

SECTION 084413

GLAZED ALUMINUM CURTAIN WALLS

PART 1-GENERAL

1.1 GENERAL REQUIREMENTS

- A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

- A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the aluminum and glass curtain wall as shown on the drawings and/or specified herein, including, but not limited to, the following:
 - 1. Aluminum and glass curtain wall assemblies.
 - 2. Operable window sash set in curtain wall.
 - 3. Curtain wall entrance doors.
 - 4. Shadow box back pan.
 - 5. Spandrel glass panels.
 - 6. Aluminum composite panels.
 - 7. Aluminum sunshade devices.
 - 8. Stainless steel mesh sunscreens.
 - 9. Glass and glazing in conjunction with the work of this Section.
 - 10. Spandrel insulation, fire separation, fire safing and smoke stop.
 - 11. All necessary steel or aluminum members where required to support, strengthen and/or reinforce aluminum members.
 - 12. Sealants, caulking, joint fillers, gaskets, fasteners, vents and weeps, weep tubes, bellows, aluminum brake metal closures and sills, gutters, end dams, flashings, trim, as shown or as may be required in conjunction with the system or to joint the system to adjacent construction.
 - 13. Anchors, inserts and insert setting diagrams, furnishing of inserts and insert setting diagrams, support brackets, reinforcing, bracing, stiffeners, flashing.
 - 14. Shop drawings engineering calculations, erection drawings, samples and conformance test data.
 - 15. Field check for water leakage.

16. Protection and cleaning, as defined herein.
17. Field measurements of adjacent and/or supporting construction and verification of existing conditions.

1.3 RELATED SECTIONS

- A. Unit Masonry - Section 042000.
- B. Architectural Structural Steel - Section 051210.
- C. Miscellaneous Metals - Section 055000.
- D. Thermal Insulation - Section 071200.
- E. Aluminum Composite Wall Panels - Section 074243.
- F. Joint Sealant - Section 079200.
- G. Fire Rated Glass and Framing System - Section 084900.
- H. Finish Hardware - Section 087100.
- I. Louvers and Vents - Section 089000.

1.4 PERFORMANCE REQUIREMENTS

- A. General Performance: Comply with performance requirements specified, as determined by manufacturer's documented performance criteria and field testing of glazed aluminum curtain walls representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction. Performance criteria must be achieved without increasing the mullion dimensions indicated on the drawings.
 1. Glazed aluminum curtain walls shall withstand movements of supporting structure and deflection from uniformly distributed and concentrated live loads.
 2. Failure also includes the following:
 - a. Thermal stresses transferring to building structure.
 - b. Glass breakage.
 - c. Noise or vibration created by wind and thermal and structural movements.
 - d. Loosening or weakening of fasteners, attachments, and other components.
 - e. Failure of operating units.
- B. Delegated Design: Design glazed aluminum curtain walls, including comprehensive engineering analysis by a qualified professional engineer licensed in the State of New Jersey, including, but not limited to story drift, twist, column shortening, long term creep, using performance requirements and design criteria indicated.
- C. Design Wind Loads: Positive Design Wind Load +/- 38 psf typical +/-45 psf at corner zones, corner zones to extend 10 percent of least horizontal dimension or 0.4H from

corners. The design pressures are minimum; if prevailing Code require greater pressures, such pressures shall apply.

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

1. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.
3. Test Durations: As required by design wind velocity, but not less than 10 seconds.

E. Deflection of Framing Members: At design wind pressure, as follows:

1. Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane not exceeding $L/175$ of the glass edge length for each individual glazing lite or an amount that restricts edge deflection of individual glazing lites to $3/4$ inch, whichever is less.
2. Deflection Parallel to Glazing Plane: Limited to $L/360$ of clear span or $1/8$ inch, whichever is smaller.
 - a. Operable Units: Provide a minimum $1/16$ -inch clearance between framing members and operable units.
3. Cantilever Deflection: Where framing members overhang an anchor point, limit deflection to two times the length of cantilevered member, divided by 175.

~~F. Windborne Debris Impact Resistance Performance: Pass missile impact and cyclic pressure tests when tested according to ASTM E 1886 and testing information in ASTM E 1996 for Wind Zone in which Project is located.~~

- ~~1. Large Missile Test: For glazed openings located within of grade.~~
- ~~2. Small Missile Test: For glazed openings located more than 30 feet above grade.~~

~~G.F.~~ Seismic Performance: Glazed aluminum curtain walls shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.

~~H.G.~~ Story Drift: Accommodate design displacement of adjacent stories indicated.

1. Design Displacement: $L/350$.
2. Test Performance: Meeting criteria for passing based on building occupancy type when tested according to AAMA 501.4 at 1.5 times the design displacement.

~~I.H.~~ Water Penetration under Static Pressure: No evidence of water penetration through fixed glazing and framing areas when tested according to ASTM E 331 at a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft.

~~J.I.~~ **Water Penetration under Dynamic Pressure:** No evidence of water penetration through fixed glazing and framing areas when tested according to AAMA 501.1 at dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft.

1. **Maximum Water Leakage:** No uncontrolled water penetrating assemblies or water appearing on assemblies' normally exposed interior surfaces from sources other than condensation. Water leakage does not include water controlled by flashing and gutters that is drained to exterior.

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

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

~~L.K.~~ **Energy Performance:** Glazed aluminum curtain walls shall have certified and labeled energy performance ratings in accordance with NFRC.

1. **Thermal Transmittance (U-factor):** Fixed glazing and framing areas shall have U-factor of not more than 0.45 Btu/sq. ft. x h x deg F as determined according to NFRC 100.
2. **Solar Heat Gain Coefficient:** Fixed glazing and framing areas shall have a solar heat gain coefficient of no greater than 0.37 as determined according to NFRC 200.
3. **Air Infiltration:** Maximum air leakage through fixed glazing and framing areas of 0.30 cfm/sq. ft. of fixed wall area as determined according to ASTM E 283 at a minimum static-air-pressure differential of 6.24 lbf/sq. ft.
4. **Condensation Resistance:** Fixed glazing and framing areas shall have an NFRC-certified condensation resistance rating of no less than 65 as determined according to NFRC 500.

~~M.L.~~ **Sound Transmission:** Provide glazed aluminum curtain walls with fixed glazing and framing areas having the following sound-transmission characteristics:

1. **Outdoor-Indoor Transmission Class:** Minimum 30 when tested for laboratory sound transmission loss according to ASTM E 90 and determined by ASTM E 1332.

~~N.M.~~ **Dimensional Tolerances:** Provide glazed aluminum curtain wall system, including anchorage, that accommodates dimensional tolerances of building frame and other adjacent construction.

Ø-N. Operable Sash: Operable projecting out window sash shall conform to the following criteria;

1. AP-AW-90 of AAMA 101/I.S.2, 2008.
2. "U" value of not more than 0.59.
3. CRI value of not less than 52.

1.5 SUBMITTALS

- A. Submit Product Data for each product specified, including details of construction relative to materials, dimensions of individual components, profiles, and finishes.
- B. Submit Shop Drawings showing fabrication and installation of glazed aluminum curtain wall system including plans, elevations, sections, details of components, and attachments to other units of Work.
 1. For installed products indicated to comply with certain design loadings, include structural analysis data signed and sealed by a professional engineer licensed in the State of New Jersey responsible for their preparation.
- C. Submit samples for verification of each type of exposed finish required in manufacturer's standard sizes. Where finishes involve normal color and texture variations, include Sample sets showing the full range of variations expected.
- D. Submit cutaway sample of each vertical-to-horizontal intersection of system, made from 12-inch lengths of full-size components and showing details of the following:
 1. Joinery.
 2. Anchorage.
 3. Expansion provisions.
 4. Glass and glazing.
 5. Flashing and drainage.
- E. Submit welder certificates indicating that welders comply with requirements specified in "Quality Assurance" Article.
- F. Submit installer certificates signed by manufacturer certifying that installers comply with requirements in "Quality Assurance" Article.
- G. Submit product test reports from a qualified independent testing agency evidencing compliance of glazed aluminum curtain wall system with requirements based on comprehensive testing of manufacturer's current system.
- H. Submit test reports, calculations, computer analysis and other necessary data from a qualified independent inspecting and testing agency retained by the Contractor indicating compliance with performance requirements of glazed aluminum curtain wall system.

1.6 QUALITY ASSURANCE

- A. **Testing Agency Qualifications:** To qualify for approval, an independent testing agency must demonstrate to Architect's satisfaction, based on evaluation of agency-submitted criteria conforming to ASTM E 699, that it has the experience and capability to satisfactorily conduct the testing indicated without delaying the Work.
- B. **Professional Engineer Qualifications:** A professional engineer who is legally qualified to practice in the jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of glazed aluminum curtain wall systems that are similar to those indicated for this Project in material, design, and extent.
- C. **Installer Qualifications:** Engage an experienced installer to assume engineering responsibility and perform work of this Section who has specialized in installing glazed aluminum curtain wall systems similar to those required for this Project and who is acceptable to manufacturer.
 - 1. **Engineering Responsibility:** Engage a qualified professional engineer to prepare or supervise the preparation of data for glazed aluminum curtain wall systems, including drawings, testing program development, test-result interpretation, and comprehensive engineering analysis that shows systems' compliance with specified requirements.
- D. **Source Limitations:** Obtain each type of glazed aluminum curtain wall system from one source and by a single manufacturer.
- E. **Product Options:** Information on Drawings and in Specifications establishes requirements for system's aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sight lines and relationships to one another and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, or in-service performance.
 - 1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval and only to the extent needed to comply with performance requirements. Where modifications are proposed, submit comprehensive explanatory data to Architect for review.
- F. **Welding Standards:** Comply with applicable provisions of AWS D1.2, "Structural Welding Code--Aluminum."
 - 1. Engage welders who have satisfactorily passed AWS qualification tests for welding processes involved and who are currently certified for these processes.
- G. **Mockups:** Prior to installing glazed aluminum curtain wall system, construct mockups for each form of construction and finish required to verify selections made under Sample submittals and to demonstrate aesthetic effects as well as qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for Work.

1. Locate mockups on-site in the location and of the size indicated on the drawings.
 2. Notify Architect 7 days in advance of the dates and times when mockups will be constructed.
 3. Demonstrate the proposed range of aesthetic effects and workmanship.
 4. Obtain Architect's approval of mockups before start of Work.
 5. Retain and maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
- H. Preinstallation Conference: Conduct conference at Project site to comply with requirements of Division 1 Section "Project Meetings." Review methods and procedures related to glazed aluminum curtain wall system including, but not limited to, the following:
1. Inspect and discuss condition of substrate and other preparatory work performed by other trades.
 2. Review structural loading limitations.
 3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 4. Review required inspecting, testing, and certifying procedures.
 5. Review weather and forecasted weather conditions and procedures for coping with unfavorable conditions.

1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify dimensions by field measurements before fabrication and show recorded measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
1. Where field measurements cannot be made without delaying the Work, guarantee dimensions and proceed with fabrication without field measurements. Coordinate construction to ensure that actual dimensions correspond to guaranteed dimensions.

1.8 WARRANTY

- A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.
- B. Special Warranty: Submit a written warranty executed by the manufacturer agreeing to repair or replace components of a glazed aluminum curtain wall system that fail in materials or workmanship within the specified warranty period. Failures include, but are not limited to, the following:

1. Structural failures including, but not limited to, excessive deflection.
 2. Noise or vibration caused by thermal movements.
 3. Failure of system to meet performance requirements.
 4. Failure of operating components to function normally.
 5. Water leakage.
 6. Glazing breakage.
- C. Warranty Period: 10 years from date of Substantial Completion (except as noted below).
- D. Special Finish Warranty: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.
1. Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 2. Warranty Period: 20 years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design: The following names and model numbers are those of Kawneer; other manufacturers noted herein are acceptable subject to conformance with drawing details and performance criteria specified herein:
1. Field Frame Assemblies: 1600 Wall System 2; provide system depths as shown on the drawings.
 2. Operable Windows: Curtain wall "GlassVent" windows.
 3. Curtain Wall Sun Shade: "Versoliel SunShade – Outrigger System – for Curtain Wall," as detailed on the drawings.
 4. Entrance Doors: "Wide Stile 500."
 5. Provide both 2-way and 4-way structurally-glazed conditions, as indicated on the drawings.
 6. Aluminum Fins: Mullion cap extensions as detailed on the drawings, provided by curtain wall manufacturer.

7. Metal Mesh Sunscreens (at G-Wing South Façades): Stainless steel mesh "Coniston 519" as manufactured by Potter & Soar, or approved equal "Ellipse 14" as manufactured by GKD Metal Fabrics, and suspension system as detailed on the drawings, attached to curtain wall mullions by the curtain wall manufacturer.
8. Acceptable Alternate Systems: "Reliance Curtain Wall System" as manufactured by Oldcastle/ Vistawall Architectural Products, "FW60+ System" as manufactured by Schüco.

2.2 METALS

- A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated, complying with the requirements of standards indicated below.
 1. Sheet and Plate: ASTM B 209.
 2. Extruded Bars, Rods, Shapes, and Tubes: ASTM B 221.
 3. Extruded Structural Pipe and Tubes: ASTM B 429.
 4. Structural Profiles: ASTM A 1008.
 5. Welding Rods and Bare Electrodes: AWS A5.10.
- B. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.
 1. Structural Shapes, Plats, and Bars: ASTM A 36.
 2. Cold Rolled Sheet and Strip: ASTM A 1008.
 3. Hot Rolled Sheet and Strip: ASTM A 1011.

2.3 FRAMING

- A. Framing Members: Extruded or formed aluminum framing members of thickness required and reinforced as required to support imposed loads.
 1. Construction: Thermally broken.
 2. Glazing System: Retained mechanically with gaskets on four sides.
 3. Glazing Plane: Front.
- B. Brackets and Reinforcements: Manufacturer's standard high strength aluminum with non-staining, non-ferrous shims for aligning system components.
- C. Fasteners and Accessories: Manufacturer's standard corrosion resistant, non-staining, non-bleeding fasteners and accessories compatible with adjacent materials.

1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
 2. Reinforce members as required to receive fastener threads.
 3. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system.
- D. Anchors: Three way adjustable anchors with minimum adjustment of 2" that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.
1. Concrete and Masonry Inserts: Hot dip galvanized cast iron, malleable iron, or steel inserts complying with ASTM A 123 or ASTM A 153 requirements.

2.4 GLASS

- A. Glass shall be of the types and minimum thickness, as shown on the drawings and specified herein, and shall, in addition, meet the requirements of the following paragraphs.
- B. All glass shall be the manufactured product of one (1) company. All fabricated glass products shall be the fabricated and coated products of one (1) company. All glass shall be delivered to the site bearing the manufacturer's label, complete with glazing instructions where applicable. **Basis of design manufacturer is Viracon (507-451-9555). Acceptable alternate manufacturers are JE Berkowitz (856-456-7800) and Guardian Sunguard (866-482-7374).**
- C. Insulating glass units shall be 1" thick (minimum), consisting of two lites of 1/4" (minimum) glass separated by a desiccant filled metal spacer with welded, fused, soldered or bent corners and welded, fused or soldered splices or joints to provide a 1/2" hermetically sealed and dehydrated space. Insulating glass shall be dual seal and certified for compliance with seal classification "CBA" by the Insulating Glass Certification Council (IGC) and tested in accordance with the following ASTM Test methods. Secondary seal on structural silicone glazed units shall be a special silicone edge seal certified for use in structural silicone glazing applications over the temperature range and structural loading as called for under the performance criteria section of this Specification.
1. ASTM E 773-97 Standard Test Method for Seal Durability of Sealed Insulating Glass Units.
 2. ASTM E 774-97 Standard Specification for Sealed Insulating Glass Units.
 3. ASTM E 546-88 Standard Test Method for Frost Point of Sealed Insulating Glass Units.
 4. ASTM E 576-88 Standard Test Method for Dew/Frost Point of Sealed Insulating Glass Units in Vertical Position.
- D. The lites comprising insulating glass units shall be annealed, heat strengthened, (or fully tempered where required to meet wind load or safety glazing requirements), as shown,

specified, required, or recommended by the specified glass fabricator to insure against heat breakage and to assure adequate glass performance at the specified design pressures specified under the performance criteria herein.

- E. Glass shall conform to the requirements of ASTM C 1036. Heat strengthened and tempered glass shall conform to the requirements of ASTM C 1048. Tempered glass shall also conform to ANSI Z97.1-1975. All heat strengthening and tempering shall be by the horizontal process, and processed in such a manner as to have all roller distortion in a horizontal direction as installed on the building.
- F. All fully tempered glass shall be heat soaked (checked) at glass surface temperatures of not less than 400 deg. F. for 4 hours, if this procedure is available from the glass manufacturer. Glass manufacturer shall submit for approval their proposal for meeting this requirement.
- G. Where glass manufacturer cannot assure adequate structural performance of insulating glass units, based upon combination of inner/outer lite, assume outer lite alone must satisfy structural requirements. Method of installation must be in accordance with the manufacturer's published literature, as well as the latest standards of the FGMA and SIGMA. Method of installation shall make provision to weep all sill glazing rabbets.
- H. Contractor shall provide certification from glass producer/fabricator that glass producer/fabricator has reviewed all glazing details and thicknesses and finds same suitable for the purpose intended in accordance with these specifications. This shall include a written wind load and thermal stress analysis showing a probability of failure of no greater than 8 lites per thousand for conventional glazing and 4 lites per thousand for structural silicone glazing at the design loads and local climatic thermal conditions.
- I. Glass producer/fabricator shall make regular inspections (maximum interval semi-monthly) of glazing work in progress at the point of glazing for both mock-up and job production units to verify that glazing is proceeding in accordance with his recommendations. Glass producer/fabricator shall attend the mock-up test at no additional cost to the Owner.
- J. Insulating glass units shall be installed in such manner as to adequately drain the glazing rabbet in a manner, as approved in writing, by the insulating unit glass manufacturer.
- K. Contractor shall include in his design provision for reglazing vision lites with access from the interior except for structurally glazed lites which shall be reglazed from the exterior and spandrel lites with access from the exterior only. Mock-up shall include lites shop glazed in the initial installation as well as field glazed in the replacement mode.
- L. Glass deflection at full design load shall be limited to the lesser of $L/100$ or $3/4"$. In event specified glass cannot meet these requirements, Contractor shall submit calculations establishing anticipated deflections and reduction in glass bite as a consequence of deflections, along with his drawings. Submittal shall include a statement from glass manufacturer/fabricator that reduction in glass bite will not result in a reduction in load resistance capacity, an increase in breakage probability and that all specified warranties shall remain in effect.

M. Glass Types: (Subject to meeting all criteria herein above.)

1. Vision Glass

- a. Outside Lite: 1/4" thick clear, heat strengthened (HS), Viracon VE 1 2-M low-e coating on #2 surface.
- b. Air Space: 1/2", with argon gas.
- c. Inner Lite: 1/4" thick clear.
- d. Grey edge seals and warm-edge spacer.
 - 1). Visible Light Transmittance: 70%.
 - 2). Shading Coefficient: 0.43.
 - 3). Solar Heat Gain Coefficient: 0.37.
 - 4). U-Value: 0.25 winter; 0.21 summer.

2. Low-Iron Vision Glass

- a. Outside Lite: 1/4" thick, heat strengthened (HS), Ultra-White Viracon VE 15 2-M low-e coating on #2 surface.
- b. Air Space: 1/2", with argon gas.
- c. Inner Lite: 1/4" thick Ultra White Viracon.
- d. Grey edge seals and warm-edge spacer.
 - 1). Visible Light Transmittance: 73%.
 - 2). Shading Coefficient: 0.45.
 - 3). Solar Heat Gain Coefficient: 0.39.
 - 4). U-Value: 0.25 winter; 0.21 summer.

3. Ceramic Frit Glass

- a. Outside Lite: 1/4" thick clear, heat strengthened (HS), Viracon VE 1-2M low-e coating on #2 surface. 40% coverage V175 silk-screened ceramic frit pattern "5006" of the "Dot/Hole Series" (1/8" dots) on #2 surface, in standard pattern orientation.
- b. Air Space: 1/2", with argon gas.
- c. Inner Lite: 1/4" thick clear.
- d. Grey edge seals and warm-edge spacer.
 - 1). Visible Light Transmittance: 49%.
 - 2). Shading Coefficient: 0.33.
 - 3). Solar Heat Gain Coefficient: 0.28.
 - 4). U-Value: 0.29 winter; 0.26 summer.

4. Colored Spandrel Glass

- a. Outside Lite: 1/4" thick clear, heat strengthened (HS), Viracon VE 1-2M low-e coating on #2 surface.
- b. Air Space: 1/2", with argon gas.
- c. Inner Lite: 1/4" thick clear.
- d. Ceramic frit spandrel custom color on #4 surface, Pittsburgh Paints color 114-5.
- e. Grey edge seals and warm-edge spacer.
 - 1). U-Value: 0.25 winter; 0.21 summer.

5. Low-Iron Terrace Interior Glass

- a. Clear uncoated monolithic glass:
 - 1). 1/4" thick Ultra White Viracon.
 - 2). Visible Light Transmittance: 90%.
 - 3). Shading Coefficient: 1.02.
 - 4). Solar Heat Gain Coefficient: 0.88.
 - 5). U-Value: 1.02 winter; 0.92 summer.

N. Shadow Box: Vision, low-iron vision, and ceramic frit glass as indicated above with painted sheet metal pan and integral insulation mechanically affixed to curtain wall mullions as shown on the drawings.

O. Where tempered glazing is indicated on the drawings, provide both lites tempered glass.

2.5 GASKETS/WEATHERSTRIPPING

A. Glazing Gaskets:

- 1. Compression type design, exterior replaceable, extruded EPDM. Interior is a dense EPDM or closed cell EPDM sponge gasket.
- 2. Comply with ASTM C 509 or C 864.
- 3. Profile and hardness as necessary to maintain uniform pressure for watertight seal.
- 4. ~~Manufacturer's standard black color~~ **Color to match insulated glass gray edge seals.**

B. Internal Sealants: Types recommended by system manufacturer to remain permanently elastic, tacky, non-drying, non-migrating and weather-tight.

2.6 SEALANTS (NON-STRUCTURAL)

- A. All joints, which are sealed with sealant as part of the fabrication or erection procedure, shall be sealed with an approved butyl (concealed) or low modulus silicone (exposed or concealed) sealant in color to match the adjoining surfaces or as may be required by the Architect. All perimeter sealant (metal to adjacent construction) shall be low or medium modulus silicone sealant. Silicone sealant shall be as manufactured by General Electric, Dow Corning or Pecora. Butyl sealant shall be PTI 707.
- B. In using specified sealants, strictly observe the printed instructions of sealant manufacturer regarding joint size, limitations, backer rod, mixing, cleaning, surface preparation, priming and application. A primer shall be used, unless printed instructions advise to the contrary, and sealant manufacturer certifies that the use thereof will reduce its performance. Sealant shall not be applied when substrates are wet or when the temperature is below 40 deg. F.
- C. Care shall be exercised to insure against "Three Surface Adhesion." Bond breakers shall be provided where necessary.

- D. Contractor shall provide certification from sealant manufacturer that the sealant manufacturer has reviewed all sealant details and finds same suitable for the purpose intended, compatible with and will not stain the surfaces with which they are in contact. Statement as to compatibility, adhesion sufficiency and non-staining shall be accompanied by actual test results on production substrates performed in accordance with applicable ASTM procedures.

2.7 SEALANTS (STRUCTURAL)

- A. All components which are adhered with a structural silicone sealant/adhesive as part of the fabrication, glazing or erection procedure, shall be sealed/adhered with an approved structural silicone, as manufactured by General Electric, Dow Corning or Pecora and approved by the Architect. All glazing with structural silicone sealant/adhesive shall be accomplished in a shop wherever consistent with the design.
- B. In using specified sealants, strictly observe the printed instructions of sealant manufacturer regarding joint size, limitations, backer rod, mixing, cleaning, surface preparation, priming and application. A primer shall be used, unless printed instructions advise to the contrary. Sealant shall not be applied when substrates are wet or when the temperature is below 40 deg. F. Units shall not be moved until structural silicone seal has achieved full cure.
- C. Care shall be exercised to insure against "Three Surface Adhesion." Bond breakers shall be provided where necessary.
- D. Contractor shall provide certification from sealant manufacturer that the sealant manufacturer has reviewed all sealant details and tested all contact surfaces, and finds same suitable for use with proposed sealant, the purpose intended and compatible with the surfaces with which they are in contact. Sealant manufacturer's certification shall include the following based upon tests performed on production run materials:
 - 1. Test data of adhesion to production samples of metal and glass, tested in accordance with ASTM C 794.
 - 2. Compatibility statement that the materials in contact with the sealant such as gaskets, spacers, setting blocks, are compatible with the sealant after 21 days exposure to ultra violet, 2000 - 4000 (micro watt u.v. radiation).
 - 3. Stress statement that when exposed to the specified wind load the stress in the silicone sealant of dimensions shown does not exceed 20 psi with a safety factor of 6:1.
- E. Where silicone bonds to a metal or glass surface, the weakest element in the line of stress must have a minimum strength of 120 psi. For each combination of substrates submit report from an independent laboratory for tests performed in the following manner:
 - 1. Assemble and fully cure a minimum of 6 samples using actual substrates and a minimum sample length of 5".
 - 2. Subject sample to a tensile load such that nominal stress on silicone is 20 psi, hold for one minute and remove load. Repeat for additional loadings, increasing

nominal silicone stress by 20 psi with each successive loading. Continue until failure occurs or until 200 psi is successfully applied.

3. All 6 samples must successfully withstand at least 120 psi. Report maximum stress and mode of failure. If one or more samples do not meet this criteria, revise failed element and repeat tests with 6 new samples. Repeat until all 6 samples are successfully tested.
4. Testing shall be performed in such a manner as to establish stress and safety factor over the temperature range described herein.
5. Prepare an outline for a quality assurance program for evaluation of adhesion and other physical attributes of sealants and submit to Architect for review and approval.
6. Program shall cover both initial testing of components for sealant adhesion/compatibility, etc., and also random testing of production run materials, etc. Include testing at full negative design pressure, one unit per one hundred units manufactured for the project. Also include methods which will be employed to monitor sealant application to insure full sealant contact. No sealant work shall be performed prior to approval of program.

2.8 GLAZING BLOCKS

- A. Provide setting blocks at the sill quarter points of all glass lites. Setting blocks shall be black dense neoprene or heat cured silicone rubber with a hardness of 80 to 90 durometer, Shore A, a minimum length of 4", and a minimum width, which will permit full support of both panes of glass in an insulating glass unit or a monolithic unit no matter how positioned within the glazing rabbet.
- B. Shims used in conjunction with setting blocks must be of the same materials, hardness, length and width as the setting blocks.
- C. Provide side blocks within the upper half of both jambs of all glass lites. Side blocks shall be black dense neoprene or heat cured silicone rubber with a 60 to 70 durometer, Shore A, or as recommended by the selected glass manufacturer. Provide 1/8" clearance between block and bearing surface.

2.9 MISCELLANEOUS MATERIALS

- A. Provide straps, plates and brackets, built-in inserts, as required for support and anchorage of the fabricated items to adjacent surfaces.
- B. Where steel reinforcement of units is required for strength or other unavoidable necessity and concealed within (encased) in aluminum sections or employed in potentially wetted areas, hot dip galvanize the pieces after fabrication with 2.0 ounce zinc coating, complying with ASTM A 123. All other steel reinforcement shall be coated with two (2) heavy coats of zinc rich primer in differing colors.
- C. Slip Joint Linings/Sleeves: Provide stainless steel sleeve spacers and/or suitable bearing pads, as required, to insure free movement between surfaces where expansion and deflection movements are intended. Provide "Eel Slip," "Nylatron" or high impact

polystyrene shims or pads or equivalent plastic units of sizes and thicknesses (minimum 1/16" except 1/8" for "Eel Slip") recommended by the manufacturer to permanently prevent "freeze up" of joints. All sleeves, spacers, bracing pads and shims must be incombustible and rated by UL.

- D. Flashing required within the system shall be 26 ga. stainless steel.
- E. Flashing required to join the system to adjacent construction shall be 26 ga. stainless steel.
- F. Aluminum Composite Panels: Manufacturer's standard aluminum composite panels finished to match curtain wall frame.
- G. Operable Sash Hardware: Provide the following:
 - 1. Stainless steel 4-bar hinges.
 - 2. Limit stop as directed by the Architect.
 - 3. Pivot shoe roto-operator.
- H. Provide exterior mullion cap extensions and interior mullion caps as detailed on the drawings.
- I. Aluminum brake metal panels and sills, as detailed on the drawings.

2.10 INSULATION AND FIRESAFING

- A. Provide thermal and fire separation insulation where shown and where required. Use U.S. Gypsum Thermafiber CW 90 curtain wall insulation or approved equal with a minimum thickness of 4" (or thicker if required to meet specified thermal performance) and the foil vapor barrier (permeability not to exceed 0.020 Perms) at interior surface and all edges. Provide insulation and "fire wrap" at mullions and/or stiffeners as required to meet overall thermal and condensation resistance requirements and as required by Code.
- B. Tape and seal all joints in vapor barrier and along edges and supports to insure continuous vapor barrier.
- C. Apply insulation utilizing welded or screw applied impaling pins and retaining clips. Adhesive attachment will not be accepted.
- D. Provide 5" thick (minimum) compacted four (4) PCF USG Thermafiber safing insulation at full perimeter at each floor level between floor edge and curtain wall to meet requirements of Building Code. Provide hourly rating as required by Code. Seal all edges with an approved fire resistant sealant to provide a continuous fire/smoke barrier.
- E. Insulation and firesafing shall be suitably isolated/separated from direct contact with spandrel glass.

2.11 THERMAL BREAK

- A. Provide thermal break or thermally improved construction, complying with the requirements of these Specifications and which have been in service on comparable installations for no less than ten (10) years. Submit data to prove structural sufficiency over full exterior thermal range specified, and anticipated wind loading. In the event a structural thermal break is employed, manufacturer shall establish structural properties over full thermal range.

2.12 FABRICATION

- A. General: Fabricate glazed aluminum curtain wall system according to Shop Drawings. Fabricate components that, when assembled, will have accurately fitted joints with ends coped or mitered to produce hairline joints free of burrs and distortion. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.
- B. Forming: Form shapes with sharp profiles, straight and free of defects or deformations, before finishing.
- C. Prepare components to receive concealed fasteners and anchor and connection devices.
- D. Fabricate components to drain water passing joints, condensation occurring in glazing channels, condensation occurring within framing members, and moisture migrating within the system to the exterior.
- E. Welding: Weld components to comply with referenced standard and Shop Drawings, unless otherwise indicated. Weld before finishing components. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
- F. Glazing Pockets: Provide minimum clearances for thickness and type of glass indicated according to GANA's "Glazing Manual."
- G. Glazing Pockets: Provide minimum clearances for thickness and type of plastic sheet indicated according to plastic sheet manufacturer's recommendations.
- H. Metal Protection: Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
- I. Frame Units: Factory assemble frame units according to Shop Drawings to greatest extent possible. Rigidly secure non-movement joints. Seal joints watertight, unless otherwise indicated. Assemble components to drain water passing joints, condensation occurring in glazing channels, condensation occurring within framing members, and moisture migrating within the system to the exterior.
 - 1. Install glazing according to approved Shop Drawings.

- J. All machining, cutting and welding shall be done before finish is applied.

2.13 ALUMINUM FINISHES

- A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying and designating finishes.
- B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- C. High-Performance Organic Coating Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Prepare, pretreat, and apply coating to exposed aluminum surfaces and to cut ends of aluminum to comply with coating and resin manufacturer's written instructions.
 - 1. Fluoropolymer Two-Coat Coating System: Manufacturer's standard 2-coat, thermocured system composed of specially formulated inhibitive primer and fluoropolymer color topcoat, containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 2605-02.
 - a. Color and Gloss: As indicated on the drawings, custom color and gloss.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of glazed aluminum curtain wall system. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Comply with manufacturer's written instructions for protecting, handling, and installing glazed aluminum curtain wall system. Do not install damaged components. Fit joints to produce hairline joints free of burrs and distortion. Rigidly secure non-movement joints. Seal joints watertight, unless otherwise indicated. Provide means to drain water to the exterior to produce a permanently weatherproof system.
- B. Metal Protection: Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

- C. Install components to drain water passing joints, condensation occurring in glazing channels, condensation occurring within framing members, and moisture migrating within the system to the exterior.
- D. Install framing members plumb and true in alignment with established lines and grades.
- E. Install factory-assembled frame units plumb and true in alignment with established lines and grades.
- F. Install column covers plumb and true in alignment with established lines and grades.
- G. Anchorage: After system components are positioned, fix connections to building structure as indicated on Shop Drawings.
 - 1. Provide separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
- H. Welding: Weld components to comply with referenced standard and Shop Drawings, unless otherwise indicated. Weld in concealed locations to minimize distortion or discoloration of finish. Protect glazing surfaces from welding.
- I. Install glazing according to approved Shop Drawings.
- J. Install sealant according to approved Shop Drawings. Comply with requirements of Section 079200, "Joint Sealers."
- K. Install firesafing in locations indicated. Comply with requirements of Section 078413, "Firestops and Smoke seals."
- L. Erection Tolerances: Install glazed aluminum curtain wall system to comply with the following maximum tolerances:
 - 1. Plumb: 1/16 inch in 10 feet; 1/8 inch in 40 feet.
 - 2. Level: 1/16 inch in 20 feet; 1/8 inch in 40 feet.
 - 3. Alignment: Where surfaces abut in line, limit offset from true alignment to 1/16 inch; where a reveal or protruding element separates aligned surfaces by less than 2 inches, limit offset to 1/4 inch.
 - 4. Location: Limit variation from plane or location shown on Shop Drawings to 1/8 inch in 12 feet; 1/4 inch over total length.

3.3 FIELD QUALITY CONTROL

- A. Testing Agency: Contractor shall engage a qualified independent testing agency to perform testing indicated.
- B. Static air infiltration test(s) as well as the static pressure water test(s) shall be performed on one bay, at least 30 feet by one story, to determine if curtain wall meets performance requirements specified herein under Article 1.4.

- C. Test for water infiltration per AAMA 501.2. Test within the first 10% of work complete, area to be a minimum of 100 SF of wall and including a perimeter where CW adjoins masonry construction. Interior finishes must not interfere with observation of test area or be removed from test area. Not appropriate for operable windows and doors.

- 1. This test (AAMA 501.2) shall be performed infield on new construction.

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

3.4 PROTECTION

- A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure glazed aluminum curtain wall system is without damage or deterioration at the time of Substantial Completion.

END OF SECTION