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PPG Architectural Glass

From the aqua-blue sheen of ***Azuria™*** Glass to the ultra-clear transparency of ***Starphire®*** Glass, PPG offers architects an almost limitless array of aesthetic options. ***Solarban 60*** and ***Solarban 80*** Solar Control Low-E Glasses and the new ***Solarban 70XL*** set the standard for superior solar control along with exceptional levels of visible light transmittance. ***Oceans of Color®*** Spectrally Selective Tinted Glasses (***Atlantica™***, ***Azuria***, ***Caribia®*** and ***Solexia™*** glasses) have Light-to-Solar Gain (LSG) ratios of up to 1.56 in four ocean-inspired tints, ranging from a subtle light green to a brilliant aqua-blue. For greater solar control, Oceans of Color tints can be combined with ***Solarban 60*** in an insulating glass unit to produce LSG ratios of up to 1.74. ***Solarban 60 Starphire*** features the clarity of an ultra-clear glass, along with excellent solar control characteristics. The revolutionary new ***Solarban 70XL*** offers an astonishing LSG ratio of 2.33, allowing designers to increase areas of vision glass in highly energy-efficient applications.

PPG Certified Fabricator Programs: PPG Architectural Glass products are available through a network of rigorously audited PPG Certified manufacturer/fabricators. These select companies offer architects: PPG high-performance glass products, accelerated lead times, in-stock replacement glass, and regional sourcing. Thanks to the popularity and success of its Certified Fabricator Program, PPG has expanded the concept to include Certified Commercial Window Fabricator and Certified Laminator programs.

PPG Ideascapes offers integrated products, services, and people to inspire your design and color vision. We recommend you consult with your regional PPG architectural representative, who can be contacted through: PPG Industries, Pittsburgh, PA, (888) 774-4332, Email: info@ppg.com http://corporateportal.ppg.com/IdeaScapes.

PPG products appear in the following MasterFormat 2004 Sections:
- Section 05 05 13 – Shop-Applied Coatings for Metal
- Section 08 80 00 – Glazing
- Section 09 91 13 – Exterior Painting
- Section 09 91 23 – Interior Painting
- Section 09 93 00 – Staining and Transparent Finishing
- Section 09 96 00 – High Performance Coatings
- Section 09 96 33 – High Temperature-Resistant Coatings
- Section 09 96 46 – Intumescent Painting
- Section 09 96 53 – Elastomeric Coatings
- Section 09 96 33 – High Temperature-Resistant Coatings
- Section 09 97 26 – Cementitious Coatings
- Section 09 96 33 – High Temperature-Resistant Coatings

Specifier: The specifier may select CSI MasterFormat 95 or MasterFormat 2004 section numbering as required. Some items in the text are bolded for editing convenience; remove bolds from final draft by highlighting document and toggling bolds: CONTROL-A, CONTROL-B.

SECTION 08 80 00 - GLAZING

SECTION 08800 - GLAZING

PART 1 - GENERAL

Specifier: Edit paragraphs below to correspond to project scope.

1.1 SECTION INCLUDES

A. Glass and glazing units for the following products and applications, and glazing requirements referenced by other sections:
   1. Windows.
   2. Doors.
   3. Interior borrowed lites.
   4. Glazed entrances.
   5. Storefront framing.
   6. Glazed curtain walls.
   7. Skylights.

B. Glazing accessories.

Specifier: Edit paragraphs below to correspond to project scope; retain references to sections specifying work that might otherwise be incorporated in work of this section. Delete Article if not required by project scope.

1.2 RELATED SECTIONS

A. Division 08 Section "Decorative Glass Glazing."

B. Division 08 Section "Mirrors."

C. Division 08 Section "Plastic Glazing."

D. Division 08 Section "Security Glazing."

Specifier: Retain references below remaining in section following editing. For projects of limited scope, delete Article.

1.3 REFERENCES

A. American Architectural Manufacturers Association:
   1. AAMA 800 - Voluntary Specifications and Test Methods for Sealants.

B. ASTM International (ASTM):
   1. ASTM C 509 - Specification for Elastomeric Cellular Preformed Gasket and Sealing Material.
   2. ASTM C 864 - Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers.
   3. ASTM C 920 - Specification for Elastomeric Joint Sealants.
   4. ASTM C 1036 - Specification for Flat Glass.
   5. ASTM C 1048 - Specification for Heat-Treated Flat Glass - Kind HS, Kind FT Coated and Uncoated Glass.
   6. ASTM C 1087 - Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems.
   7. ASTM C 1115 - Specification for Dense Elastomeric Silicone Rubber Gaskets and Accessories.
   8. ASTM C 1172 - Specification for Laminated Architectural Flat Glass.
   9. ASTM C 1281 - Specification for Preformed Tape Sealants for Glazing Applications.

10. ASTM C 1330 - Specification for Cylindrical Sealant Backing for Use with Cold Liquid Applied Sealants.
11. ASTM C 1376 - Specification for Pyrolytic and Vacuum Deposition Coatings on Glass.
12. ASTM E 774 - Specification for the Classification of the Durability of Sealed Insulating Glass Units.
13. ASTM E 1300 - Practice for Determining Load Resistance of Glass in Buildings.
14. ASTM E 2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation.

C. Code of Federal Regulations:
1. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials.

D. Glass Association of North America (GANA):
1. Glazing Manual.
2. Laminated Glass Design Guide.
3. Engineering Standards Manual.

E. The Insulating Glass Manufacturers Alliance (IGMA):
1. IGMA TB-3001 - Sloped Glazing Guidelines.
2. SIGMA TM-3000 - Glazing Guidelines for Sealed Insulating Glass Units.

F. Lawrence Berkeley National Laboratory; Environmental Energy Technologies Division; Building Technologies Department; Windows & Daylighting Group, windows.lbl.gov/software:
1. LBL-44789 WINDOW 5.0 - A PC Program for Analyzing Window Thermal Performance.

G. National Fenestration Rating Council (NFRC):
1. NFRC 100 - Procedure for Determining Fenestration Product Thermal Properties.
2. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficients at Normal Incidence.
3. NFRC 300 - Procedures for Determining Solar Optical Properties of Simple Fenestration Products.

H. National Fire Protection Association (NFPA):
1. NFPA 80 - Fire Doors and Windows.
2. NFPA 252 - Fire Tests of Door Assemblies.
3. NFPA 257 - Fire Test for Window and Glass Block Assemblies.

1.4 DEFINITIONS

A. Manufacturers of Primary Glass: Firms that produce primary glass, as defined in referenced industry publications.

B. Manufacturers/Fabricators of Glass Products: Firms that utilize primary glass in the production of glass products that may include coated glass, laminated glass, and insulating glass.

C. Sealed Insulating Glass Unit Surfaces:
1. Surface 1: Exterior surface of outer lite.
2. Surface 2: Interspace-facing surface of outer lite.
3. Surface 3: Interspace-facing surface of inner lite.
4. Surface 4: Interior surface of inner lite.

1.5 PERFORMANCE REQUIREMENTS

Specifier: Modify example performance requirements in this Article to suit project and local conditions.

A. General: Provide glazing systems that will withstand indicated loads and normal thermal movement without failure, including loss or glass breakage resulting from defective

manufacture, fabrication, or installation; failure of glazing systems to remain watertight and airtight; or deterioration of glazing materials.

B. Glass Design: Glass thicknesses indicated are minimums. Select actual glass lite thicknesses by analyzing loads and conditions. Provide glass lites in the thicknesses and in strengths required to meet or exceed the following criteria:
   1. Glass Thicknesses: Comply with ASTM E 1300, as follows:

Specifier: Consult structural engineer. Verify compliance with local codes. Verify structural load information is included in construction documents. Retain option for snow load compliance where required for sloped glazing systems.

      a. Specified Design Wind **[**and Snow**]** Loads: As indicated.
      b. Probability of Breakage for Vertical Glazing: 8 lites per 1000 for lites set within 15 degrees of vertical and under wind load for a load duration of **[**3**]** seconds.
      c. Probability of Breakage for Sloped Glazing: 1 lite per 1000 for lites set more than 15 degrees off vertical and under wind and snow loads for a duration of **[**30**]** days.
      d. Thickness of Tinted Glass: Provide the same thickness for each tint color for all applications.

C. Thermal Movements: Allow for thermal movements of glazing components and glass framing members resulting from a temperature change range of 120 deg F ambient and 180 deg F material surfaces.

D. Thermal and Optical Performance Properties: Provide glass meeting specified performance properties, based on manufacturer's published test data for units of thickness indicated, and the following:
   1. Center-of-Glass Values: Per LBL-44789 WINDOW 5.0 analysis, as follows:
      a. U-Factors: NFRC 100 expressed as Btu/sq. ft. x h x deg F.
      b. Solar Heat Gain Coefficient: NFRC 200.
      c. Solar Optical Properties: NFRC 300.

1.6 SUBMITTALS

A. Product Data: Manufacturer’s data sheets for each glass product and glazing material.

B. Samples: 12-inch-square, for each type of glass product, other than monolithic clear float glass **[**or clear float glass only set in insulated glass units**]**.

C. Glazing Schedule: Prepare schedule using designations used on Drawings.

D. Product Certificates: Signed by manufacturers/fabricators of glass products certifying that products furnished comply with project requirements.

E. Preconstruction Adhesion and Compatibility Test Report: From glazing sealant manufacturer, based on submitted samples or acceptable data from previous testing of current formulations with similar products.

F. Qualification Information: For Installer firm and Installer’s manufacturer/fabricator-trained field supervisor.

G. Warranties: Submit sample meeting warranties requirements of this Section.

1.7 QUALITY ASSURANCE

A. Manufacturer/Source: Obtain each type of glass product from a single primary glass manufacturer and a single manufacturer/fabricator for each glass product type.

Specifier: Retain below when specifying PPG Solarban 60, 70XL, or 80 glass or glass of other manufacturers that maintain fabricator certifying program.

1. For glass sputter-coated with solar-control low-e coatings, obtain glass products in fabricated units from a manufacturer/fabricator certified by the primary glass manufacturer.

B. Installer Qualifications: Experienced Installer with minimum of 5 successful completed projects of similar materials and scope, approved by glass product manufacturer/fabricator.

C. Preconstruction Adhesion and Compatibility Testing: Submit glass units, glazing materials, and glass-framing members with applicable finish to elastomeric glazing sealant manufacturer for determination of sealant compatibility, priming, and preparation requirements for optimum adhesion and performance.

Specifier: Retain paragraph below and add proprietary fire-rated glazing products to Part 2 of this section if required for project.

D. Glazing for Fire-Rated Door and Window Assemblies: Glazing tested per NFPA 252 and NFPA 257, as applicable, for assemblies complying with NFPA 80 and listed and labeled per requirements of authorities having jurisdiction.

E. Safety Glazing Products: Comply with size, glazing type, location, and testing requirements of 16 CFR 1201 for Category I and II glazing products, and requirements of authorities having jurisdiction.

F. Glazing Industry Publications: Comply with glass product manufacturers' recommendations and the following:
1. GANA Publications: GANA Laminated Division's "Laminated Glass Design Guide" and GANA's "Glazing Manual."
2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "Glazing Guidelines for Sealed Insulating Glass Units."

G. Insulating-Glass Certification Program: Indicate compliance with requirements of Insulating Glass Certification Council on applicable glazing products.

H. Mockups: Prior to installing glazing, build mockups to demonstrate materials and workmanship. Coordinate with mockup requirements of related sections.

I. Preinstallation Conference: Conduct conference at Project site in compliance with Division 01 requirements.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials during shipping, handling, and storage to prevent breakage, scratching, damage to seals, or other visible damage. Deliver, unload, store, and erect glazing materials without exposing panels to damage from construction operations.
1. Comply with manufacturer's venting and sealing recommendations for shipping and handling of insulating glass units exposed to substantial altitude change.

1.9 WARRANTY

Specifier: Warranty terms below are available from PPG-certified manufacturers/fabricators of glass products and are issued in conjunction with PPG's warranty on the properties of PPG primary glass products. Verify that other manufacturers/fabricators under consideration furnish warranties meeting requirements below.

A. Warranty for Coated-Glass Products: Manufacturer's standard form, signed by coated-glass product primary manufacturer or manufacturer/fabricator, as applicable, agreeing to replace coated-glass units that display peeling, cracking, and other deterioration in metallic coating under normal use, within **[**10**]** years of date of Substantial Completion.

B. Warranty for Laminated Glass: Manufacturer's standard form, signed by laminated-glass product manufacturer/fabricator, agreeing to replace laminated-glass units that display edge separation, delamination, and blemishes exceeding those allowed by ASTM C 1172, within **[**five**]** years of date of Substantial Completion.

C. Warranty for Insulating Glass: Manufacturer's standard form, signed by insulating-glass product manufacturer/fabricator, agreeing to replace insulating-glass units that exhibit failure of hermetic seal under normal use evidenced by the obstruction of vision by dust, moisture, or film on interior surfaces of glass, within **[**10**]** years of date of Substantial Completion.

D. Installer's Warranty: Form acceptable to Owner, signed by glass product Installer, agreeing to replace glass products that deteriorate, or that exhibit damage or deterioration of glass or glazing products due to faulty installation, within **[**2**]** years of date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: Glass product selections are based upon the primary glass manufacturer below. Provide basis of design product **[**, or comparable product of a listed manufacturer approved by the Architect prior to bid**]**:
   1. PPG Industries, Inc, Pittsburgh, PA, (888) 774-4332, Email: info@ppg.com, http://corporateportal.ppg.com.
   2. **[**Specifier: insert names of manufacturers with comparable products to basis of design products, if required.**]**

2.2 GLASS PRODUCTS

A. Annealed Float Glass, General: ASTM C 1036, Type I, Quality-Q3, class indicated.

Specifier: Retain below if Ultra-Clear glass product required.

B. Annealed Ultra-Clear (Low Iron) Float Glass: Class I (clear).
   1. Basis of Design Product: PPG Industries, Inc., Starphire.
   2. **[**Specifier: insert manufacturer of comparable product if required**]**

C. Heat-Treated Float Glass, Heat-Strengthened: ASTM C 1048; Type I (transparent flat glass); Quality-Q3; Kind HS, of class and condition indicated: where indicated, where needed to resist thermal stresses and where required to comply with performance requirements.

D. Heat-Treated Float Glass, Fully Tempered: ASTM C 1048; Type I (transparent flat glass); Quality-Q3; Kind FT, of class and condition indicated: where safety glass is indicated.

E. Pyrolytic-Coated Float Glass: ASTM C 1376, float glass with metallic-oxide coating applied by pyrolytic deposition process during primary glass product manufacture.

F. Sputter-Coated Float Glass: ASTM C 1376, float glass with metallic-oxide or -nitride coating deposited by vacuum deposition process following primary glass product manufacture.

G. Ceramic-Coated Vision Glass: Float glass with silk-screened ceramic enamel application, per ASTM C 1048, Condition C, Type I, Quality-Q3, and Specification No. 95-1-31 in GANA "Engineering Standards Manual."

H. Ceramic-Coated Spandrel Glass: ASTM C 1048, Condition B, Type I, Quality-Q3 and GANA "Engineering Standards Manual."

I. Coated Spandrel Float Glass: Float glass complying with ASTM C 1048 and other requirements specified, with manufacturer's standard opacifier material on coated second surface of lites.

J. Laminated Glass: ASTM C 1172, with manufacturer's standard polyvinyl butyral or cured resin interlayer.

K. Insulating-Glass Units: Factory-assembled units consisting of dual-sealed lites of glass separated by a dehydrated interspace, with manufacturer's standard spacer material and construction, per ASTM E 774 and E 2190.

2.3 GLAZING ACCESSORIES

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

B. Glazing Tape: Butyl-based elastomeric tape with integral resilient tube spacer, 10 to 15 Shore A durometer hardness, black color, coiled on release paper; widths required for specified installation, complying with ASTM C 1281 and AAMA 800 for application.

Specifier: Select above or below, or retain both types as required by project scope. Consult manufacturer for tape recommendations.

C. Glazing Tape: Closed cell polyvinyl chloride foam, maximum water absorption by volume 2 percent, designed for 25 percent compression percent for air barrier and vapor retarder seal, black color, coiled on release paper over adhesive on two sides; widths required for specified installation, and complying with AAMA 800.

D. Glazing Gaskets:
1. Dense Compression Gaskets: ASTM C 864, neoprene or EPDM, or ASTM C 1115, silicone or thermoplastic polyolefin rubber, as recommended by glazing product manufacturer for application, molded or extruded shape to fit glazing channel retaining slot; black color.
2. Soft Compression Gaskets: ASTM C 509, Type II, black, molded or extruded, neoprene, EPDM, silicone or thermoplastic polyolefin rubber, of profile and hardness required to maintain watertight seal.

E. Setting Blocks: ASTM C 864, neoprene, 80 to 90 Shore A durometer hardness; length 4 inches, width of glazing rabbet space less 1/16 inch, height required for glazing method, pane weight, and pane area.

F. Spacer Shims: ASTM C 864, neoprene, 50 to 60 Shore A durometer hardness; length 3 inches, one half height of glazing stop, thickness required for application, one face self-adhesive.

G. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

Delete first paragraph below if not applicable in glazing channels.

H. Glazing Sealants: ASTM C 920, type recommended by glazing product manufacturer for application indicated, complying with requirements of Division 07 Section "Joint Sealants," color as selected by Architect.

I. 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.

Specifier: Retain below where required by authorities having jurisdiction. Below typically applies to high-rise construction.

J. Smoke Removal Unit Targets: Adhesive targets for application to glass, identifying glass units designed for removal for smoke control.

2.4 FABRICATION OF GLAZING UNITS, GENERAL

A. Fabricate glazing units in dimensions required, with edge and face clearances, edge and surface conditions, and bite in accordance with glazing product manufacturer/fabricator's instructions and referenced glazing publications.

Specifier: Glass and interlayer units in glazing schedules below are examples only and should be reviewed with respect to project requirements and requirements of authorities having jurisdiction. Drawings should indicate required locations for safety glass. Additional options and combinations of glass products are available. Many options available from PPG are not published; we recommend you review project requirements with PPG representative. Recommendations vary significantly by project type and location.

2.5 MONOLITHIC (SINGLE-GLAZED) FLOAT-GLASS UNITS

A. Uncoated Clear Float Glass Units SG#1:
   1. Class 1 (clear) float glass, **[**6 mm**]** minimum thickness.
      a. Annealed.
      b. Kind HS (heat strengthened) where required.
      c. Kind FT (fully tempered) where indicated.

B. Uncoated Ultra Clear Float Glass Units SG#2:
   1. Class 1 ultra-clear (low-iron) float glass, **[**6 mm**]** minimum thickness.
      a. Annealed.
      b. Kind HS (heat strengthened) where required.
      c. Kind FT (fully tempered) where indicated.
      d. Basis of Design Product:
         1) PPG Industries, Inc., **Starphire**.
         2) **[**Specifier: insert manufacturer of comparable product if required**]**

Specifier: Below is example only. Consult PPG product literature for range of tinted glass available.

C. Uncoated Tinted Float Glass Units SG#3:
   1. Class 2 tinted float glass, **[**6 mm**]** minimum thickness.
      a. Annealed.
      b. Kind HS (heat strengthened) where required.
      c. Kind FT (fully tempered) where indicated.
      d. Tint Color: **Warm bronze**.
      e. Basis of Design Product:

1) PPG Industries, Inc., **Solarbronze**.
2) [Specifier: insert manufacturer of comparable product if required]

D. Coated Tinted Float Glass Units SG#4:
1. Class 2 tinted float glass, [6 mm] minimum thickness.
a. Annealed.
b. Kind HS (heat strengthened) where required.
c. Kind FT (fully tempered) where indicated.
d. Reflective Coating: Pyrolytic coating on [first] [second] surface.
e. Tint Color: **Warm bronze metallic**.
f. Basis of Design Product:
1) PPG Industries, Inc., **Solarcool Bronze**.
2) [Specifier: insert manufacturer of comparable product if required]

Specifier: Below is example only. Coordinate with monolithic and insulating glass unit selections. Select from coating options listed below.

E. Coated Tinted Spandrel Glass Units SG#5:
1. Class 2 tinted float glass, [6 mm] minimum thickness.
a. Kind HS (heat strengthened) where required.
b. Reflective Coating: Pyrolytic coating on first surface matching coated tinted float glass units.
c. Opacifier Coating: Manufacturer's standard, on second surface.
d. Ceramic Coating: On second surface, match Architect's sample.

2.6 LAMINATED-GLASS UNITS

A. Laminated Glass Units LG#1:
1. Laminated glass unit: [Kind LA: Two lites of annealed float glass] [LHS: Two lites of heat-strengthened float glass] [LR: Two lites of heat-treated float glass, one of which is reflective] [LT: Two lites of fully tempered float glass].
a. Laminated Lite Outer Ply: [Class 1 (clear)] [Class 1 (clear) ultra clear (low iron)] [Class 2 (tinted)] float glass.
1) Thickness: [3.0 mm] [5.0 mm] [6.0 mm].
b. Reflective Coating: [Pyrolytic] [Sputtered].
1) Color: [Specifier select color].
2) Location: [Second] [Third] surface.
c. Laminated Lite Inner Ply: [Class 1 (clear)] [Class 1 (clear) ultra clear (low iron)] float glass.
1) Thickness: [3.0 mm] [5.0 mm] [6.0 mm].
d. Laminated Lite Plastic Interlayer:
1) Thickness: [0.030] inch.
2) Interlayer Color: [Clear] [Specifier select color].
e. Visible Light Transmittance: [Specifier insert] percent minimum.
f. Winter Nighttime U-Factor: [Specifier insert] maximum.
g. Summer Daytime U-Factor: [Specifier insert] maximum.
h. Solar Heat Gain Coefficient: [Specifier insert] maximum.
i. Outdoor Visible Reflectance: [Specifier insert] percent maximum.

2.7 INSULATING-GLASS UNITS

Argon-filled units are available where lower U-Factor is required.

A. Clear Insulating-Glass Units IG#1:
   1. Unit Overall Thickness **[**25 mm**]**.
   2. Interspace Content: **[**Air**]**.
   3. Outdoor Lite: Class 1 (clear) float glass, **[**6 mm**]** minimum thickness.
      a. Annealed.
      b. Kind HS (heat strengthened) where required.
      c. Kind FT (fully tempered) where indicated.
   4. Indoor Lite: Class 1 (clear) float glass, **[**6 mm**]** minimum thickness.
      a. Annealed.
      b. Kind HS (heat strengthened) where required.
      c. Kind FT (fully tempered) where indicated.
   5. Visible Light Transmittance: 79 percent minimum.
   6. Winter Nighttime U-Factor: 0.47 maximum.
   7. Summer Daytime U-Factor: 0.50 maximum.
   8. Solar Heat Gain Coefficient: 0.70 maximum.
   9. Outdoor Visible Light Reflectance: 15 percent maximum.
   10. Light to Solar Gain (LSG): 1.13 minimum.

B. Ultra-Clear Insulating-Glass Units IG#2:
   1. Unit Overall Thickness **[**25 mm**]**.
   2. Interspace Content: **[**Air**]**.
   3. Outdoor Lite: Class 1 (clear) ultra-clear (low-iron) float glass, **[**6 mm**]** minimum thickness.
      a. Annealed.
      b. Kind HS (heat strengthened) where required.
      c. Kind FT (fully tempered) where indicated.
      d. Basis of Design Product:
         1) PPG Industries, Inc., **Starphire**.
         2) **[**Specifier: insert manufacturer of comparable product if required**]**
   4. Indoor Lite: Class 1 (clear) ultra-clear (low-iron) float glass, **[**6 mm**]** minimum thickness.
      a. Annealed.
      b. Kind HS (heat strengthened) where required.
      c. Kind FT (fully tempered) where indicated.
      d. Basis of Design Product:
         1) PPG Industries, Inc., **Starphire**.
         2) **[**Specifier: insert manufacturer of comparable product if required**]**
   5. Visible Light Transmittance: 84 percent minimum.
   6. Winter Nighttime U-Factor: 0.47 maximum.
   7. Summer Daytime U-Factor: 0.50 maximum.
   8. Solar Heat Gain Coefficient: 0.82 maximum.
   9. Outdoor Visible Light Reflectance: 15 percent maximum.
   10. Light to Solar Gain (LSG): 1.19 minimum.

Solarban 70XL Glass: The following insulating glass unit utilizes PPG's Solarban 70XL coated ultra-clear Starphire glass, a new generation solar heat gain control product. In a one-inch insulating glass unit with a standard clear inboard lite, Solarban 70XL Glass has the following features: Exterior appearance similar to clear, uncoated glass; blocks more than 70% of the total solar energy while allowing over 60% of visible light to pass through (excellent low solar heat gain coefficient); excellent insulation value (U-Value= 0.27). Solarban 70XL coated glass yields the color neutrality of clear uncoated glass, together

with dramatically improved performance. Solarban 70XL glass also can be combined in insulating glass units with an outboard lite of a PPG tinted or reflective glass tint to increase aesthetic and performance options.

C. Solar Control Low-E Ultra-Clear Insulating-Glass Units IG#3:
   1. Unit Overall Thickness [25 mm].
   2. Interspace Content: [Air].
   3. Outdoor Lite: Class 1 (clear) ultra-clear (low-iron) float glass, [6 mm] minimum thickness.
      a. Annealed.
      b. Kind HS (heat strengthened) where required.
      c. Kind FT (fully tempered) where indicated.
      d. Solar Control Low-E Coating: Sputtered on second surface.
      e. Color: **Ultra-clear**.
      f. Basis of Design Product:
         1) PPG Industries, Inc., **Solarban 70XL**.
         2) [Specifier: insert manufacturer of comparable product if required]
   4. Indoor Lite: Class 1 (clear) clear float glass, [6 mm] minimum thickness.
      a. Annealed.
      b. Kind HS (heat strengthened) where required.
      c. Kind FT (fully tempered) where indicated.
   5. Visible Light Transmittance: 63 percent minimum.
   6. Winter Nighttime U-Factor: 0.29 maximum.
   7. Summer Daytime U-Factor: 0.27 maximum.
   8. Solar Heat Gain Coefficient: 0.27 maximum.
   9. Outdoor Visible Light Reflectance: 11 percent maximum.
   10. Light to Solar Gain (LSG): 2.33 minimum.

Solarban 60 Glass: The following 17 insulating glass units utilize PPG's Solarban 60 coated glass, which is engineered to control solar heat gain - essential to minimizing cooling costs. In a standard one-inch insulating glass unit, Solarban 60 Glass has the following features: Exterior appearance similar to clear, uncoated glass; Blocks more than 60% of the total solar energy while allowing 70% of visible light to pass through (excellent low solar heat gain coefficient); Excellent insulation value (U-Value= 0.29). Solarban 60 coated glass yields the color neutrality of clear uncoated glass, together with dramatically improved performance. Solarban 60 glass also can be combined in insulating glass units with an outboard lite of a PPG tinted or reflective glass tint to increase aesthetic and performance options.

D. Solar Control Low-E Clear Insulating-Glass Units IG#4:
   1. Unit Overall Thickness [25 mm].
   2. Interspace Content: [Air].
   3. Outdoor Lite: Class 1 (clear) float glass, [6 mm] minimum thickness.
      a. Annealed.
      b. Kind HS (heat strengthened) where required.
      c. Kind FT (fully tempered) where indicated.
      d. Solar Control Low-E Coating: Sputtered on second surface.
      e. Basis of Design Product:
         1) PPG Industries, Inc., **Solarban 60**.
         2) [Specifier: insert manufacturer of comparable product if required]
   4. Indoor Lite: Class 1 (clear) float glass, [6 mm] minimum thickness.
      a. Annealed.
      b. Kind HS (heat strengthened) where required.
      c. Kind FT (fully tempered) where indicated.
   5. Visible Light Transmittance: 70 percent minimum.

6. Winter Nighttime U-Factor: 0.29 maximum.
7. Summer Daytime U-Factor: 0.27 maximum.
8. Solar Heat Gain Coefficient: 0.38 maximum.
9. Outdoor Visible Light Reflectance: 11 percent maximum.
10. Light to Solar Gain (LSG): 1.84 minimum.

Solarban 60 Starphire: Solarban 60 Starphire glass allows ultra-clear glass to be used for vision glass, skylights, atriums, storefronts and entryways without sacrificing energy performance. This new product, used in an insulating glass unit, provides high visible light transmittance (73%) while offering superior solar control (0.41 SHGC). Used in a one-inch insulating glass unit with a Starphire glass inboard lite as well, Solarban 60 Starphire glass is visibly clearer and has a higher light transmittance than a conventional clear/clear Low-E coated insulating unit.

E. Solar Control Low-E Ultra-Clear Insulating-Glass Units IG#5:
1. Unit Overall Thickness **[**25 mm**]**.
2. Interspace Content: **[**Air**]**.
3. Outdoor Lite: Class 1 (clear) ultra-clear (low-iron) float glass, **[**6 mm**]** minimum thickness.
   a. Annealed.
   b. Kind HS (heat strengthened) where required.
   c. Kind FT (fully tempered) where indicated.
   d. Solar Control Low-E Coating: Sputtered on second surface.
   e. Color: **Ultra-clear**.
   f. Basis of Design Product:
      1) PPG Industries, Inc., **Solarban 60 Starphire**.
      2) **[**Specifier: insert manufacturer of comparable product if required**]**
4. Indoor Lite: Class 1 (clear) ultra-clear (low-iron) float glass, **[**6 mm**]** minimum thickness.
   a. Annealed.
   b. Kind HS (heat strengthened) where required.
   c. Kind FT (fully tempered) where indicated.
   d. Color: **Ultra-clear**.
   e. Basis of Design Product:
      1) PPG Industries, Inc., **Starphire**.
      2) **[**Specifier: insert manufacturer of comparable product if required**]**
5. Visible Light Transmittance: 73 percent minimum.
6. Winter Nighttime U-Factor: 0.29 maximum.
7. Summer Daytime U-Factor: 0.28 maximum.
8. Solar Heat Gain Coefficient: 0.41 maximum.
9. Outdoor Visible Light Reflectance: 12 percent maximum.
10. Light to Solar Gain (LSG): 1.78 minimum.

Solexia Glass: Solexia Glass (formerly Solex) is a soothing, light-green glass that is now part of the Oceans of Color collection by PPG. Launched in 1934, Solex glass introduced the concept of spectrally selective glasses to the architectural community and launched an unparalleled heritage of energy-saving performance and exceptionally attractive looks. With its new identity, Solexia glass will remain an industry standard for spectrally selective performance - a role it has played for more than a half-century.

F. Solar Control Low-E Tinted Insulating-Glass Units IG#6:
1. Unit Overall Thickness **[**25 mm**]**.
2. Interspace Content: **[**Air**]**.
3. Outdoor Lite: Class 2 (tinted) float glass, **[**6 mm**]** minimum thickness.
   a. Annealed.
   b. Kind HS (heat strengthened) where required.

c. Kind FT (fully tempered) where indicated.
d. Solar Control Low-E Coating: Sputtered on second surface.
e. Tint Color: **Light green**.
f. Basis of Design Product:
1) PPG Industries, Inc., **Solarban 60 Solexia**.
2) **[**Specifier: insert manufacturer of comparable product if required**]**

4. Indoor Lite: Class 1 (clear) float glass, **[**6 mm**]** minimum thickness.
a. Annealed.
b. Kind HS (heat strengthened) where required.
c. Kind FT (fully tempered) where indicated.
5. Visible Light Transmittance: 60 percent minimum.
6. Winter Nighttime U-Factor: 0.29 maximum.
7. Summer Daytime U-Factor: 0.30 maximum.
8. Solar Heat Gain Coefficient: 0.30 maximum.
9. Outdoor Visible Light Reflectance: 10 percent maximum.
10. Light to Solar Gain (LSG): 1.62 minimum.

G. Solar Control Low-E Tinted Insulating-Glass Units IG#7:
1. Unit Overall Thickness **[**25 mm**]**.
2. Interspace Content: **[**Air**]**.
3. Outdoor Lite: Class 2 (tinted) float glass, **[**6 mm**]** minimum thickness.
a. Annealed.
b. Kind HS (heat strengthened) where required.
c. Kind FT (fully tempered) where indicated.
d. Tint Color: **Light green**.
e. Basis of Design Product:
1) PPG Industries, Inc., **Solexia**.
2) **[**Specifier: insert manufacturer of comparable product if required**]**

4. Indoor Lite: Class 1 (clear) float glass, **[**6 mm**]** minimum thickness.
a. Annealed.
b. Kind HS (heat strengthened) where required.
c. Kind FT (fully tempered) where indicated.
d. Solar Control Low-E Coating: Sputtered on third surface.
e. Basis of Design Product:
1) PPG Industries, Inc., **Solarban 60**.
2) **[**Specifier: insert manufacturer of comparable product if required**]**

5. Visible Light Transmittance: 60 percent minimum.
6. Winter Nighttime U-Factor: 0.29 maximum.
7. Summer Daytime U-Factor: 0.27 maximum.
8. Solar Heat Gain Coefficient: 0.37 maximum.
9. Outdoor Visible Light Reflectance: 11 percent maximum.
10. Light to Solar Gain (LSG): 1.62 minimum.

Atlantica Glass: Atlantica Glass (formerly Solargreen) is one of the original ocean-inspired tints now featured in PPG's Oceans of Color collection of spectrally selective tinted architectural glasses. As timeless and beautiful as the ocean for which it is named, Atlantica glass combines desirable visible light transmittance and excellent solar heat control with a pleasant green aesthetic that complements a diverse range of building materials.

H. Solar Control Low-E Tinted Insulating-Glass Units IG#8:
1. Unit Overall Thickness **[**25 mm**]**.
2. Interspace Content: **[**Air**]**.
3. Outdoor Lite: Class 2 (tinted) float glass, **[**6 mm**]** minimum thickness.

a. Annealed.
b. Kind HS (heat strengthened) where required.
c. Kind FT (fully tempered) where indicated.
d. Tint Color: **Emerald green**.
e. Basis of Design Product:
1) PPG Industries, Inc., **Atlantica**.
2) **[**Specifier: insert manufacturer of comparable product if required**]**

4. Indoor Lite: Class 1 (clear) float glass, **[**6 mm**]** minimum thickness.
a. Annealed.
b. Kind HS (heat strengthened) where required.
c. Kind FT (fully tempered) where indicated.
d. Solar Control Low-E Coating: Sputtered on third surface.
e. Basis of Design Product:
1) PPG Industries, Inc., **Solarban 60.**
2) **[**Specifier: insert manufacturer of comparable product if required**]**

5. Visible Light Transmittance: 52 percent minimum.
6. Winter Nighttime U-Factor: 0.29 maximum.
7. Summer Daytime U-Factor: 0.27 maximum.
8. Solar Heat Gain Coefficient: 0.31 maximum.
9. Outdoor Visible Light Reflectance: 10 percent maximum.
10. Light to Solar Gain (LSG): 1.68 minimum.

Azuria Glass: (formerly Azurlite) is a stunning aqua-blue glass. Azuria glass's distinctive aesthetic blends brilliantly with the surrounding environment, adding beauty while delivering solar control and spectrally selective properties.

I. Solar Control Low-E Tinted Insulating-Glass Units IG#9:
1. Unit Overall Thickness **[**25 mm**]**.
2. Interspace Content: **[**Air**]**.
3. Outdoor Lite: Class 2 (tinted) float glass, **[**6 mm**]** minimum thickness.
a. Annealed.
b. Kind HS (heat strengthened) where required.
c. Kind FT (fully tempered) where indicated.
d. Tint Color: **Aqua Blue**.
e. Basis of Design Product:
1) PPG Industries, Inc., **Azuria**.
2) **[**Specifier: insert manufacturer of comparable product if required**]**

4. Indoor Lite: Class 1 (clear) float glass, **[**6 mm**]** minimum thickness.
a. Annealed.
b. Kind HS (heat strengthened) where required.
c. Kind FT (fully tempered) where indicated.
d. Solar Control Low-E Coating: Sputtered on third surface.
e. Basis of Design Product:
1) PPG Industries, Inc., **Solarban 60.**
2) **[**Specifier: insert manufacturer of comparable product if required**]**

5. Visible Light Transmittance: 54 percent minimum.
6. Winter Nighttime U-Factor: 0.29 maximum.
7. Summer Daytime U-Factor: 0.27 maximum.
8. Solar Heat Gain Coefficient: 0.31 maximum.
9. Outdoor Visible Light Reflectance: 9 percent maximum.
10. Light to Solar Gain (LSG): 1.74 minimum.

Caribia Glass: Caribia glass's aqua-green tint is as strikingly beautiful as the sea from which it draws its name. The pleasing combination of tropical green and ocean blue is a welcome addition to the design palette of architects. This unique tint works with a range of different building materials to create structures of lasting beauty. Caribia glass was developed in response to an extensive color/tint survey of design architects. Their top glass color choice led PPG to create this highly unique aqua-green spectrally selective glass. Spectrally selective Caribia glass is designed to combine excellent visible light transmittance with reduced infrared transmittance, thereby reducing solar heat loads.

J. Solar Control Low-E Tinted Insulating-Glass Units IG#10:
   1. Unit Overall Thickness **[**25 mm**]**.
   2. Interspace Content: **[**Air**]**.
   3. Outdoor Lite: Class 2 (tinted) float glass, **[**6 mm**]** minimum thickness.
      a. Annealed.
      b. Kind HS (heat strengthened) where required.
      c. Kind FT (fully tempered) where indicated.
      d. Tint Color: **Aqua green**.
      e. Basis of Design Product:
         1) PPG Industries, Inc., **Caribia**.
         2) **[**Specifier: insert manufacturer of comparable product if required**]**
   4. Indoor Lite: Class 1 (clear) float glass, **[**6 mm**]** minimum thickness.
      a. Annealed.
      b. Kind HS (heat strengthened) where required.
      c. Kind FT (fully tempered) where indicated.
      d. Solar Control Low-E Coating: Sputtered on third surface.
      e. Basis of Design Product:
         1) PPG Industries, Inc., **Solarban 60**.
         2) **[**Specifier: insert manufacturer of comparable product if required**]**
   5. Visible Light Transmittance: 54 percent minimum.
   6. Winter Nighttime U-Factor: 0.29 maximum.
   7. Summer Daytime U-Factor: 0.27 maximum.
   8. Solar Heat Gain Coefficient: 0.31 maximum.
   9. Outdoor Visible Light Reflectance: 9 percent maximum.
   10. Light to Solar Gain (LSG): 1.74 minimum.

Solarbronze Glass: A popular choice for both commercial buildings and homes, Solarbronze glass has a warm bronze tint that adds a subtle richness to the exterior and a warm glow to interior décor. The bronze color especially complements brick and stone facades.

K. Solar Control Low-E Tinted Insulating-Glass Units IG#11:
   1. Unit Overall Thickness **[**25 mm**]**.
   2. Interspace Content: **[**Air**]**.
   3. Outdoor Lite: Class 2 (tinted) float glass, **[**6 mm**]** minimum thickness.
      a. Annealed.
      b. Kind HS (heat strengthened) where required.
      c. Kind FT (fully tempered) where indicated.
      d. Tint Color: **Warm bronze**.
      e. Basis of Design Product:
         1) PPG Industries, Inc., **Solarbronze**.
         2) **[**Specifier: insert manufacturer of comparable product if required**]**
   4. Indoor Lite: Class 1 (clear) float glass, **[**6 mm**]** minimum thickness.
      a. Annealed.
      b. Kind HS (heat strengthened) where required.
      c. Kind FT (fully tempered) where indicated.

d. Solar Control Low-E Coating: Sputtered on third surface.
e. Basis of Design Product:
1) PPG Industries, Inc., **Solarban 60**.
2) [Specifier: insert manufacturer of comparable product if required]

5. Visible Light Transmittance: 42 percent minimum.
6. Winter Nighttime U-Factor: 0.29 maximum.
7. Summer Daytime U-Factor: 0.27 maximum.
8. Solar Heat Gain Coefficient: 0.31 maximum.
9. Outdoor Visible Light Reflectance: 8 percent maximum.
10. Light to Solar Gain (LSG): 1.35 minimum.

Solargray Glass: A cool light-gray color that enhances almost any building facade and the ability to control solar heat gain and glare have made Solargray glass a top choice for commercial structures. With a visible light transmittance of 40% for a 1-inch insulating glass unit with clear interior light, Solargray helps manage energy use. Solargray glass also reduces ultraviolet energy transmittance, allowing only 20% of the UV energy to pass through the glass. Ultraviolet energy has long been associated with the accelerated fading of fabrics and other interior materials.

L. Solar Control Low-E Tinted Insulating-Glass Units IG#12:
1. Unit Overall Thickness [25 mm].
2. Interspace Content: [Air].
3. Outdoor Lite: Class 2 (tinted) float glass, [6 mm] minimum thickness.
a. Annealed.
b. Kind HS (heat strengthened) where required.
c. Kind FT (fully tempered) where indicated.
d. Tint Color: **Cool gray**.
e. Basis of Design Product:
1) PPG Industries, Inc., **Solargray**.
2) [Specifier: insert manufacturer of comparable product if required]

4. Indoor Lite: Class 1 (clear) float glass, [6 mm] minimum thickness.
a. Annealed.
b. Kind HS (heat strengthened) where required.
c. Kind FT (fully tempered) where indicated.
d. Solar Control Low-E Coating: Sputtered on third surface.
e. Basis of Design Product:
1) PPG Industries, Inc., **Solarban 60**.
2) [Specifier: insert manufacturer of comparable product if required]

5. Visible Light Transmittance: 35 percent minimum.
6. Winter Nighttime U-Factor: 0.29 maximum.
7. Summer Daytime U-Factor: 0.27 maximum.
8. Solar Heat Gain Coefficient: 0.28 maximum.
9. Outdoor Visible Light Reflectance: 7 percent maximum.
10. Light to Solar Gain (LSG): 1.25 minimum.

Optigray 23 Glass: Optigray 23 glass is gray-tinted with warm bronze undertones and enhanced solar control capabilities. Optigray 23 glass transmits 21% of the sun's visible light while blocking more than 80% of its solar energy in a one-inch insulating unit. The result is a Solar Heat Gain Coefficient among the lowest of any architectural tinted glass product. Along with a reduced air-conditioning load, Optigray 23 glass also significantly diminishes glare and ultraviolet light transmittance, which is associated with the accelerated fading of fabrics and other interior materials.

M. Solar Control Low-E Tinted Insulating-Glass Units IG#13:
1. Unit Overall Thickness [25 mm].

2. Interspace Content: [Air].
3. Outdoor Lite: Class 2 (tinted) float glass, [6 mm] minimum thickness.
   a. Annealed.
   b. Kind HS (heat strengthened) where required.
   c. Kind FT (fully tempered) where indicated.
   d. Tint Color: **Dark gray with warm bronze undertone**.
   e. Basis of Design Product:
      1) PPG Industries, Inc., **Optigray 23**.
      2) [Specifier: insert manufacturer of comparable product if required]
4. Indoor Lite: Class 1 (clear) float glass, [6 mm] minimum thickness.
   a. Annealed.
   b. Kind HS (heat strengthened) where required.
   c. Kind FT (fully tempered) where indicated.
   d. Solar Control Low-E Coating: Sputtered on third surface.
   e. Basis of Design Product:
      1) PPG Industries, Inc., **Solarban 60**.
      2) [Specifier: insert manufacturer of comparable product if required]
5. Visible Light Transmittance: 18 percent minimum.
6. Winter Nighttime U-Factor: 0.29 maximum.
7. Summer Daytime U-Factor: 0.27 maximum.
8. Solar Heat Gain Coefficient: 0.18 maximum.
9. Outdoor Visible Light Reflectance: 5 percent maximum.
10. Light to Solar Gain (LSG): 1.00 minimum.

Graylite Glass: Graylite glass delivers optimum levels of solar control together with a fashionable, nearly black appearance. Graylite glass has a Solar Heat Gain Coefficient among the lowest available for any uncoated glass. In addition, Graylite glass helps protect interior fabrics and colors from fading by blocking up to 94% of the sun's ultraviolet energy - more than any architectural glass on the market today. Graylite glass is ideal glare control and privacy glazing.

N. Solar Control Low-E Tinted Insulating-Glass Units IG#14:
1. Unit Overall Thickness [25 mm].
2. Interspace Content: [Air].
3. Outdoor Lite: Class 2 (tinted) float glass, [6 mm] minimum thickness.
   a. Annealed.
   b. Kind HS (heat strengthened) where required.
   c. Kind FT (fully tempered) where indicated.
   d. Tint Color: **Dark cool gray**.
   e. Basis of Design Product:
      1) PPG Industries, Inc., **Graylite**.
      2) [Specifier: insert manufacturer of comparable product if required]
4. Indoor Lite: Class 1 (clear) float glass, [6 mm] minimum thickness.
   a. Annealed.
   b. Kind HS (heat strengthened) where required.
   c. Kind FT (fully tempered) where indicated.
   d. Solar Control Low-E Coating: Sputtered on third surface.
   e. Basis of Design Product:
      1) PPG Industries, Inc., **Solarban 60**.
      2) [Specifier: insert manufacturer of comparable product if required]
5. Visible Light Transmittance: 11 percent minimum.
6. Winter Nighttime U-Factor: 0.29 maximum.
7. Summer Daytime U-Factor: 0.27 maximum.
8. Solar Heat Gain Coefficient: 0.17 maximum.

9. Outdoor Visible Light Reflectance: 5 percent maximum.
10. Light to Solar Gain (LSG): 0.65 minimum.

Solarcool Azuria Glass: (formerly Solarcool Azurlite): Solarcool Azuria Glass's stunning aquamarine tint can be captured with the reflective coating on the inboard surface (#2) or take on a more shimmering quality with the addition of the reflective coating on the outboard (#1) surface. In either case, this exceptionally attractive glass evokes the soothing qualities of the azure blue sea.

O. Reflective Solar Control Low-E Tinted Insulating-Glass Units IG#15:
1. Unit Overall Thickness **[**25 mm**]**.
2. Interspace Content: **[**Air**]**.
3. Outdoor Lite: Class 2 (tinted) float glass, **[**6 mm**]** minimum thickness.
   a. Annealed.
   b. Kind HS (heat strengthened) where required.
   c. Kind FT (fully tempered) where indicated.
   d. Reflective Coating: Pyrolytic coating on second surface.
   e. Tint Color: **Aquamarine metallic**.
   f. Basis of Design Product:
      1) PPG Industries, Inc., **Solarcool Azuria**.
      2) **[**Specifier: insert manufacturer of comparable product if required**]**
4. Indoor Lite: Class 1 (clear) float glass, **[**6 mm**]** minimum thickness.
   a. Annealed.
   b. Kind HS (heat strengthened) where required.
   c. Kind FT (fully tempered) where indicated.
   d. Solar Control Low-E Coating: Sputtered on third surface.
   e. Basis of Design Product:
      1) PPG Industries, Inc., **Solarban 60**.
      2) **[**Specifier: insert manufacturer of comparable product if required**]**
5. Visible Light Transmittance: 21 percent minimum.
6. Winter Nighttime U-Factor: 0.29 maximum.
7. Summer Daytime U-Factor: 0.27 maximum.
8. Solar Heat Gain Coefficient: 0.16 maximum.
9. Outdoor Visible Light Reflectance: 19 percent maximum.

Solarcool Solexia Glass: (formerly Solarcool Solex): The light green color of Solexia Glass, part of the Oceans of Color collection, is an exceptional complement to the soft reflectivity of the Solarcool coating. When glazed with the reflective coating facing inboard (#2), Solarcool (2) Solexia Glass has a natural green reflectivity that enhances the beauty of its surroundings while harmonizing with other natural building materials. To achieve a higher visible light reflectivity, Solarcool (1) Solexia can be glazed with the reflective coating on the outboard surface (#1) to capture the mood of changing skies and the neighboring environment.

P. Reflective Solar Control Low-E Tinted Insulating-Glass Units IG#16:
1. Unit Overall Thickness **[**25 mm**]**.
2. Interspace Content: **[**Air**]**.
3. Outdoor Lite: Class 2 (tinted) float glass, **[**6 mm**]** minimum thickness.
   a. Annealed.
   b. Kind HS (heat strengthened) where required.
   c. Kind FT (fully tempered) where indicated.
   d. Reflective Coating: Pyrolytic coating on second surface.
   e. Tint Color: **Natural green metallic**.
   f. Basis of Design Product:
      1) PPG Industries, Inc., **Solarcool Solexia**.

2) [Specifier: insert manufacturer of comparable product if required]

4. Indoor Lite: Class 1 (clear) float glass, [6 mm] minimum thickness.
   a. Annealed.
   b. Kind HS (heat strengthened) where required.
   c. Kind FT (fully tempered) where indicated.
   d. Solar Control Low-E Coating: Sputtered on third surface.
   e. Basis of Design Product:
      1) PPG Industries, Inc., **Solarban 60**.
      2) [Specifier: insert manufacturer of comparable product if required]
5. Visible Light Transmittance: 24 percent minimum.
6. Winter Nighttime U-Factor: 0.29 maximum.
7. Summer Daytime U-Factor: 0.27 maximum.
8. Solar Heat Gain Coefficient: 0.19 maximum.
9. Outdoor Visible Light Reflectance: 24 percent maximum.

Solarcool Caribia Glass: The newest member of PPG's industry-leading collection of spectrally selective architectural glasses, Solarcool Caribia Glass creates a softly reflective, warm, green appearance when glazed with the reflective coating facing inboard (#2). When glazed with the reflective coating on the outboard surface (#1), higher visible light reflectivity mutes the aqua green hue to create a more metallic appearance that highlights shifting light conditions and the surrounding landscapes.

Q. Reflective Solar Control Low-E Tinted Insulating-Glass Units IG#17:
1. Unit Overall Thickness [25 mm].
2. Interspace Content: [Air].
3. Outdoor Lite: Class 2 (tinted) float glass, [6 mm] minimum thickness.
   a. Annealed.
   b. Kind HS (heat strengthened) where required.
   c. Kind FT (fully tempered) where indicated.
   d. Reflective Coating: Pyrolytic coating on second surface.
   e. Tint Color: **Warm green metallic**.
   f. Basis of Design Product:
      1) PPG Industries, Inc., **Solarcool Caribia**.
      2) [Specifier: insert manufacturer of comparable product if required]
4. Indoor Lite: Class 1 (clear) float glass, [6 mm] minimum thickness.
   a. Annealed.
   b. Kind HS (heat strengthened) where required.
   c. Kind FT (fully tempered) where indicated.
   d. Solar Control Low-E Coating: Sputtered on third surface.
   e. Basis of Design Product:
      1) PPG Industries, Inc., **Solarban 60**.
      2) [Specifier: insert manufacturer of comparable product if required]
5. Visible Light Transmittance: 21 percent minimum.
6. Winter Nighttime U-Factor: 0.29 maximum.
7. Summer Daytime U-Factor: 0.27 maximum.
8. Solar Heat Gain Coefficient: 0.16 maximum.
9. Outdoor Visible Light Reflectance: 19 percent maximum.

Solarcool Bronze Glass: Solarcool Bronze glass can be glazed with the reflective coating positioned on either the first (#1) or second (#2) surface. The glass has improved performance, higher exterior visible reflectivity and a slight bronze hue when installed with the coating on the first surface. When installed with the coating on the second surface, Solarcool glass has lower exterior visible reflectivity while maintaining the substrate glass color.

R. Reflective Solar Control Low-E Tinted Insulating-Glass Units IG#18:
   1. Unit Overall Thickness **[**25 mm**]**.
   2. Interspace Content: **[**Air**]**.
   3. Outdoor Lite: Class 2 (tinted) float glass, **[**6 mm**]** minimum thickness.
      a. Annealed.
      b. Kind HS (heat strengthened) where required.
      c. Kind FT (fully tempered) where indicated.
      d. Reflective Coating: Pyrolytic coating on second surface.
      e. Tint Color: **Bronze metallic**.
      f. Basis of Design Product:
         1) PPG Industries, Inc., **Solarcool Bronze**.
         2) **[**Specifier: insert manufacturer of comparable product if required**]**
   4. Indoor Lite: Class 1 (clear) float glass, **[**6 mm**]** minimum thickness.
      a. Annealed.
      b. Kind HS (heat strengthened) where required.
      c. Kind FT (fully tempered) where indicated.
      d. Solar Control Low-E Coating: Sputtered on third surface.
      e. Basis of Design Product:
         1) PPG Industries, Inc., **Solarban 60**.
         2) **[**Specifier: insert manufacturer of comparable product if required**]**
   5. Visible Light Transmittance: 17 percent minimum.
   6. Winter Nighttime U-Factor: 0.29 maximum.
   7. Summer Daytime U-Factor: 0.27 maximum.
   8. Solar Heat Gain Coefficient: 0.18 maximum.
   9. Outdoor Visible Light Reflectance: 14 percent maximum.

Solarcool Gray Glass: Two options abound with Solarcool Gray glass. A strikingly beautiful silvery aesthetic results when the reflective coating is applied to the outboard (#1) surface. A subtly powerful dark gray tint appears when the reflective coating is applied to the inboard (#2) surface.

S. Reflective Solar Control Low-E Tinted Insulating-Glass Units IG#19:
   1. Unit Overall Thickness **[**25 mm**]**.
   2. Interspace Content: **[**Air**]**.
   3. Outdoor Lite: Class 2 (tinted) float glass, **[**6 mm**]** minimum thickness.
      a. Annealed.
      b. Kind HS (heat strengthened) where required.
      c. Kind FT (fully tempered) where indicated.
      d. Reflective Coating: Pyrolytic coating on second surface.
      e. Tint Color: **Gray metallic**.
      f. Basis of Design Product:
         1) PPG Industries, Inc., **Solarcool Gray**.
         2) **[**Specifier: insert manufacturer of comparable product if required**]**
   4. Indoor Lite: Class 1 (clear) float glass, **[**6 mm**]** minimum thickness.
      a. Annealed.
      b. Kind HS (heat strengthened) where required.
      c. Kind FT (fully tempered) where indicated.
      d. Solar Control Low-E Coating: Sputtered on third surface.

e. Basis of Design Product:
1) PPG Industries, Inc., **Solarban 60**.
2) [Specifier: insert manufacturer of comparable product if required]

5. Visible Light Transmittance: 14 percent minimum.
6. Winter Nighttime U-Factor: 0.29 maximum.
7. Summer Daytime U-Factor: 0.27 maximum.
8. Solar Heat Gain Coefficient: 0.16 maximum.
9. Outdoor Visible Light Reflectance: 11 percent maximum.

Solarcool Graylite Glass: Many structures are designed to be clad in the stark elegance of a dark, almost black exterior glazing. Solarcool Graylite can be used to achieve this effect when the reflective coating is applied to the inboard (#2) surface of the glass. When the reflective coating is glazed to the outboard (#1) surface, Solarcool Graylite yields a rich, silvery aesthetic.

T. Reflective Solar Control Low-E Tinted Insulating-Glass Units IG#20:
1. Unit Overall Thickness [25 mm].
2. Interspace Content: [Air].
3. Outdoor Lite: Class 2 (tinted) float glass, [6 mm] minimum thickness.
a. Annealed.
b. Kind HS (heat strengthened) where required.
c. Kind FT (fully tempered) where indicated.
d. Reflective Coating: Pyrolytic coating on second surface.
e. Tint Color: **Dark cool gray metallic**.
f. Basis of Design Product:
1) PPG Industries, Inc., **Solarcool Graylite**.
2) [Specifier: insert manufacturer of comparable product if required]

4. Indoor Lite: Class 1 (clear) float glass, [6 mm] minimum thickness.
a. Annealed.
b. Kind HS (heat strengthened) where required.
c. Kind FT (fully tempered) where indicated.
d. Solar Control Low-E Coating: Sputtered on third surface.
e. Basis of Design Product:
1) PPG Industries, Inc., **Solarban 60**.
2) [Specifier: insert manufacturer of comparable product if required]

5. Visible Light Transmittance: 4 percent minimum.
6. Winter Nighttime U-Factor: 0.29 maximum.
7. Summer Daytime U-Factor: 0.27 maximum.
8. Solar Heat Gain Coefficient: 0.12 maximum.
9. Outdoor Visible Light Reflectance: 5 percent maximum.

Solarban 80: Solarban 80 glass combines good visible light transmittance and aesthetic appeal with unequaled solar control. A sample viewed indoors provides the same steel jade appearance exhibited by Solarban 80 glass when shaded from the sun. In direct sunlight, the glass transforms into a satin reflective finish, with true color-reflected images of the blue sky and green trees and landscaping. Solarban 80 glass appears non-reflective in the shade while providing some privacy when fully bathed in the sun. A one-inch insulating unit of Solarban 80 clear glass provides: optimum balance among visible light transmittance, glare control, and superior solar control; a satin finish that clearly reflects undistorted images; and solar control properties that meet the most stringent mechanical requirements.

U. High-Performance Solar Control Low-E Clear Insulating-Glass Units IG#21:
1. Unit Overall Thickness [25 mm].
2. Interspace Content: [Air].
3. Outdoor Lite: Class 1 (clear) float glass, [6 mm] minimum thickness.

a. Annealed.
b. Kind HS (heat strengthened) where required.
c. Kind FT (fully tempered) where indicated.
d. Solar Control Low-E Coating: Sputtered on second surface.
e. Basis of Design Product:
1) PPG Industries, Inc., **Solarban 80**.
2) [Specifier: insert manufacturer of comparable product if required]

4. Indoor Lite: Class 1 (clear) float glass, [6 mm] minimum thickness.
a. Annealed.
b. Kind HS (heat strengthened) where required.
c. Kind FT (fully tempered) where indicated.
5. Visible Light Transmittance: 47 percent minimum.
6. Winter Nighttime U-Factor: 0.29 maximum.
7. Summer Daytime U-Factor: 0.27 maximum.
8. Solar Heat Gain Coefficient: 0.24 maximum.
9. Outdoor Visible Light Reflectance: 33 percent maximum.
10. Light to Solar Gain (LSG): 1.96 minimum.

Specifier: Unit below contains one of many possible configurations of glass products for use in sloped glazing applications. Confirm requirements of authorities having jurisdiction. Select products in consultation with mechanical engineer. Use of reflective coating, tinted glass, or ultra-clear glass may be recommended for certain applications. Indoor lite of laminated glass may include tinted plastic interlayer. Consult with PPG representative to determine performance requirements resulting from combined units.

V. Solar Control Low-E Insulating-Glass Units for Skylights and Sloped Glazing IG#22:
1. Overall Unit Thickness: [25 mm].
2. Interspace Content: [Air].
3. Outdoor Lite: Class [1 (clear)] [2 (tinted)] float glass, [6 mm] minimum thickness.
a. Kind HS (heat strengthened).
b. Solar Control Low-E Coating: Sputtered on second surface.
c. Basis of Design Product:
1) PPG Industries, Inc., [**Solarban 60**][**Solarban 80**].
2) [Specifier: insert manufacturer of comparable product if required]

4. Indoor Lite: Laminated glass unit: [Kind LA: Two lites of annealed float glass] [LHS: Two lites of heat-strengthened float glass] [LR: Two lites of heat-treated float glass, one of which is reflective] [LT: Two lites of fully tempered float glass] [LD: Two lites of float glass, one of which is ceramic-coated vision glass].
a. Laminated Lite Outer Ply: Class 1 (clear) float glass.
1) Thickness: [3.0 mm] [5.0 mm] [6.0 mm].
b. Laminated Lite Plastic Interlayer:
1) Thickness: 0.030 inch.
2) Interlayer Color: [Clear].
c. Laminated Lite Inner Ply: Class 1 (clear) float glass.
1) Thickness: [3.0 mm] [5.0 mm] [6.0 mm].
d. Silk-Screened Coating: Ceramic enamel on second surface of laminated lite.
1) Color and Pattern: Match [Specifier insert pattern and color selected].
5. Insulating Glass Unit Performance Requirements:
a. Visible Light Transmittance: [Specifier insert] percent minimum.
b. Winter Nighttime U-Factor: [Specifier insert] maximum.
c. Summer Daytime U-Factor: [Specifier insert] maximum.
d. Solar Heat Gain Coefficient: [Specifier insert] maximum.
e. Outdoor Visible Reflectance: [Specifier insert] percent maximum.

Sungate 100: Sungate 100 glass delivers a bright, virtually transparent aesthetic, with a Light to Solar Gain (LSG) ratio of 1.40, when combined with clear glass in a one-inch insulating glass unit. Sungate 100 glass can also be combined with any one of the four Oceans of Color spectrally selective tints, producing LSG ratings of up to 1.70 Sungate 100 glass provides a 31% U-Value improvement compared with a standard clear glass insulating unit, while transmitting 73% of the sun's visible light. This dramatically enhances energy efficiency while reducing reliance on artificial lighting systems.

W. Passive Solar Low-E Clear Insulating-Glass Units IG#23:
1. Unit Overall Thickness **[**25 mm**]**.
2. Interspace Content: **[**Air**]**.
3. Outdoor Lite: Class 1 (clear) float glass, **[**6 mm**]** minimum thickness.
   a. Annealed.
   b. Kind HS (heat strengthened) where required.
   c. Kind FT (fully tempered) where indicated.
   d. Solar Control Low-E Coating: Sputtered on second surface.
   e. Basis of Design Product:
      1) PPG Industries, Inc., **Sungate 100**.
      2) **[**Specifier: insert manufacturer of comparable product if required**]**
4. Indoor Lite: Class 1 (clear) float glass, **[**6 mm**]** minimum thickness.
   a. Annealed.
   b. Kind HS (heat strengthened) where required.
   c. Kind FT (fully tempered) where indicated.
5. Visible Light Transmittance: 73 percent minimum.
6. Winter Nighttime U-Factor: 0.31 maximum.
7. Summer Daytime U-Factor: 0.30 maximum.
8. Solar Heat Gain Coefficient: 0.52 maximum.
9. Outdoor Visible Light Reflectance: 12 percent maximum.
10. Light to Solar Gain (LSG): 1.40 minimum.

Sungate 500: Sungate 500 coated glass yields the color neutrality of clear uncoated glass, together with dramatically improved performance. When compared with regular clear glass in a one-inch insulating glass unit, Sungate 500 glass produces impressive U-Value improvements of 27% and 36% (winter and summer respectively) while transmitting as much as 94% of visible light. The key advantage of Sungate 500 glass is its versatility. In situations that would benefit from passive solar energy, the ability of Sungate 500 glass to transmit the warming rays of the sun (as measured by its higher solar heat gain coefficient) can lower heating requirements.

When more stringent solar control measures are required, Sungate 500 Low-E Glass can be teamed with a spectrally selective tint from the Oceans of Color collection in a one-inch insulating glass unit. This produces the benefit of high visible light transmittance together with improved solar control and a wide range of aesthetic options.

X. Passive Solar Low-E Clear Insulating-Glass Units IG#24:
1. Unit Overall Thickness **[**25 mm**]**.
2. Interspace Content: **[**Air**]**.
3. Outdoor Lite: Class 1 (clear) float glass, **[**6 mm**]** minimum thickness.
   a. Annealed.
   b. Kind HS (heat strengthened) where required.
   c. Kind FT (fully tempered) where indicated.
   d. Solar Control Low-E Coating: Sputtered on second surface.
   e. Basis of Design Product:
      1) PPG Industries, Inc., **Sungate 500**.
      2) **[**Specifier: insert manufacturer of comparable product if required**]**

4. Indoor Lite: Class 1 (clear) float glass, [6 mm] minimum thickness.
   a. Annealed.
   b. Kind HS (heat strengthened) where required.
   c. Kind FT (fully tempered) where indicated.
5. Visible Light Transmittance: 74 percent minimum.
6. Winter Nighttime U-Factor: 0.35 maximum.
7. Summer Daytime U-Factor: 0.35 maximum.
8. Solar Heat Gain Coefficient: 0.62 maximum.
9. Outdoor Visible Light Reflectance: 17 percent maximum.
10. Light to Solar Gain (LSG): 1.19 minimum.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that glazing channels are clean and ready to accept glazing installation, and that weeps are unobstructed. Confirm that minimum required face and edge clearances will be maintained. Do not proceed with glazing until unsatisfactory conditions have been corrected.

B. Examine glazing units prior to setting. Reject units that display edge or face damage that may impede performance of unit or that will be visible when installed.

3.2 PREPARATION

A. Clean glazing channels with recommended solvent and wipe dry. Apply primers to joint surfaces to ensure adhesion of sealants, unless preconstruction sealant-substrate testing indicates no primer is required.

3.3 GLAZING INSTALLATION

A. General: Install glass and glazing materials in accordance with instructions of manufacturers and requirements of GANA Glazing Manual.
   1. Install setting blocks of size and in location required by glass manufacturer. Set blocks in bed of approved sealant.
   2. Provide spacers for glass lites as recommended, based upon size of glass unit.
   3. Comply with glass manufacturer's limits on edge pressures.
   4. Ensure that glazing units are set with proper and consistent orientation of glass units toward interior and exterior.
   5. Provide edge blocking where recommended.
   6. Install sealants in accordance with requirements of Division 07 Section "Joint Sealants."

Specifier: Select glazing method or methods below that are applicable to project.

B. Tape Glazing: Place tapes on fixed stops positioned to be flush or protrude slightly when compressed by glass. Install tapes continuously. Form butt joints at corners and where required, and seal tape joints with approved sealant.
   1. Apply heel bead of glazing sealant along intersection of permanent stop and frame for continuity of air and vapor seal.
   2. Set glass lites centered in openings on setting blocks.
   3. Install removable stops, and insert dense compression gaskets at corners, working toward centers of lites, compressing glass against tape on fixed stops.
   4. Apply cap bead of elastomeric sealant over exposed edge of tape or gasket on exterior of glass unit.

C. Sealant Glazing: Install continuous spacers between glass lites and glazing stops. Install cylindrical sealant backing where recommended, in width and depth recommended to provide proper depth and width of sealant bead. Ensure sealant cannot block weep system.
   1. Install sealant under pressure to completely fill glazing channel without voids, with full bond to glass and channel surfaces.
   2. Tool sealant bead to proper profile providing wash away from glass.

D. Sealant Glazing for Butt Glazing:
   1. Brace glass in position for duration of glazing process
   2. Mask edges of glass at adjoining glass edges and between glass edges and framing members.
   3. Secure small diameter non-adhering foamed rod on back side of joint.
   4. Apply sealant to open side of joint in continuous operation; completely fill joint without displacing foam rod; tool sealant surface smooth to concave profile.
   5. Allow sealant to cure, then remove foam backer rod.
   6. Apply sealant to opposite side; tool sealant smooth to concave profile.
   7. Remove masking tape.

E. Gasket Glazing: Fabricate gaskets to fit openings exactly. Allow for stretching of gaskets during installation.
   1. Set soft compression gasket against fixed stop or frame, secure, with bonded miter cut joints at corners.
   2. Set glass lites centered in openings on setting blocks.
   3. Install removable stops, and insert dense compression gaskets at corners, working toward centers of lites, compressing glass against soft compression gaskets and to produce a weathertight seal. Seal joints in gaskets. Allow gaskets to protrude past face of glazing stops.

3.4 CLEANING AND PROTECTION

A. Protect installed glass from damage. Attach streamers or warning tape to framing members, away from contact with glass. Remove nonpermanent labels.

B. Protect glass from contact with contaminating substances during construction. Immediately clean glass exposed to contamination using methods recommended by glass manufacturer.

C. Within 5 working days prior to inspection for Substantial Completion, clean all exposed glass surfaces using methods recommended by manufacturer. Remove glazing compounds from framing surfaces.

D. Remove and replace broken or damaged glass.

[END OF SECTION 08 80 00**]**

[END OF SECTION 08800**]**

Evaluating Submittals and Substitution Requests: When reviewing submittals or substitution requests for other products for compliance with this specification, PPG recommends particular attention to the following issues:

- Confirm that all required submittal items have been provided before reviewing submittal.
- Review proposed warranty terms and conditions.

- Confirm manufacturer/fabricator has certified that proposed materials in each installation method are compatible.
- Verify glazing sealant adhesion to specified glazing framing finish.
- Confirm that proposed products meet general performance requirements and specific requirements for each glazing unit type.
- Confirm scheduled availability through qualified manufacturer/fabricator.

Coordination with Drawings and other sections: PPG recommends you coordinate the following:

- Structural loading on glass, including design wind and snow loads.
- Locations of each type of glazing unit; coordinate with unit designations used in this section.
- Locations where safety glazing is required.
- Locations for types of glazing methods, if more than one is used, and details of glazing methods, including profiles of gaskets if used.