SECTION 012300 - OPTIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for options.

1.2 DEFINITIONS

A. Option: An amount proposed by bidders and stated on the Bid Form for certain work defined in the bidding requirements that may be added to or deducted from the base bid amount if the Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
   1. Options described in this Section are part of the Work only if enumerated in the Agreement.
   2. The cost or credit for each option is the net addition to or deduction from the Contract Sum to incorporate options into the Work. No other adjustments are made to the Contract Sum.

1.3 PROCEDURES

A. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the option into Project.
   1. Include, as part of each option, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation, whether or not indicated as part of alternate.

B. Execute accepted options under the same conditions as other Work of the Contract.

C. Schedule: Part 3 "Schedule of Options" Article is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF OPTIONS

A. Additive Option No. 1, Whole Campus Water Filtration System:
   1. Base Bid: Provide plumbing equipment BP-1 and WT-2 as indicated on Sheet P7.2 and specified in Section 223200 - Domestic Water Filtration Equipment.
   2. Option: Provide whole campus water filtration system as indicated on Sheets P2.1.PH, P7.1.PH, P5.2.1, P7.2, and specified in Section 223200 - Domestic Water Filtration Equipment.

B. Additive Option No. 2, Spray Fields at Hon Dah Waste Water Treatment Plant:
   1. Base Bid: No Spray Fields.
   2. Option: Provide Spray Fields as indicated on Sheets LI1.0.0, LI5.0.0.

C. Additive Option No. 3, Acoustic Floor System:
   1. Base Bid: Provide floor at Warehouse as indicated on Sheet S2.2.1E.
   2. Option: Provide acoustic floor system at Warehouse as indicated on Sheet S2.2.1E and specified in Section 035400 – Cast Underlayment.

D. Additive Option No. 4, Circadian Lighting System:
   1. Base Bid: Provide lighting as indicated in Electrical Drawings and specified in Division 26.
   2. Option: Provide line-item pricing for circadian lighting system (tunable white) and required controls by functional area in the following list. Spaces are selected to emphasize non-transitional areas where patients and staff spend extended periods such as patient rooms, nurse stations and corridors, open and closed offices, and in-patient areas. Clinical support spaces and operating rooms are not included. System shall be selected to maintain photometric and aesthetic performance to Basis of Design with preference to exact fixture matches where possible and similar type and form factor where exact matches are not available. The system shall be capable of modulating light output and color temperature over a 24hr time cycle between 2200 and 6500 kelvin with both automated networked and user manual control per IES recommendations for healthcare circadian lighting.
      a. Acute Care
      b. Administration
      c. Behavioral Health
      d. Emergency Department
      e. Labor and Delivery
      f. Specialty Care

E. Additive Option No. 5, Bipolar Ionization Air Filters:
   1. Base Bid: Bid Documents as shown.
   2. Option: Provide bipolar Ionization air filters as indicated on Sheets M6.1, M6.2. M6.3, and M7.2, and specified in Section 238610 - Bi-Polar Ionization Air Purification System.

F. Additive Option No. 6, Photovoltaic System ~~**and Video Surveillance Cameras**~~:
   1. Base Bid: ~~**Provide infrastructure and equipment for emergency help points and video surveillance cameras as shown on Sheets T1.2.1 and TY1.2.1, and as specified in Sections 275123 - Emergency Help Points And Call Boxes, and 282300 - Video Surveillance. Cameras and emergency help points shall be identical to others in the Project design. See sheet keynotes for additional information**~~. **Provide all underground conduits associated with photovoltaic system, including but not limited to, handholes, conduit stub-ups between main electrical room, photovoltaic distribution panel and AC combiner boxes. Cap, protect and mark conduit locations with detectable underground tape for implementation of fully functioning future photovoltaic system. A plan indicating underground conduit size/quantity/routing for future photovoltaic will be required for review prior to backfill. All underground conduits will be required to be shown in as-built documentation.** **(Add. F)**

2. Option: ~~**Provide photovoltaic system and video surveillance cameras as indicated on Sheets T1.2.1 and TY1.2.1, and specified in Sections 282300 that will replace the emergency help points. See Drawings for exact locations and quantities. See sheet notes for additional information.**~~ **Provide parking shade canopy-mounted photovoltaic panels, DC conductors, inverters, ac combiner boxes, photovoltaic distribution panelboards, and all other required photovoltaic hardware and accessories for the construction of a complete and functioning photovoltaic system as noted in Construction Drawings and Specifications. Note, parking shade canopies are not part of photovoltaic system option.** **(Add. F)**

G. Additive Option No. 7, Acoustical Panels:
   1. Base Bid: Provide finishes in Conference Rooms as shown in AI Series Drawings.
   2. Option: Provide acoustical panels as shown on AI Series Drawings and as specified in Sections 098433 – Sound Absorbing Wall Units and 097723 - Fabric-Wrapped Panels.

H. Additive Option No. 8, Hon-Dah Utility Campus:
   1. Base Bid: No Hon-Dah Utility Campus.
   2. Option: Provide Hon-Dah Utility Campus per Building Package No. 3 (BP3).

I. Additive Option No. 9, PLC Cabinets at Surface Water Treatment Plant:
   1. Base Bid: Provide new PLC cabinet, PLC programming, operator interface programming, and modifications to the 3 existing PLC's for the new Tonka treatment unit as indicated on the SWTP plans and as specified in Specification Section 460713.
   2. Option: In addition to the Base Bid, remove and replace the 3 existing PLC cabinets and internal components with new PLC cabinets and internal components, including PLC and operator interface programming. New PLC and internal components to match the new PLC for the new Tonka treatment unit, as specified in Specification Section 460713.

J. Additive Option No. 10, Radon Mitigation **(Add. A)**
   1. Base Bid: No Radon Mitigation
   2. Option: Provide delegated design and installation of an Active Soil Depressurization (ASD) radon mitigation system that follows ANSI/AARST standards and EPA Guidelines for system designs, installation, and verification. System shall be installed on the lowest level of the building with ventilation extending from the lowest level of the building up to the second-floor roof level. Ventilation locations at the roof level shall be approved by the Architect prior to Installation. **(Add. A)**

END OF SECTION

SECTION 088000 - GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:
   1. Windows.
   2. Doors.
   3. Glazed curtain walls.
   4. Storefront framing.
   5. Glazed entrances.
   6. Interior borrowed lites.
   7. Glazing sealants and accessories.

B. Related Requirements:
   1. Section 013573 "Delegated Design Requirements and Procedures" for definitions, submittal procedures, responsibilities, and scheduling requirements associated with delegated design assignment indicated in this Section.
   2. Section 088113 "Decorative Glass Glazing."
   3. Section 088813 "Fire-Rated Glazing."

1.2 DEFINITIONS

A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Glass Fabrication: Using primary glass in the production of single pane glass products such as coated, laminated and heat treated glass. Can be done by either the Glass Manufacturer or the Glazing Product Manufacturer.

C. Glazing Product Manufacturer: Firm that uses fabricated glass in the production of insulating glass (multiple panes of glass).

D. Glass Thicknesses: Indicated by thickness designations in millimeters in accordance with ASTM C1036.

E. IBC: International Building Code.

F. Interspace: Space between lites of an insulating-glass unit.

G. Large Glass Lites and Insulating Glass Units: Over 55 SF.

H. Structural Glazing Product Manufacturer: Firm that produces insulating glass for use in a structural glazing system.

1.3 COORDINATION

A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
   1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   2. Review temporary protection requirements for glazing during and after installation.
   3. Review glazing systems included in Project and specified in other Sections.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of glass product and glazing material specified.

B. Sustainable Design Submittals:
   1. Product Data: For sealants, indicating VOC content.
   2. Laboratory Test Reports: For sealants, indicating compliance with requirements for low-emitting materials.

C. Shop Drawings:
   1. Submit shop drawings of glazing details. Draw details minimum full size (twice full size preferred) and indicate dimensions, tolerances, and materials.
   2. Submit shop drawings for structural sealant glazing after review and approval of shop drawings by sealant and glass product manufacturers.

D. Glass Samples:
   1. Each type of monolithic and laminated glass, except clear monolithic glass, no less than 3 by 6 inches.
   2. Each type of insulating and insulating laminated glass, no less than 12 by 12 inches, including type of edge seal, spacer, and corner construction of spacer. Identify specific type of reflective and Low-e coated glass, coated surfaces, and exterior face of unit.
   3. Each type of spandrel glass, no less than 12 by 12 inches.

E. Exposed Glazing Accessory Samples: For gaskets, sealants, and colored spacers, in 12 inch lengths. Install sealant samples between two strips of material representative in color of the adjoining framing system after sealant color selections have been made.

F. Other Glazing Accessory Samples:
   1. Corner construction of compression gasket for dry glazing with each leg approximately 6 inches long.
   2. Tape sealant, 6 inches long.
   3. Compression wedge, 6 inches long.
   4. Channel gasket, 6 inches long.
   5. Bed gasket, 6 inches long.
   6. Face shim or spacer.
   7. Setting block.
   8. Edge block.
   9. Compressible filler.
   10. Open cell filler.

G. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

H. Delegated-Design Submittal: Refer to Section 013573 "Delegated Design Requirements and Procedures" for delegated design submittal procedures and requirements.
   1. Provide delegated-design submittals for glass.

I. Qualification Data: For Installer, manufacturers of insulating-glass units with sputter-coated, low-E coatings, glass testing agency, and sealant testing agency.

J. Product Certificates:
   1. Submit statement from glazing product manufacturer stating that glazing products meet the requirements of the specified standards, the project specifications, and that there is no incompatibility of glazing materials with the insulating glass unit sealants.
   2. Provide glass fabrication manufacturer's statement that they have reviewed and approved the application of the glazing details for the project.
   3. Upon request, submit reports indicating results of distortion and flatness monitoring and inspection for laminated and heat treated glass and for continuous on-line color measurement via spectrophotometer inspection device.
   4. Submit statement from structural glazing product manufacturer indicating the following:
      a. The details of construction have been reviewed and are approved for use with the glass products.
      b. The secondary seal of insulating glass units has been designed and sized to resist the applied loads.
      c. The Contractor's quality assurance program has been reviewed and is approved.
   5. Submit statement from structural glazing sealant manufacturer indicating that structural sealants have been tested prior to installation and conform to the requirements of the Contract Documents and the following:
      a. The structural sealant meets ASTM C1184.
      b. The structural sealant is compatible with specified sealant backing and spacer materials as determined by ASTM C1087.
      c. The structural sealant is compatible with and does not adhere to specified bond breaker and spacer materials as determined by ASTM C1087.
      d. The structural sealant is compatible with the insulating glass unit edge seal.
      e. The structural sealant is compatible with and has been tested for adequate adhesion to each respective substrate.
      f. The details of construction have been reviewed and are approved for use with the structural sealant.
      g. The design stress of the sealant due to the application of the primary forces does not exceed 20 psi.
   6. If any of the above required statements involve more than one manufacturer, submit certificates from each of those manufacturers.

K. Glazing Analysis:

1. For exterior glazing, provide an analysis confirming all in service thermal stressing of the glass has been evaluated and that expected thermal stressing will not exceed the strength capacity of the glass and the glass is acceptable for the anticipated in-service conditions of exposure. All such analysis shall be performed by experts experienced in analyzing thermal stressing of glazing due to in service environmental conditions utilizing appropriate engineering means of thermal stress analysis.
   a. Provide copy of analysis and summary report.
   b. Analysis shall include consideration for the following conditions where applicable:
      1) Thermal properties of the glass units, including laminate interlayers, coatings and applied frits, and thermal spacers in the case of insulated units.
      2) Geographic and weather conditions of the building site.
      3) Solar orientation of the glass units.
      4) Impact of shading by adjacent structures.
      5) Glazing system's properties that may impact temperature differentials within the glass units.
      6) Highly reflective surfaces in the immediate area which may impact temperature differentials within the glass units.
      7) Shading of glass units by properties of the building configuration including, but not limited to, fins, projections, changes in building lines in plan, overhangs, projections, and similar physical attributes.
      8) Glazing conditions including spandrels and shadow boxes including back pans and insulation layers on the inboard side of the glass.
      9) Interior conditions nearby the glass which may impact glazing unit temperatures including pockets resulting from interior configurations, interior shading or other window treatment devices, and mechanical heating or cooling systems.
      10) Consideration for potential loss of strength of glass due to application of frits or coatings.
      11) Industry standard ranges of strength for annealed, heat strengthened, or tempered glass units unless fabricator/manufacturer can demonstrate strength properties outside of these ranges.
      12) Consideration for predictability of post fabrication heat forming of glass units.
      13) Heated framing systems.

L. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for tinted glass, coated glass, insulating glass, glazing sealants, and glazing gaskets.
   1. For glazing sealants, provide test reports based on testing current sealant formulations within previous 36-month period.

M. Preconstruction adhesion and compatibility test report.

N. Quality Assurance Program (QAP):

1. Glass fabrication: Written QAP including but not limited to reference of applicable ASTM testing methodology, type and frequency of in-line monitoring of glass fabrication, and reporting and documentation. Test sample lite of glass, at Contractor™™s expense, for conformance to:
   a. Bow and warp.
   b. Localized distortion/roller wave.
   c. Concavity/convexity.
   d. Compression strength.
   e. Distortion and Flatness Monitoring and Inspection Device for Laminated and Heat Treated Glass: Osprey 8 by LiteSentry.
2. Installation: Written QAP to monitor quality of products such as cleaners, solvents, primers, and sealants; and sealant workmanship including, cleaning, priming, joint opening preparation, and sealant installation.
   a. Include as part of program random adhesion and compatibility testing of production run products.
   b. Do not install sealant work prior to review of program.
   c. Submit quality assurance program to glass and sealant manufacturers for review and approval prior to submission to Architect.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. At Owner's direction, and prior to construction completion, furnish for future maintenance and repair, the following glass types for attic stock:
   1. Furnish 5 percent of quantity for each size and type but not less than 1, nor more than 6 units for each size of each type of rectangular shaped units.
   2. **Furnish 2 units of the same size for each color of the Landscape Pillar glazing units indicated. (Add. F)**

B. Units for attic stock shall be adequately crated and identified as to storage conditions, unit type, size, surface to be glazed to exterior, and any other pertinent information to assist the Owner in future maintenance.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications for Insulating-Glass Units with Sputter-Coated, Low-E Coatings: A qualified insulating-glass manufacturer who is approved and certified by coated-glass manufacturer.

B. Glass Testing Agency Qualifications: A qualified independent testing agency accredited in accordance with the NFRC CAP 1 Certification Agency Program.

C. Sealant Testing Agency Qualifications: An independent testing agency qualified in accordance with ASTM C1021 to conduct the testing indicated.

D. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and to set quality standards for materials and execution.
   1. Glazing mock-up: Produce three full-sized IGUs for review and approval by the Architect before full production run.
   2. Install glazing in mockups specified in Division 08 Section "Aluminum-Framed Entrances and Storefronts, and Glazed Aluminum Curtain Walls " to match glazing systems required for Project, including glazing methods.

3. Approved sample installation may become part of the completed Work if undisturbed at time of Substantial Completion.
4. Place mockup where reflection from adjacent buildings or other structures with a regular pattern can be used to gauge overall appearance / distortion of the glass.

1.8 PRECONSTRUCTION TESTING

A. Preconstruction Adhesion and Compatibility Testing: Test each glass product, tape sealant, gasket, glazing accessory, and glass-framing member for adhesion to and compatibility with elastomeric glazing sealants.
   1. Testing is not required if data are submitted based on previous testing of current sealant products and glazing materials matching those submitted.
   2. Use ASTM C1087 to determine whether priming and other specific joint-preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to glass, tape sealants, gaskets, and glazing channel substrates.
   3. Test no fewer than eight Samples of each type of material, including joint substrates, shims, sealant backings, secondary seals, and miscellaneous materials.
   4. Schedule enough time for testing and analyzing results to prevent delaying the Work.
   5. For materials failing tests, submit sealant manufacturer's written instructions for corrective measures including the use of specially formulated primers.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials in accordance with manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. Comply with insulating-glass manufacturer's written instructions for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.10 FIELD CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
   1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or are below 40 deg F. Do not install sealants to wet or frost covered surfaces.

1.11 WARRANTY

A. General: During the warranty period, restore defective Work to the standard of the Contract Documents, including all labor, materials, refinishing and other costs incidental to the Work. Restore Work found to be defective as defined in the Contract Documents. The warranty period starts at the date of Substantial Completion.

B. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.
   1. Warranty Period: 10 years from date of Substantial Completion.

C. Manufacturer's Special Warranty for Laminated Glass: Manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.
   1. Warranty Period: 10 years from date of Substantial Completion.

D. Manufacturer's Special Warranty for Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.
   1. Warranty Period: 10 years from date of Substantial Completion.

E. Manufacturer's Special Warranty for Heat Soaking of Tempered Glass: Manufacturer agrees to replace heat soaked tempered glass units that fail. Warrant that heat soaked tempered glass will not spontaneously break as a result of nickel sulfide (NiS) inclusions at a rate exceeding 0.3 percent (3/1000).
   1. Warranty Period: 10 years from date of Substantial Completion.

F. Installation: Glazing systems installation shall be warranted for a period of five years against defective materials and workmanship.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND FABRICATORS

A. Basis of Design (Product Standard): Contract Documents are based on products and systems indicated to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

B. Source Limitations for Glass: Obtain from single source from single manufacturer for each glass type.
   1. Obtain tinted glass from single source from single manufacturer.
   2. Obtain reflective-coated glass from single source from single manufacturer.

C. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.

2.2 PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Delegated Design: Engage a registered design professional, as defined in Section 013573 "Delegated Design Requirements and Procedures" to design glazing.
   1. Material properties indicated in this Section shall be considered as minimum properties.

C. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined in accordance with the IBC and ASTM E1300.
   1. Wind Load Design Criteria:
      a. As indicated on Drawings.
      b. Design Wind Pressures: Determine design wind pressures applicable to Project in accordance with ASCE/SEI 7, based on heights above grade indicated on Drawings.
   2. Design Snow Loads: As indicated on Drawings.
   3. Thickness of Patterned Glass: Base design of patterned glass on thickness at thinnest part of the glass.
   4. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch, whichever is less.
   5. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.

D. Safety Glazing:
   1. CPSC 16 CFR part 1201, testing requirements of ANSI Z97.1, and listed in the SGCC Certified Products Directory with appropriate SGCC certification mark or label permanently affixed.
   2. Furnish safety glass for glass occurring in doors and sidelights, and where indicated and further required by authorities having jurisdiction.

E. Sound Control Glazing: Products with air borne sound transmission loss as measured by ASTM E90 and STC rating as classified by ASTM E413.

F. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
   1. For monolithic-glass lites, properties are based on units with lites 6 mm thick.
   2. For laminated-glass lites, properties are based on products of construction indicated.
   3. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
   4. U-Factors: Center-of-glazing values, in accordance with NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F.

5. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, in accordance with NFRC 200 and based on LBL's WINDOW 5.2 computer program.
6. Visible Reflectance: Center-of-glazing values, in accordance with NFRC 300.

2.3 GLASS PRODUCTS, GENERAL

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.
   1. GANA Publications: "Laminated Glazing Reference Manual" and "Glazing Manual."
   2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.

D. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than the thickness indicated.
   1. Minimum Glass Thickness for Exterior Lites: 6 mm.
   2. Thickness of Tinted Glass: Provide same thickness for each tint color indicated throughout Project.

E. Strength: Where heat-strengthened float glass is indicated, provide heat-strengthened float glass unless fully tempered float glass is required to comply with "Performance Requirements" Article. Where fully tempered float glass is indicated, provide fully tempered float glass.

F. Low-E Coatings: For glazing requiring low-e coatings, comply with the following.
   1. Provide a minimum of 95 percent edge deletion of low-e coating around the entire perimeter of the unit to ensure proper seal in insulated unit.
   2. Utilize coated glass produced using continuous in-line color measurement via spectrophotometer inspection device.
   3. Tolerance for color variation to be no greater than a total range of 4.5 delta E for color incident and at angle, based on measurement protocol described in ASTM C1376.
   4. Transmitted and reflected color for all coated glass shall be consistent and fall on the same side of the neutral axis of the color spectrum as defined in ASTM D2244.

2.4 GLASS PRODUCTS

A. Fully Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
2. Heat Soak Testing: For all fully tempered glass, provide heat soak testing conforming to EN14179 which includes a 2 hour dwell at 290 deg C, +/- 10 deg C.

B. Heat-Strengthened Float Glass: ASTM C1048, Kind HS (heat strengthened), Type I, Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
2. For uncoated glass, comply with requirements for Condition A.
3. For coated vision glass, comply with requirements for Condition C (other coated glass).
4. Limit Kind HS surface compression to upper end of ASTM C 1048 range, 7,500 psi.
5. Distortion Tolerances:
a. Roller Wave: Maximum 0.003 inch from peak to valley within the main body of the sheet and maximum 0.008 inch within 10.5 inches of a leading or trailing edge.
b. Localized Warp: Maximum 0.03 inch over any 12 inch span, but limited to 0.31 inch.

C. Low-E / Reflective-Coated Vision Glass: ASTM C1376.

D. Low-E / Reflective-Coated Ceramic Spandrel Glass: ASTM C1376, Kind CS, coated by vacuum deposition (sputter-coating) process, ASTM C1048, Condition B, Type I, Quality-Q3, and complying with other specified requirements.

2.5 LAMINATED GLASS

A. Laminated Glass: ASTM C1172. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.
1. Construction: Laminate glass with ionomeric polymer interlayer to comply with interlayer manufacturer's written instructions. **Basis-of-Design: Kuraray, "SentryGlas". (Add. F)**
2. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
3. Interlayer Color: Clear unless otherwise indicated.
4. Glass Edge Alignment Tolerances:
a. Concealed Laminated Glass Edge Offset:
1) Edge length less than 80-inches: ±0.04-inch.
2) Edge length greater than 80-inches: ±0.08-inch.
b. Exposed Laminated Glass Edge Offset: The edges of the laminated glass plies shall be **flat, polished** ~~flush~~ and level ±0.04-inch. **(Add. F)**

2.6 INSULATING GLASS

A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified in accordance with ASTM E2190.

1. Sealing System: Dual seal, with manufacturer's standard primary and secondary seal, and with soldered, welded, and/or bent spacer corner construction.
   a. Units for Structural Sealant Glazing: Dual seal construction of a polyisobutylene primary seal and silicone secondary seal, and with soldered, welded, and/or bent spacer corner construction.
   b. Secondary Seal: Continuous, free of skips and voids.
2. Perimeter Spacer: Manufacturer's standard spacer material and construction.
3. Desiccant: Molecular sieve or silica gel, or a blend of both.
4. Units which will be shipped through or glazed at altitudes of 5000 feet or more above sea level, fabricated with breather or capillary tubes, to permit air space pressure equalization. Provide same warranty as for non-breather or capillary tube units. Pinch tubes during glazing if required by glass manufacturer.
5. Flatness Tolerance: Manufacturer units so that maximum out-of-plane concavity/convexity, at center of each lite, does not exceed the following when ambient temperature is 70 degrees Fahrenheit and glass surface temperature is within +/- 5 degrees Fahrenheit of ambient temperature. Measure flatness with units installed in vertical position.
   a. Units 20 square feet and longer in area: + / - 1/16-inch maximum.
   b. Units smaller than 20 square feet: + / - 1/32-inch maximum.
   c. If units are manufactured at geodetic elevation higher or lower than that of the Project, take measures to assure that flatness tolerance are met. If filling or deflating is used at time of manufacture to compensate for elevation difference, it shall be done after full curing of glass edge seals.

2.7 GLAZING GASKETS

A. Dense Compression Gaskets: Molded or extruded gaskets of profile and hardness required to maintain watertight seal, made from one of the following:
   1. Neoprene complying with ASTM C 864.
   2. EPDM complying with ASTM C 864.
   3. Silicone complying with ASTM C 1115.
   4. Thermoplastic polyolefin rubber complying with ASTM C 1115.
   5. Compression wedge for dry glazing system: of shape and size to compress the exterior compression gasket a minimum of 25 percent, and as recommended by glazing and sealing systems manufacturer.
   6. Provide gaskets that are compatible with glazing sealants and will provide for silicone adhesion.

B. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned silicone gaskets complying with ASTM C 509, Type II, black; of profile and hardness required to maintain watertight seal.
   1. Bed gasket for wet glazing system: continuous with pressure sensitive adhesive 1 side, designed to be compressed 25-40 percent in the opening.
   2. Compression gasket for dry glazing system: shape as required to be compressed in place a minimum of 25 percent and of one-piece construction with factory-assembled frames with injection-molded, vulcanized corners; produced oversize in opening dimension, as determined by measurements, to insure compression at corners but within limits so that compression does not create a "pucker".

3. Channel gasket: continuous channel of shape and dimensions for application in the opening with specified glazing.
4. Provide gaskets that are compatible with glazing sealants and will provide for silicone adhesion.

2.8 GLAZING SEALANTS

A. General:
1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
3. Sealant shall have a VOC content of 250 g/L or less.
4. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
5. Colors of Exposed Glazing Sealants: Match Architect's samples.

B. Glazing Sealant:
1. Neutral-curing silicone glazing sealant complying with ASTM C920, Type S, Grade NS, Class 50, Use NT.
   a. Manufacturers: Subject to compliance with requirements, provide one of the following:
      1) Dow Corning Corporation; 756 SMS.
      2) GE Construction Sealants; Momentive Performance Materials Inc.; SilPruf NB SCS9000 .

2.9 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C1281 and AAMA 800 for products indicated below:
1. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
2. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:
1. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

C. For openings up to 75 united inches, use unshimmed tape. For openings over 75 united inches, use pre-shimmed tape.

2.10 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, with requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
   1. Each block shall be properly sized for load, as wide or wider than glazing, no less than 4 inches long; profile to permit friction fit, dart insertion into metal chair, or pressure sensitive adhesive one side to fix block in glazing opening.

D. Spacers: Elastomeric blocks or continuous extrusions of 40 to 60 Shore "A" durometer hardness to maintain glass lites in place for installation indicated.
   1. Profile to permit friction fit, dart insertion or pressure sensitive adhesive one side to fix shim or spacer in location.

E. Edge Blocks: Elastomeric material of 40 to 60 Shore "A" durometer hardness to limit glass lateral movement (side walking).
   1. Each block shall be a minimum of 4 inches long, as wide as glazing, placed in the vertical glazing channel, and sized to allow a nominal 1/8-inch clearance between glass edge and installed block; profile to permit friction fit or pressure sensitive adhesive one side to fix block in glazing opening.

F. Cylindrical Glazing Sealant Backing: ASTM C1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

G. Open Cell Filter: Reticulated flexible polyester urethane foam having 20 pores per inch, sized at least 1 inch larger in dimension than weephole, of cross section to provide 15 to 25 percent compression for friction fit and as manufactured by Foam Division, Scott Paper Co.; H-O Products Corp. or approved comparable product.

H. Bond Breaker : Heavy duty, 11-mil minimum thickness, colored, polyethylene or teflon, self-adhesive bond breaker of type recommended by sealant manufacturer and suitable for conditions of usage. Liquid bond breaker is not permitted.

2.11 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
   1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
      a. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.

C. Grind smooth and polish exposed glass edges and corners.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:
   1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
   2. Presence and functioning of weep systems.
   3. Minimum required face and edge clearances.
   4. Effective sealing between joints of glass-framing members.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
   1. Ensure approved Quality Assurance Program is implemented.

B. Adjust glazing channel dimensions as required by Project conditions during installation to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.

D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
   1. Locate one quarter of glass width from each corner, but with block edge nearest corner no closer than 6 inches from corner, unless otherwise specified or required by glass manufacturer.
   2. Insulating glass used in sloped glazing shall have both panes supported by setting blocks.

F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

G. Provide spacers for glass lites where length plus width is larger than 50 inches.
   1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
   2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and in accordance with requirements in referenced glazing publications.

I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

J. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

K. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

L. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

M. Where butted glass without mullions is indicated, seal open joints with silicone sealant in accordance with sealant and glass manufacturer's written instructions. Set glass so that joint is plumb and glass edges are aligned to provide for a uniform joint width of 3/8 inch maximum. Mask edges of glass to confine sealant to joints and to avoid contact with either face of glass. Use primer where required. Neatly tool joints to slightly concave surface using recommended tooling agent. Remove masking from glass and clean glass surfaces completely free of sealant material.

3.4 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until right before each glazing unit is installed.

F. Apply heel bead of elastomeric sealant.

G. Center glass lites in openings on setting blocks, and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

E. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or backings in place and in position to control location and depth of installed sealant for required sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a smooth surface and on exterior applications provide a wash away from glass.

3.7 STRUCTURAL SEALANT GLAZING

A. Install continuous spacers between glass lites and glazing channels to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Perform no structural sealant glazing prior to written certification of adhesion and compatibility test results, review and written approval of glazing details by glass and sealant manufacturers, and acceptance of written quality assurance program.

C. Install glass in metal windows or framing with continuous spacer installed between glass and window or frame, setting blocks properly sized and located and structural sealant installed in properly sized and located cavity formed by glass, spacer and window or frame.

D. Provide installation that maintains glass face clearances and prevents sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or backings in place and in position to control location and depth of installed sealant for required sealant performance.

E. Perform installation procedures per written sealant and glass manufacturers' requirements and written quality assurance program.

F. Force sealants into glazing channels to eliminate voids and to ensure complete wetting and bond of sealant to glass and channel surfaces.

G. Tool exposed surfaces of sealants to provide a smooth surface and on exterior applications provide a wash away from glass.

H. Do not allow sealant to bleed into the interface between the glass and glazing spacer.

I. Structural sealant work shall be shop-glazed.

3.8 CLEANING AND PROTECTION

A. Immediately after installation remove nonpermanent labels and clean surfaces.

B. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels and clean surfaces.

C. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.
   1. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.

D. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.

E. Remove and replace glass that is damaged during construction period.

F. Wash glass on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

3.9 MONOLITHIC GLASS SCHEDULE

A. Glass Type: Clear fully tempered float glass.
   1. Minimum Thickness: 6 mm.
   2. Safety glazing required.

3.10 LAMINATED GLASS SCHEDULE

A. Glass Type: Clear laminated glass with two plies of heat-strengthened float glass.
   1. Minimum Thickness of Each Glass Ply: 6 mm.
   2. Interlayer Thickness: 0.090 inch.
   3. Safety glazing required.

B. Glass Type for Landscape Pillars: Colored laminated glass with two plies of heat-strengthened Low-Iron float glass. Refer to the Landscape Drawings for locations and colors. Basis-of-Design: Meltdown Glass Art and Design, LLC.
   1. Minimum Thickness of Each Glass Ply: 12 mm.
   2. Interlayer Thickness: 0.090 inch.
   3. Exposed Laminated Glass Edge Offset: The edges of the laminated glass shall be flat, polished, and level +/- 0.04 inch.
   4. Apply a clear, curable acrylic sealant to all edges. (Add. F)

3.11 INSULATING GLASS SCHEDULE

A. Glass Type GL-1: High Performance Vision Unit.
   1. Basis-of-Design Product: 1" VNE35-53 Insulating Glass as manufactured by Viracon.
   2. Overall Unit Thickness: 1 inch.
   3. Minimum Thickness of Each Glass Lite: 6 mm.
   4. Outdoor Lite: Heat-strengthened float glass, Pure Mid Iron.
   5. Coating: VNE-53 on #2 surface.
   6. Interspace Content: 1/2" VTS black spacer - Argon filled.
   7. Silicone: Black
   8. Indoor Lite: Heat-strengthened float glass, Pure Mid Iron.
   9. Visible Light Transmittance: 51%
   10. Exterior Reflectance: 20%
   11. Winter Nighttime U-Factor: 0.24.
   12. Summer Daytime U-Factor: 0.20.
   13. Shading Coefficient: 0.26
   14. Solar Heat Gain Coefficient: 0.22
   15. Light to Solar Gain Ratio: 2.32
   16. Safety glazing required.

B. Glass Type GL-2: (GL-1 with Painted Back Pan).
   1. Basis-of-Design Product: 1" VNE35-53 Insulating Glass as manufactured by Viracon.
   2. Overall Unit Thickness: 1 inch.
   3. Minimum Thickness of Each Glass Lite: 6 mm.
   4. Outdoor Lite: Heat-strengthened float glass, Pure Mid Iron.
   5. Coating: VNE-53 on #2 surface.
   6. Interspace Content: 1/2" VTS black spacer - Argon filled.

7. Silicone: Black
8. Indoor Lite: Heat-strengthened float glass, Pure Mid Iron; V957 SUBDUED GRAY on #4 surface.
9. Visible Light Transmittance: N/A
10. Exterior Reflectance: N/A
11. Winter Nighttime U-Factor: 0.24.
12. Summer Daytime U-Factor: 0.20.
13. Shading Coefficient: N/A
14. Solar Heat Gain Coefficient: N/A
15. Light to Solar Gain Ratio: N/A
16. Safety glazing required.

C. Glass Type GL-3: High Performance Vision Unit with Ceramic Frit.
1. Basis-of-Design Product: 1" VNE35-53 Insulating Glass as manufactured by Viracon.
2. Overall Unit Thickness: 1 inch.
3. Minimum Thickness of Each Glass Lite: 6 mm.
4. Outdoor Lite: Heat-strengthened float glass, Pure Mid Iron.
5. Coating: VNE-53 on #2 surface.
6. Ceramic Frit: V957 SUBDUED GRAY on #2 surface; print as indicated on Drawings.
7. Interspace Content: 1/2" VTS black spacer - Argon filled.
8. Silicone: Black
9. Indoor Lite: Heat-strengthened float glass, Pure Mid Iron.
10. Visible Light Transmittance: 32%
11. Exterior Reflectance: 17%
12. Winter Nighttime U-Factor: 0.24.
13. Summer Daytime U-Factor: 0.20.
14. Shading Coefficient: 0.18
15. Solar Heat Gain Coefficient: 0.16
16. Light to Solar Gain Ratio: 2.00
17. Safety glazing required.

D. Glass Type GL-4: **Same as GL-1** ~~**High Performance Vision Unit**~~ with Decorative Film **applied in the field**. **(Add. F)**
~~**1. Basis-of-Design Product: 1" VNE35-53 Insulating Glass as manufactured by Viracon.**~~
~~**2. Overall Unit Thickness: 1 inch.**~~
~~**3. Minimum Thickness of Each Glass Lite: 6 mm.**~~
~~**4. Outdoor Lite: Heat-strengthened float glass, Pure Mid Iron.**~~
~~**5. Coating: VNE-53 on #2 surface.**~~
~~**6. Interspace Content: 1/2" VTS black spacer - Argon filled.**~~
~~**7. Silicone: Black**~~
~~**8. Indoor Lite: Heat-strengthened float glass, Pure Mid Iron.**~~
~~**9. Safety glazing required.**~~

E. Glass Type GL-5: (GL-1 with Privacy Film).
1. Basis-of-Design Product: 1" VNE35-53 Insulating Glass as manufactured by Viracon.
2. Overall Unit Thickness: 1 inch.

3. Minimum Thickness of Each Glass Lite: 6 mm.
4. Outdoor Lite: Heat-strengthened float glass, Pure Mid Iron.
5. Coating: VNE-53 on #2 surface.
6. Interspace Content: 1/2" VTS black spacer - Argon filled.
7. Silicone: Black
8. Indoor Lite: Heat-strengthened float glass, Pure Mid Iron.
9. Safety glazing required.

F. Glass Type GL-6: **~~(GL-1 with Meltdown Glass).~~**
1. Basis-of-Design Product: 1" **~~VNE35-53~~** Insulating Glass as manufactured by **~~Viracon~~** **Meltdown Glass Art and Design, LLC.**
2. Overall Unit Thickness: 1 inch.
3. Minimum Thickness of Each Glass Lite: 6 mm.
4. Outdoor Lite: Heat-strengthened float glass, **Low-Iron clear** **~~Pure Mid Iron~~**.
5. **~~Coating: VNE-53 on #2 surface~~**.
6. Interspace Content: 1/2" VTS black spacer - Argon filled.
7. Silicone: Black
8. Indoor Lite: **Fully-tempered** float glass, **Low-Iron** **MD-Snow clear** **~~Pure Mid Iron~~**. **Basis of Design: SunGuard SNX 51/23: "Snow Texture" on No. 4 surface.** **(Add. F)**
9. Safety glazing required.

END OF SECTION

SECTION 088113 - DECORATIVE GLASS GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Patterned glass.
2. Glass with decorative film overlay.
3. Glass with finished edges.

B. Related Requirements:

1. Section 013573 "Delegated Design Requirements and Procedures" for definitions, submittal procedures, responsibilities, and scheduling requirements associated with delegated design assignment indicated in this Section.

1.2 DEFINITION

A. Glass Thickness: Indicated by thickness designations in millimeters in accordance with ASTM C1036.

1.3 COORDINATION

A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Review temporary protection requirements for glazing during and after installation.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For decorative glass. Show fabrication and installation details. Include the following:

1. Size and location of penetrations.
2. Glazing method.
3. Mounting method.
4. Attachments to other work.
5. Full-size details of edge-finished profiles.

C. Glass Samples: For the following products, 12 inches square:

1. Each type of decorative glass.
2. Each edge treatment on type of decorative glass.
3. Each decorative film overlay on type of decorative glass.

D. Glazing Accessory Samples: For sealants, in 12-inch lengths. Install sealant Samples between two strips of material representative of the glazed system.

E. Decorative Glazing Schedule: List decorative glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

F. Delegated Design Submittal: Refer to Section 013573 "Delegated Design Requirements and Procedures" for delegated design submittal procedures and requirements.
1. Provide delegated-design submittals for decorative glass.

1.6 INFORMATIONAL SUBMITTALS

A. Preconstruction adhesion and compatibility test report.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of decorative glass and each decorative film overlay to include in maintenance manuals.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under NGA's Certified Glass Installer Program.

B. Sealant Testing Agency Qualifications: An independent testing agency qualified in accordance with ASTM C1021 to conduct the testing indicated.

C. Provide the following upon request:

1. Qualification Data: For Installer and sealant testing agency.

2. Product Certificates: For each type of decorative glass.

D. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
1. Build mockups in the location and of the size indicated or, if not indicated, as directed by Architect.

2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 PRECONSTRUCTION TESTING

A. Preconstruction Adhesion and Compatibility Testing: Test each glass with decorative film overlay, tape sealant, gasket, glazing accessory, and glass-framing member for adhesion to and compatibility with elastomeric glazing sealants.

1. Use ASTM C1087 to determine whether priming and other specific joint-preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to glass, tape sealants, gaskets, and glazing channel substrates.
2. Test no fewer than eight Samples of each type of material, including joint substrates, shims, sealant backings, secondary seals, and miscellaneous materials.
3. Schedule enough time for testing and analyzing results to prevent delaying the Work.
4. For materials failing tests, submit sealant manufacturer's written instructions for corrective measures including the use of specially formulated primers.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Protect decorative glass and glazing materials in accordance with manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. Retain packaging and sequencing numbers for decorative glass units.

1.11 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install decorative glass until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

B. Field Measurements: Verify actual dimensions of openings and construction contiguous with decorative glass by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 MANUFACTURERS OF DECORATIVE GLASS

A. Basis of Design (Product Standard): Contract Documents are based on products and systems indicated to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

B. Source Limitations for Glass: Obtain each type of decorative glass from single source from single manufacturer.

C. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer, for each product and installation method.

2.2 PERFORMANCE REQUIREMENTS

A. General Performance: Installed glazing systems shall withstand normal thermal movement and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; deterioration of glazing materials; or other defects in construction.

B. Delegated Design: Engage a registered design professional, as defined in Section 013573 "Delegated Design Requirements and Procedures" to design decorative glass.
   1. Material properties indicated in this Section shall be considered as minimum properties.

C. Structural Performance: Decorative glass installed adjacent to walking surfaces shall withstand the following design loads within limits and under conditions indicated:
   1. Differential deflection of adjacent unsupported edges shall not exceed glass thickness when subjected to 50 lbf/ft. applied horizontally to one panel at any point up to 42 inches above the adjacent walking surface.
   2. Base design on thickness at thinnest part of the glass.

D. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.

2.3 GLASS PRODUCTS, GENERAL

A. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

B. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass lites in thicknesses as needed to comply with requirements indicated.

2.4 GLASS PRODUCTS

A. Fully Tempered Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

B. Tempered Patterned Glass: ASTM C1048, Kind FT (fully tempered), Type II, Class 1 (clear) or Class 2 (tinted) as indicated, Form 3; finish, pattern, and quality as indicated.

C. Decorative Film Overlay: Translucent, dimensionally stable, cast PVC film, 2-mil-minimum thickness, with pressure-sensitive, clear adhesive back for adhering to glass and releasable protective backing.
   1. <u>Manufacturers: Subject to compliance with requirements, provide products by the following as indicated in drawings</u>
   2. <u>3M</u>
   3. <u>Avery Dennison Graphics</u>
   4. <u>Skyline Designs</u>
   5. <u>FDC Graphic Films</u> (Add. F)

2.5 GLAZING MATERIALS

A. Glazing Sealants, Tapes, and Miscellaneous Glazing Materials: As specified in Section 088000 "Glazing."

   1. Colors: As selected by Architect from manufacturer's full range.

2.6 HARDWARE FOR GLASS INSTALLATION

A. Hardware: Of configuration indicated.

1. Basis of Design (Product Standard): Contract Documents are based on products and systems indicated to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect
   a. C.R. Laurence Co., Inc.
   b. <u>3-Form</u> (Add. F)

B. Fasteners: Fabricated of same basic metal and alloy as fastened metal and matching it in finished color and texture where fasteners are exposed.

C. Gaskets: Manufacturer's standard, compatible with decorative glass type indicated.

D. Anchors and Inserts: Provide devices as required for hardware installation. Provide metal expansion-bolt devices for drilled-in-place anchors. Provide stainless steel anchors and inserts.

2.7 DECORATIVE GLASS FABRICATION

A. Fabricate decorative glass and provide other glazing products in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with product manufacturer's written instructions and with referenced glazing standard.

B. Edge Finishing: Finish edges smooth and polished, without chips, scratches, or warps.

1. Finished Edge: Rounded polished.

C. Decorative Film Overlay: Apply squarely aligned to glass edges, uniformly smooth, and free from tears, air bubbles, wrinkles, and rough edges, in single sheet completely overlaying the back face of clean glass, in accordance with manufacturer's written instructions, including surface preparation and application temperature limitations.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine decorative glass framing members, with Installer present, for compliance with the following:
   1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
   2. Minimum required face or edge clearances.
   3. Effective sealing between joints of decorative glass framing members.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

B. Examine glazing units to locate orientation of outer surfaces. Label or mark units as needed so that surface orientation is readily identifiable. Do not use materials that leave visible marks in the completed Work.

3.3 INSTALLATION

A. Set decorative glass units in each series true in line with uniform orientation, pattern, draw, bow, and similar characteristics.

B. Set glass lites with outer surface facing proper orientation.

C. Set decorative glass in locations indicated on Drawings. Install glass with hardware and accessories in accordance with hardware manufacturer's written instructions. Attach hardware securely to mounting surfaces.

3.4 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, gaskets, sealants, tapes, and other glazing materials unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

F. Provide spacers for glass lites where length plus width is more than 50 inches.
   1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances, and to comply with system performance requirements.
   2. Provide 1/8-inch- minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and in accordance with requirements in referenced glazing publications.

3.5 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels and between glass-to-glass joints to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants smooth.

3.6 CLEANING AND PROTECTION

A. Immediately after installation, remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer.

C. Remove and replace glass that is damaged during construction period.

D. Wash glass on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

3.7 DECORATIVE GLASS SCHEDULE

A. Patterned Glass: Clear, patterned tempered patterned glass.

1. Glass Thickness: 6.0 mm.
2. Pattern: Match Architect's samples.
3. Safety glazing required.

B. Decorative Film Overlays: Glass with decorative film overlay.
1. Retain "Basis-of-Design Product" Subparagraph below to require a specific product or a comparable product from manufacturers listed in "Manufacturers of Decorative Glass" Article.
2. Glass Type: Clear, fully tempered float glass.
3. Glass Thickness: 6.0 mm.
4. Safety glazing required.
5. Use: Suitable for exterior and interior applications.
6. Outdoor Durability: Not less than five years.
7. **Pattern: As indicated on applied finish schedule.** **(Add. F)**

END OF SECTION