

SECTION 08 80 00 - GLAZING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. The Contractor's attention is specifically directed, but not limited, to the following documents for additional requirements:
 - 1. *Uniform General Conditions for Construction Contracts, State of Texas, 2005 (UGC).*
 - 2. *The University of Houston's Supplemental General Conditions and Special Conditions for Construction.*

1.2 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.
- B. Related Sections:
 - 1. Section 08 32 13 "Sliding Aluminum-Framed Glass doors".
 - 2. Section 08 41 13 "Aluminum-framed Entrances and Storefronts".
 - 3. Section 08 42 29.23 "Sliding Automatic Entrances".
 - 4. Section 08 42 29.33 "Swinging Automatic Entrances".
 - 5. Section 08 44 13 "Glazed Aluminum Curtain Walls".

1.3 DEFINITIONS

- A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.
- B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.
- C. Interspace: Space between lites of an insulating-glass unit.

1.4 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: Design glass, including comprehensive engineering analysis according to ASTM E 1300 by a qualified professional engineer, using the following design criteria:
 - 1. Design Wind Pressures: As indicated on Drawings.
 - 2. Vertical Glazing: For glass surfaces sloped 15 degrees or less from vertical, design glass to resist design wind pressure based on glass type factors for short-duration load.
 - 3. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/200 times the short-side length or flexure limit of glass, whichever is less.
 - 4. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.
- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
 - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

1.5 PRECONSTRUCTION TESTING

- A. Preconstruction Adhesion and Compatibility Testing: Test each glazing material type, tape sealant, gasket, glazing accessory, and glass-framing member for adhesion to and compatibility with elastomeric glazing sealants.
 - 1. Testing will not be required if data are submitted based on previous testing of current sealant products and glazing materials matching those submitted.
 - 2. Use ASTM C 1087 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] <Insert number> Samples of each type of material, including joint substrates, shims, sealant backings, secondary seals, and miscellaneous materials.
 - 4. Schedule sufficient 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.

1.6 ACTION SUBMITTALS

- A. Product Data: For each glass product and glazing material indicated.
- B. LEED Submittals: Products authorized for LEED certification only.

1. Product Data for Credit IEQ 4.1: For glazing sealants used inside the weatherproofing system, documentation including printed statement of VOC content.
 2. Laboratory Test Reports for Credit IEQ 4: For glazing sealants used inside the weatherproofing system, documentation indicating that they comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. Glass Samples: For each type of glass product other than clear monolithic vision glass ; 12 inches square.
1. Tinted glass.
 2. Coated glass.
 3. Wired glass.
 4. Fire-resistive glazing products.
 5. Insulating glass.
- D. Glazing Accessory Samples: For gaskets and sealants , in 12-inch lengths. Install sealant Samples between two strips of material representative in color of the adjoining framing system.
- E. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.
- F. Delegated-Design Submittal: For glass indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.7 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For installers manufacturers of insulating-glass units with sputter-coated, low-e coatings glass testing agency and sealant testing agency.
- B. Product Certificates: For glass and glazing products, from manufacturer.
- C. 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.
- D. Preconstruction adhesion and compatibility test report.
- E. Warranties: Sample of special warranties.

1.8 QUALITY ASSURANCE

- A. Manufacturer Qualifications for Insulating-Glass Units with Sputter-Coated, Low-E Coatings: A qualified insulating-glass manufacturer who is approved by coated-glass manufacturer.
- B. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.
- C. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.
- D. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.
- E. Source Limitations for Glass: Obtain tinted float glass and coated float glass from single source from single manufacturer for each glass type.
- F. Source Limitations for Fabricated Glass and Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.
- G. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
 - 1. GANA Publications: GANA's "Laminated Glazing Reference Manual" and GANA's "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."
- H. Safety Glazing Labeling: Where safety glazing labeling is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction or the manufacturer. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
- I. Fire-Protection-Rated Glazing Labeling: Permanently mark fire-protection-rated glazing with certification label of a testing agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, test standard, whether glazing is for use in fire doors or other openings, whether or not glazing passes hose-stream test, whether or not glazing has a temperature rise rating of 450 deg F, and the fire-resistance rating in minutes.
- J. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.
- K. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Install glazing in mockups specified in Section 08 41 13 "Aluminum-Framed Entrances and Storefronts" Section 08 44 13 "Glazed Aluminum Curtain Walls" - to match glazing systems required for Project, including glazing methods.
2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

L. 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.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials according to 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 recommendations for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.10 PROJECT 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 below 40 deg F.

1.11 WARRANTY

- A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer's standard form in which coated-glass 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.
- B. Manufacturer's Special Warranty on Laminated Glass: Manufacturer's standard form in which 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.

C. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form in which 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.

PART 2 - PRODUCTS

2.1 GLASS PRODUCTS, GENERAL

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

1. Thickness of Tinted Glass: Provide same thickness for each tint color indicated throughout Project.

B. Strength: Where float glass is indicated, provide annealed float glass, Kind HS heat-treated float glass, or Kind FT heat-treated float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened glass is indicated, provide Kind HS heat-treated float glass or Kind FT heat-treated float glass as needed to comply with "Performance Requirements" Article. Where fully tempered glass is indicated, provide Kind FT heat-treated float glass.

C. Windborne-Debris-Impact Resistance: Provide exterior glazing that passes basic -protection testing requirements in ASTM E 1996 for **[Wind Zone 1]** **[Wind Zone 2]** when tested according to ASTM E 1886. Test specimens shall be no smaller in width and length than glazing indicated for use on the Project and shall be installed in same manner as glazing indicated for use on the Project.

1. Large-Missile Test: For glazing located within 30 feet of grade.

2. Small-Missile Test: For glazing located more than 30 feet above grade.

D. 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 6.0 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, according to 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, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
6. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.2 GLASS PRODUCTS

- A. Float Glass: ASTM C 1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. AFG Industries, Inc.; Krystal Klear.
 - b. Guardian Industries Corp.; Ultrawhite.
 - c. Pilkington North America; Optiwhite.
 - d. PPG Industries, Inc.; Starphire.
- B. Heat-Treated Float Glass: ASTM C 1048; Type I; Quality-Q3; Class I (clear) unless otherwise indicated; of kind and condition indicated.
 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).
- C. Uncoated Tinted Float Glass: Class 2, complying with other requirements specified.
 1. Basis-of-Design Product: Subject to compliance with requirements, provide PPG Industries, Inc., www.ppg.com, or comparable product by one of the following:
 - a. Guardian Industries Corp., www.guardiancorp.com.
 2. Tint Color: **Gray (Bronze or Green with permission of Owner)**
 3. Visible Light Transmittance: 44 percent minimum.
- D. Ceramic-Coated Spandrel Glass: ASTM C 1048, Condition B, Type I, Quality-Q3, and complying with other requirements specified.
 1. Basis-of-Design Product: Subject to compliance with requirements, provide Oldcastle Building Envelope, www.oldcastleglass.com, or comparable product by one of the following:
 - a. Vitro America, vitroamerica.com.
 - b. Craftsman Fabricated Glass, Ltd., www.craftsmanfab.com.
 2. Glass: **[Clear float] Tinted float.**
 3. Tint Color: **Gray (Bronze or Green with permission of Owner)**

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4. Ceramic Coating Color: As selected by Architect from manufacturer's full range .

2.3 LAMINATED GLASS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following :
 1. Oldcastle Building Envelope, www.oldcastleglass.com.
 2. Vitro America, www.vitroamerica.com.
 3. Craftsman Fabricated Glass, Ltd., www.craftsmanfab.com.
- B. Laminated Glass: ASTM C 1172, and complying with testing requirements in 16 CFR 1201 for Category II materials, and with other requirements specified. 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 polyvinyl butyral interlayer to comply with interlayer manufacturer's written recommendations.
 2. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
 3. Interlayer Color: Clear unless otherwise indicated.
- C. Windborne-Debris-Impact-Resistant Laminated Glass: ASTM C 1172, and complying with testing requirements in 16 CFR 1201 for Category II materials, with "Windborne-Debris-Impact Resistance" Paragraph in "Glass Products, General" Article, and with other requirements specified. 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 interlayer to comply with requirements, per the manufacturer's written recommendations.
 2. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
 3. Interlayer Color: Clear unless otherwise indicated.
- D. Glass: Comply with applicable requirements in "Glass Products" Article as indicated by designations in "Laminated-Glass Types" Article.

2.4 INSULATING GLASS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following :
 1. PPG Industries, Inc. "Solar Ban" 60 (2) Clear + Clear, www.ppg.com
 2. Oldcastle Building Envelope, www.oldcastleglass.com
 3. Vitro America, www.vitroamerica.com.
 4. Craftsman Fabricated Glass, Ltd., www.craftsmanfab.com.

- B. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190, and complying with other requirements specified.
 - 1. Sealing System: Dual seal, with polyisobutylene and silicone polyisobutylene and hot-melt butyl polyisobutylene and polyurethane primary and secondary.
 - 2. Spacer: Aluminum with mill or clear anodic finish .
 - 3. Desiccant: Molecular sieve or silica gel, or blend of both.
- C. Glass: Comply with applicable requirements in "Glass Products" Article as indicated by designations in "Insulating-Glass Types" Article.

2.5 FIRE-PROTECTION-RATED GLAZING

- A. Fire-Protection-Rated Glazing, General: Listed and labeled by a testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 252 for door assemblies and NFPA 257 for window assemblies.
- B. Monolithic Ceramic Glazing: Clear, ceramic flat glass; 3/16-inch nominal thickness.
 - 1. Products: Subject to compliance with requirements, provide one of the following :
 - a. Nippon Electric Glass Co., Ltd. (distributed by Technical Glass Products), www.fireglass.com; Premium FireLite .
 - b. Schott North America, Inc., www.us.schott.com; Pyran Platinum .
 - c. Vetrotech Saint-Gobain, www.vetrotechusa.com; SGG Keralite FR-R.
- C. Film-Faced Ceramic Glazing: Clear, ceramic flat glass; 3/16-inch nominal thickness; faced on one surface with a clear glazing film; complying with testing requirements in 16 CFR 1201 for Category II materials.
 - 1. Products: Subject to compliance with requirements, provide one of the following :
 - a. Nippon Electric Glass Co., Ltd. (distributed by Technical Glass Products), www.fireglass.com; FireLite NT, Premium Grade.
 - b. Schott North America, Inc., www.us.schott.com; Pyran Platinum F .
 - c. Vetrotech Saint-Gobain, www.vetrotechusa.com; SGG Keralite FR-F.
- D. Laminated Ceramic Glazing: Laminated glass made from 2 plies of clear, ceramic flat glass; 5/16-inch total nominal thickness; complying with testing requirements in 16 CFR 1201 for Category II materials.
 - 1. Products: Subject to compliance with requirements, provide one of the following :
 - a. Nippon Electric Glass Co., Ltd. (distributed by Technical Glass Products), www.fireglass.com; FireLite Plus, Premium Grade.
 - b. Schott North America, Inc., www.us.schott.com; Pyran Platinum L.
 - c. Vetrotech Saint-Gobain, www.vetrotechusa.com; SGG Keralite FR-L.

- E. Fire-Protection-Rated Laminated Glass: 5/16-inch- thick, fire-protection-rated laminated glass, complying with testing requirements in 16 CFR 1201 for Category II materials.

1. Products: Subject to compliance with requirements, provide the following :

a. Oldcastle Glass, Inc.; Pyroguard.

2.6 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. EPDM complying with ASTM C 864.
2. Silicone complying with ASTM C 1115.
3. Thermoplastic polyolefin rubber complying with ASTM C 1115.

- B. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned **[EPDM]** **[silicone]** **[or]** **[thermoplastic polyolefin rubber]** gaskets complying with ASTM C 509, Type II, black; of profile and hardness required to maintain watertight seal.

1. Application: Use where soft compression gaskets will be compressed by inserting dense compression gaskets on opposite side of glazing or pressure applied by means of pressure-glazing stops on opposite side of glazing.

2.7 GLAZING SEALANTS

- A. General:

1. Compatibility: Provide glazing sealants that are compatible with one another and with other materials they will 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. Sealants used inside the weatherproofing system, shall have a VOC content of not more than 250 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
4. Sealants used inside the weatherproofing system shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
5. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.

- B. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 50, Use NT.

1. Products: Subject to compliance with requirements, provide one of the following :

- a. Dow Corning Corporation; 795 .
 - b. GE Advanced Materials - Silicones; SilPruf SCS2000 .
 - c. Tremco Incorporated; Spectrem 2 .
- C. Glazing Sealants for Fire-Rated Glazing Products: Products that are approved by testing agencies that listed and labeled fire-resistant glazing products with which they are used for applications and fire-protection ratings indicated.

2.8 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 C 1281 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 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.9 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, 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.
- D. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
- E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).
- F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

- G. Perimeter Insulation for Fire-Resistive Glazing: Product that is approved by testing agency that listed and labeled fire-resistant glazing product with which it is used for application and fire-protection rating indicated.

2.10 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.
- 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.

2.11 MONOLITHIC-GLASS TYPES

- A. Glass Type FG-1 : Clear heat-strengthened float glass .
 - 1. Thickness: 6.0 mm .
- B. Glass Type FG-2: Clear fully tempered float glass.
 - 1. Thickness: 6.0 mm .
 - 2. Provide safety glazing labeling.
- C. Glass Type FG-3 : Tinted heat-strengthened float glass .
 - 1. Thickness: 6.0 mm .
 - 2. Winter Nighttime U-Factor: 1.02 maximum.
 - 3. Summer Daytime U-Factor: 0.93 maximum.
 - 4. Solar Heat Gain Coefficient: 0.63 maximum.
- D. Glass Type SG-1 : Ceramic-coated spandrel glass, heat-strengthened float glass .
 - 1. Thickness: 6.0 mm .
 - 2. Coating Location: Second surface.
 - 3. Winter Nighttime U-Factor: 1.02 maximum.
 - 4. Summer Daytime U-Factor: 0.93 maximum.
 - 5. Fallout Resistance (optional): Passes fallout-resistance test in ASTM C 1048 for an assembly of glass and adhered reinforcing material.

2.12 LAMINATED-GLASS TYPES

- A. Glass Type LG-1: Clear laminated glass with two plies of heat-strengthened float glass .

1. Thickness of Each Glass Ply: 3.0 mm .
2. Interlayer Thickness: 0.030 inch minimum, or thickness as needed to comply with requirements .
3. Provide safety glazing labeling.

2.13 INSULATING-GLASS TYPES

A. Glass Type IG-1 : Clear insulating glass.

1. Overall Unit Thickness: 1 inch .
2. Thickness of Each Glass Lite: 6.0 mm .
3. Outdoor Lite: Heat-strengthened float glass .
4. Interspace Content: Air or Argon.
5. Indoor Lite: Heat-strengthened float glass .
6. Winter Nighttime U-Factor: 0.47 maximum.
7. Summer Daytime U-Factor: 0.50 maximum.

B. Glass Type IG-2 : Low-e-coated, clear insulating glass.

1. Overall Unit Thickness: 1 inch .
2. Thickness of Each Glass Lite: 6.0 mm .
3. Outdoor Lite: Heat-strengthened float glass .
4. Interspace Content: Air or Argon.
5. Indoor Lite: Heat-strengthened float glass .
6. Low-E Coating: Sputtered on second or third surface.
7. Visible Light Transmittance: 64 percent minimum.
8. Winter Nighttime U-Factor: 0.28 maximum.
9. Summer Daytime U-Factor: 0.26 maximum.
10. Solar Heat Gain Coefficient: 0.27 maximum.

C. Glass Type IG-3: Tinted insulating glass.

1. Overall Unit Thickness: 1 inch .
2. Thickness of Each Glass Lite: 6.0 mm .
3. Outdoor Lite: Tinted heat-strengthened float glass .
4. Interspace Content: Air or Argon.
5. Indoor Lite: Clear heat-strengthened float glass .
6. Winter Nighttime U-Factor: 0.47 maximum.
7. Summer Daytime U-Factor: 0.50 maximum.
8. Solar Heat Gain Coefficient: 0.51 maximum.

D. Glass Type IG-4: Low-e-coated, tinted insulating glass.

1. Overall Unit Thickness: 1 inch .
2. Thickness of Each Glass Lite: 6.0 mm .
3. Outdoor Lite: Tinted heat-strengthened float glass .
4. Interspace Content: Air or Argon.
5. Indoor Lite: Clear heat-strengthened float glass .

6. Low-E Coating: Pyrolytic or sputtered on second surface.
7. Visible Light Transmittance: 35 percent minimum.
8. Winter Nighttime U-Factor: 0.28 maximum.
9. Summer Daytime U-Factor: 0.26 maximum.
10. Solar Heat Gain Coefficient: 0.25 maximum.

E. Glass Type IG-5: Ceramic-coated , insulating spandrel glass.

1. Overall Unit Thickness: 1 inch .
2. Thickness of Each Glass Lite: 6.0 mm .
3. Outdoor Lite: Heat-strengthened float glass .
4. Interspace Content: Air or Argon.
5. Indoor Lite: Heat-strengthened float glass .
6. Coating Location: Fourth surface.
7. Winter Nighttime U-Factor: 0.47 maximum.
8. Summer Daytime U-Factor: 0.50 maximum.

F. Glass Type IG-6: Ceramic-coated , tinted, insulating spandrel glass.

1. Overall Unit Thickness: 1 inch .
2. Thickness of Each Glass Lite: 6.0 mm .
3. Outdoor Lite: Tinted heat-strengthened float glass .
4. Interspace Content: Air or Argon.
5. Indoor Lite: Clear heat-strengthened float glass .
6. Coating Location: Fourth surface.
7. Winter Nighttime U-Factor: 0.47 maximum.
8. Summer Daytime U-Factor: 0.50 maximum.

2.14 INSULATING-LAMINATED-GLASS TYPES

A. Glass Type [GL-<#>]: Clear insulating laminated glass.

1. Overall Unit Thickness: [1-3/16 inch] [1 inch] [3/4 inch] <insert dimension>.
2. Thickness of Outdoor Lite: [3.0 mm] [4.0 mm] [5.0 mm] [6.0 mm] <Insert thickness designation>.
3. Outdoor Lite: [Heat-strengthened float glass] [Fully tempered float glass].
4. Interspace Content: [Air] [Argon].
5. Indoor Lite: Clear laminated glass with two plies of [float glass] [heat-strengthened float glass] [fully tempered float glass].
 - a. Thickness of Each Glass Ply: [3.0 mm] [4.0 mm] [5.0 mm] [6.0 mm] [As indicated] <Insert thickness designation>.
 - b. Interlayer Thickness: [0.030 inch] [0.060 inch] [0.090 inch].
6. Winter Nighttime U-Factor: <Insert value> maximum.
7. Summer Daytime U-Factor: <Insert value> maximum.
8. Solar Heat Gain Coefficient: <Insert value> maximum.
9. Provide safety glazing labeling.

- B. Glass Type [GL-<#>]: Low-e-coated, clear insulating laminated glass.
1. Overall Unit Thickness: [1-3/16 inch] [1 inch] [3/4 inch] <insert dimension>.
 2. Thickness of Outdoor Lite: [3.0 mm] [4.0 mm] [5.0 mm] [6.0 mm] <Insert thickness designation>.
 3. Outdoor Lite: [Heat-strengthened float glass] [Fully tempered float glass].
 4. Interspace Content: [Air] [Argon].
 5. Indoor Lite: Clear laminated glass with two plies of [float glass] [heat-strengthened float glass] [fully tempered float glass].
 - a. Thickness of Each Glass Ply: [3.0 mm] [4.0 mm] [5.0 mm] [6.0 mm] [As indicated] <Insert thickness designation>.
 - b. Interlayer Thickness: [0.030 inch] [0.060 inch] [0.090 inch].
 6. Low-E Coating: [Pyrolytic on second] [Pyrolytic on third] [Sputtered on second] [Sputtered on third] [Pyrolytic or sputtered on second or third] surface.
 7. Visible Light Transmittance: <Insert value> percent minimum.
 8. Winter Nighttime U-Factor: <Insert value> maximum.
 9. Summer Daytime U-Factor: <Insert value> maximum.
 10. Solar Heat Gain Coefficient: <Insert value> maximum.
 11. Provide safety glazing labeling.
- C. Glass Type [GL-<#>]: Tinted, insulating laminated glass.
1. Overall Unit Thickness: [1-3/16 inch] [1 inch] [3/4 inch] <insert dimension>.
 2. Thickness of Outdoor Lite: [3.0 mm] [4.0 mm] [5.0 mm] [6.0 mm] <Insert thickness designation>.
 3. Outdoor Lite: Tinted [heat-strengthened float glass] [fully tempered float glass].
 4. Interspace Content: [Air] [Argon].
 5. Indoor Lite: Clear laminated glass with two plies of [float glass] [heat-strengthened float glass] [fully tempered float glass].
 - a. Thickness of Each Glass Ply: [3.0 mm] [4.0 mm] [5.0 mm] [6.0 mm] [As indicated] <Insert thickness designation>.
 - b. Interlayer Thickness: [0.030 inch] [0.060 inch] [0.090 inch].
 6. Winter Nighttime U-Factor: <Insert value> maximum.
 7. Summer Daytime U-Factor: <Insert value> maximum.
 8. Solar Heat Gain Coefficient: <Insert value> maximum.
 9. Provide safety glazing labeling.
- D. Glass Type [GL-<#>]: Low-e-coated, tinted, insulating laminated glass.
1. Overall Unit Thickness: [1-3/16 inch] [1 inch] [3/4 inch] <insert dimension>.
 2. Thickness of Outdoor Lite: [3.0 mm] [4.0 mm] [5.0 mm] [6.0 mm] <Insert thickness designation>.
 3. Outdoor Lite: Tinted [heat-strengthened float glass] [fully tempered float glass].
 4. Interspace Content: [Air] [Argon].

5. Indoor Lite: Clear laminated glass with two plies of **[float glass] [heat-strengthened float glass] [fully tempered float glass]**.
 - a. Thickness of Each Glass Ply: **[3.0 mm] [4.0 mm] [5.0 mm] [6.0 mm] [As indicated] <Insert thickness designation>**.
 - b. Interlayer Thickness: **[0.030 inch] [0.060 inch] [0.090 inch]**.
6. Low-E Coating: **[Pyrolytic on second] [Pyrolytic on third] [Sputtered on second] [Sputtered on third] [Pyrolytic or sputtered on second or third]** surface.
7. Visible Light Transmittance: **<Insert value>** percent minimum.
8. Winter Nighttime U-Factor: **<Insert value>** maximum.
9. Summer Daytime U-Factor: **<Insert value>** maximum.
10. Solar Heat Gain Coefficient: **<Insert value>** maximum.
11. Provide safety glazing labeling.

2.15 FIRE-PROTECTION-RATED GLAZING TYPES

- A. Glass Type FPG-1 : 20-minute fire-rated glazing with hose-stream test; monolithic ceramic glazing .
- B. Glass Type FPG-2 : 45-minute, 60-minute or 90-minute fire-rated glazing; film-faced ceramic glazing or laminated ceramic glazing .
 1. Provide safety glazing labeling.

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 will 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.
- 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 is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and 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.
- 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 according to 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.

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 and then to jambs. Cover horizontal framing joints by applying tapes to jambs and 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 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 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 substantial wash away from glass.

3.7 CLEANING AND PROTECTION

- A. 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.
- 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. 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.
- D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.
- E. Wash glass on both exposed surfaces in each area of Project 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.

END OF SECTION 08 80 00