primer or other separation in accordance with manufacturer's recommendations. Where aluminum components will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
5. No holes or slots shall be burned, cut into, or field drilled in any building framing member without the written acceptance of the structural engineer.

B. Glazed Aluminum Curtain Wall, Entrance and Storefront Framing: Install framing components plumb and true in alignment with established lines and grades without warp or rack of framing members.

C. Entrance Doors: Doors shall be securely anchored in place to a straight, plumb and level condition, without distortion. Adjust doors to provide a tight fit at contact points for weathertight closure and to operate smoothly, without binding, with hardware functioning

properly. Weatherstripping contact, and hardware movement, shall be field tested and final adjustment, and lubrication, made for proper operation and performance of doors.

1. Door Hardware: Refer to Section 08 71 00 "Door Hardware."
2. Install surface-mounted hardware according to manufacturer's written instructions using concealed fasteners to greatest extent possible.
3. Set, seal, and grout floor closer cases as required to suit hardware and substrate indicated.
4. Set sill members in a bed of silicone sealant to provide weathertight construction. Comply with requirements of Section 07 92 00 "Joint Sealants."
5. Install complete automatic door operator system in accordance with door manufacturer's instructions including controls, control wiring, and power units.

    a. Refer to Division 26 Sections for connection to electrical power distribution system.

D. Grilles, Louvers, Metal Panels, Copings and Signs: Install components plumb and true in alignment with established lines and grades.

E. Sheet Metal Partition Filler Panels: Locate and place partition filler panels plumb, level, and in alignment with adjacent construction, with uniform reveals as shown. Provide concealed foam tapes, and install as the installation progresses to make installations acoustically sealed and light tight. Do not penetrate window and curtain wall framing with any type of fastenings.

F. Canopy Metal Panels: Erect to levels and slopes indicated, in proper alignment and relation to established lines and grades. Do not use fastening systems which will telegraph through or deform canopy metal panels in any way.

G. Exterior Wall Maintenance Equipment: Install components plumb and true in alignment with established lines and grades and in compliance with the building maintenance system consultant's criteria.

H. Flashing: Install flashings fabricated from specified flashing material to the profiles shown. Flashings shall be furnished in single piece lengths. Laps and joints, where required, shall be lap seamed by a minimum of 4 inches (100 mm) with lap completely embedded in sealant. Mechanical fasteners shall be used where necessary to maintain contact of overlapping elements. Spot heads of all fasteners with sealant. Refer to Section 07 62 00 "Sheet Metal Flashing and Trim."

I. Install glazing to comply with requirements of Section 08 80 00 "Glazing," unless otherwise indicated.

J. Install perimeter sealant to comply with requirements of Section 07 92 00 "Joint Sealants," unless otherwise indicated.

K. Concealed Sealing Components: Apply sealant and gasket components which are integral to the glazed aluminum curtain wall systems in strict accordance with the each component manufacturer's printed instructions. Before applying components remove all mortar, dust, dirt, moisture, and other foreign matter that will be deleterious to the intended performance of the component. Mask adjoining exposed surfaces to avoid spilling, dripping, dropping or other unintended contact of the sealing components onto adjacent exposed surfaces.

L. Field Applied Insulation:

1. Exterior Wall Building Insulation: Install insulation materials as specified in Section 07 21 00 "Thermal Insulation."
2. Firesafing: Clean debris from behind curtain wall framing during erection and provide temporary closures to prevent further accumulation of debris. Install firesafing to comply with local authorities having jurisdiction and AAMA TIR-A3 "Fire Resistive Design Guidelines for Curtain Wall Assemblies." Install firesafing with securely anchored metal flanges or make equivalent provisions to prevent dislocation. Comply with the requirements of Section 07 84 43 "Joint Firestopping."

3.4 ERECTION TOLERANCES

A. The glazed aluminum curtain wall systems shall be fabricated and erected to accommodate the dimensional tolerances of the structural frame and surrounding cladding while providing the following as installed tolerances.

1. Variation from theoretical calculated position as located in plan or elevation in relation to established floors lines, column lines and other fixed elements of the structure, including variations from plumb, level, straight and member size: +/- 1/4 inch max in any 20'-0" (+/- 6 mm in any 6 m) run, column-to-column bay, or floor-to-floor height.
2. Alignment: Where surfaces abut in line, and meet at corners, limit offset from true alignment to 1/32 inch (0.75 mm).
3. Variation from angle, or plumb, shown: +/- 1/8 inch max in any 10'-0" (+/- 3 mm in any 3 m) run or story height, non-cumulative.
4. Variation from slope, or level, shown: +/- 1/8 inch max in any 20'-0" (+/- 3 mm in any 6 m) run or column-to-column bay, non-cumulative.

3.5 ANCHORAGE

A. Anchorage of the glazed aluminum curtain wall work to the structure and surrounding cladding shall be in accordance with the accepted shop drawings.

3.6 WELDING

A. Weld with electrodes and by methods recommended by manufacturer of material being welded, and in accordance with AWS D1.1 for concealed steel members.

B. Welds and adjacent metal areas shall be thoroughly cleaned and coated with a single coat of bituminous paint.

3.7 FIELD QUALITY CONTROL

A. Field quality control shall be the responsibility of the Contractor in accordance with Section 01 45 17 "Contractor's Quality Control." Field quality control testing and inspection shall be at the discretion of the Contractor as necessary to assure compliance with Contract requirements. Owner T&I shall not preclude Contractor responsibility to perform similar routine, necessary,

and customary testing and inspection of the methods and frequency suitable for the type of work involved.

B. Testing Agency: Owner to engage a qualified independent testing agency to observe field quality-control testing indicated. Conduct tests of each specified sample installation under the direction of the testing agency in the presence of the Owner, Architect, BECxP, the Contractor, various component manufacturers and fabricators and the Installer for each system incorporated in the sample installation.

1. Field Testing: Test the curtain wall, and punched opening window, sample installations erected to the opaque portions of the exterior wall cladding in accordance with the specified field test methods. Conduct tests of each specified sample installation under the direction of the testing laboratory in the presence of the Owner, Architect, BECxP Consultant, the Contractor, various component manufacturers and fabricators and the installer for each specified system incorporated in the sample installations.

a. Field Test for Water Leakage (Chamber Testing):

1) Water Spray Test with Static Air Pressure Difference: ASTM E 1105 Procedure A and AAMA 503 conducted at a Uniform Static Test Pressure of 12 lbf/sq. ft. (580 Pa), with no reduction in pressure allowable.
2) Criteria: No water at 12 lbf/sq. ft. (580 Pa).
3) Schedule and Number of Tests: At each Parking Garage, provide 1 location at 20% completion (3 total tests) - sizes and locations to be determined by Architect / BECxP.
4) Correct all deficiencies observed as a result of this test and retest. For each unsuccessful field test, two similar sample installation areas shall be selected and tested. Any repairs or remediation conducted to pass a test, if they constitute a change to the design (e.g., sealing of a joint that was previously open, or adding a weep hole) must be implemented throughout the work. Any remedial repairs which increase the maintenance requirements of the system (i.e., face sealing of a drained system), will not be accepted.

b. Field Test for Water Leakage (Hose Stream Testing):

1) Water Spray Test without Static Air Pressure Difference: AAMA 501.2.
2) Criteria: No leaks.
3) Schedule and Number of Tests: At each Parking Garage, provide:

a) 5 window to masonry cladding joints, 10 LF each.
b) 5 curtain wall vertical and horizontal unit joints, 15 LF each

4) Correct all deficiencies observed as a result of this test and retest. For each unsuccessful field test, two similar sample installation areas shall be selected and tested. Any repairs or remediation conducted to pass a test, if they constitute a change to the design (e.g., sealing of a joint that was previously open, or adding a weep hole) must be implemented throughout the work. Any remedial repairs which increase the maintenance

requirements of the system (i.e., face sealing of a drained system), will not be accepted.

c. Field Test for Water Leakage (Hose Stream Testing) at perimeter of louver sealant joints:

1) Water Spray Test without Static Air Pressure Difference: AAMA 501.2.
2) Criteria: No leaks.
3) Schedule and Number of Tests: At each Parking Garage, provide 3 locations, entire perimeter of louver, maximum 20 LF; at 10%, 25% and 50% completion of sealant installation = 9 tests total.
4) Correct all deficiencies observed as a result of this test and retest. For each unsuccessful field test, two similar sample installation areas shall be selected and tested. Any repairs or remediation conducted to pass a test, if they constitute a change to the design (e.g., sealing of a joint that was previously open, or adding a weep hole) must be implemented throughout the work. Any remedial repairs which increase the maintenance requirements of the system (i.e., face sealing of a drained system), will not be accepted.

d. Field Test for Sill Dam Water Testing at louver sill pan flashing:

1) Sill Dam Water Testing: AAMA 502-11.
2) Criteria: No water.
3) Schedule and Number of Tests: At each Parking Garage, provide 3 locations at 10%, 25% and 50% completion, prior to and following the setting of louver = 18 tests total. If a parking Garage includes louver installation in curtainwall and precast wall, one of the test location shall be at a precast wall.
4) Correct all deficiencies observed as a result of this test and retest. For each unsuccessful field test, two similar sample installation areas shall be selected and tested. Any repairs or remediation conducted to pass a test, if they constitute a change to the design (e.g., sealing of a joint that was previously open, or adding a weep hole) must be implemented throughout the work. Any remedial repairs which increase the maintenance requirements of the system (i.e., face sealing of a drained system), will not be accepted.

C. Repair or remove and replace Work that does not meet requirements or that is damaged by testing; replace to conform to specified requirements.

3.8 REMOVAL OF DEBRIS

A. All debris caused by, or incidental to, the erection of the glazed aluminum curtain wall work shall be removed from the site and disposed of legally.

3.9 CLEANING

A. Clean metal surfaces promptly after installation, exercising care to avoid damage to factory finished exposed surfaces.

B. Wash glass on both faces not more than 4 days prior to date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended by glass manufacturer. Remove excess glazing and sealant compounds, dirt, and other substances.

C. Immediately remove any deleterious material from surfaces of aluminum.

3.10 PROTECTION

A. Institute protective measures required throughout the remainder of the construction period to ensure that glazed aluminum curtain wall work will be without damage or deterioration, other than normal weathering, at time of acceptance.

B. Damaged work will not be accepted and should be repaired or replaced per approval of Architect.

3.11 DEMONSTRATION

A. Engage automatic entrance door manufacturer's installer to train Owner's maintenance personnel to adjust, operate, and maintain automatic entrance doors as specified below:

1. Train Owner's maintenance personnel on procedures and schedules for starting up and shutting down, troubleshooting, servicing, complying with safety requirements, and maintaining equipment and schedules.
2. Review data in maintenance manuals. Refer to Section 01 77 00 "Project Closeout."

B. Schedule training with Owner with at least seven days' advance notice.

END OF SECTION 08 44 13