

GLASS DESIGN GUIDELINES

In addition to the important considerations of aesthetics and energy related performance characteristics of glass products, it is critical that attention be given to other design considerations, including the following. This should be done by the appropriate design professional as early in the design cycle as possible.

- ⇒ **Safety** - appropriate safety glazing materials, such as tempered or laminated glass, must be specified where required by codes, or when dictated by design judgment based on the intended application.
- ⇒ **Wind and Snow Loads** - the appropriate glass thickness and type (annealed, heat strengthened, tempered) must be specified to resist the design wind and/or snow loads for the application. The current industry accepted procedure for determining the load resistance of glass is **ASTM E1300 "Standard Design Practice for Determining Load Resistance of Glass in Buildings."** You may wish to visit PPG's website and review PPG's Technical Document, **TD-134: "Designing Glass to Resist Wind and Snow Loads,"** in the Technical Bulletins section of the PPG website, www.ppgideascales.com, for a brief tutorial on the use of ASTM E1300. A computerized version of the ASTM E1300 procedure is also available for purchase from the Standards Design Group, Inc. (www.StandardsDesign.com). For PPG Certified Fabricator Program customers, a computerized version of ASTM E1300-02 is available on the PPG website.
- ⇒ **Thermal Stress** - strengthened glass (heat strengthened or tempered) may be required to resist thermally induced stresses in the specified glass. These stresses are caused by a number of design factors, including the glass type, shading patterns, indoor shading devices, etc. and, if not considered, can and do lead to glass breakage. Thermally induced glass breakage is recognized and well understood in the glass industry. Procedures to help design

professionals evaluate the risk and specify strengthened glass when required have long been offered by PPG. You may wish to review PPG's Technical Document **TD-109: "Thermal Stress Update"** for further information. Also, PPG offers a computerized thermal stress analysis program. Both the document and the program are available at www.ppgideascales.com.

- ⇒ **Surface Orientation** - when darker tinted glass (such as Graylite® glass and Optigray® 23 glass) are specified, it is critical that the glass be fabricated and glazed with consistent surface orientation in order to achieve consistency of appearance. You may wish to visit PPG's website and review PPG's Technical Document **TD-122: "Surface Orientation of Low Light Transmittance Glasses,"** in the Technical Bulletins section of the PPG website, www.ppgideascales.com/glasstechnical for further information.
- ⇒ **Aesthetics and Mock-Up** - PPG offers a broad selection of glass products such as clear, ultra clear, and tinted glasses that can be used as stand alone products for their own inherent beauty and performance, or combined to create deeper and richer hues and improved performance. Many additional aesthetic, environmentally friendly, and energy control solutions can be achieved by including a PPG high performance glass coating in the design, such as a visibly reflective coating, a non-reflective low emissivity coating or one of our many non-reflective solar control low-emissivity coatings. The broadest product selection in North America can further be combined with custom fabrication using multiple glass lites, ceramic frits, laminates, etc. which can lead to an almost infinite number of installed glass products. Today's individualistic design concepts can truly be

achieved when utilizing PPG Glass Technology. The ultimate glass solution for your project marries together the preferred aesthetic to enhance the building façade with the many other design considerations of performance, safety, wind / snow loads, thermal stress, etc. Once all of the design considerations have been appropriately addressed, **PPG Strongly recommends the viewing of a full-size mockup**, preferably at the job site, prior to making final design decisions.

- ⇒ **Availability** - available software, such as the LBNL Window program, permits users to simulate practically unlimited combinations of glass, gas cavity gaps, and gas fills in insulating glass units. It is the design professional's responsibility to ensure that products he may wish to specify are available and that they are available in the sizes he may wish to use.

PPG Glass Technical Documents **TD-101 Gas Space Convection Effects on U-Values in Insulating Glass Units**

This document discusses how U-value changes as air/gas space thickness changes in an insulating unit, and the effects of different gas types on IG unit insulating value.

TD-102 Outdoor Condensation on Glass

A discussion of why condensation sometimes occurs on outdoor glass surfaces.

TD-103 Capillary Breather Tubes in Insulating Glass Units

A discussion of the use of breather tubes in insulating glass units.

TD-104 Coatings on PPG Starphire Glass

A discussion of coatings on PPG Starphire Glass, and how to identify which surface of the glass was exposed to the tin bath during glass making.

TD-105 How to Prevent Glass Corrosion

This document discusses the chemical mechanisms causing glass corrosion and the conditions under which it can exist, interleaving systems and the restoration of lightly corroded glass.

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TD-106 Glass Reactivity and its Potential Impact on Coating Processes

Discussion of glass corrosion in glass racks and cases, damaging effects of glass fines, hard water silicates and their effect on glass coating operations.

TD-107 Residue on Glass

A discussion of how residues may deposit on exterior glass surfaces, and methods of removal.

TD-108 Sungate® 500 Coated Glass - Design Considerations

Discussion of potential design issues, including inherent color variation and use in monolithic applications.

TD-109 Thermal Stress Update

Discussion of thermal stress issues with glass, includes a procedure for doing a thermal stress analysis with resulting glass recommendations.

TD-110 Glass Breakage Analysis I

A brief discussion of thermal stress and mechanical stress glass breakage.

TD-111 Glass Breakage Analysis II

A brief discussion of analysis of glass break origins, mirror radius, and glass breaking stress.

TD-112 Handling Do's and Don'ts to Reduce Glass Breakage

A discussion of things to do and not do when storing and fabricating glass.

TD-113 Why Annealed, Heat Strengthened and Tempered Glass All Deflect the Same Amount

A discussion of the stiffness of glass and the deflection characteristics of annealed, heat strengthened, and tempered glass.

TD-114 Recommendations for Fully Tempered Interior Butt-Glazed Fixed Glass Panels

Design recommendations for fully tempered butt-glazed fixed glass panels. Size, height, and deflection guidelines.

TD-115 Strain Pattern in Tempered and Heat Strengthened Glass

A discussion of visual strain patterns in tempered and heat-strengthened glass, including how and why they occur.

TD-116 Observation Room Windows

A discussion of lighting levels and glass selection for observation room windows.

TD-117 Cutting Wheel Selection For Conventional Glass Cutting

Offers information on selecting cutting wheel size and edge angle combinations to help achieve better edge cut quality in conventional glass cutting operations.

TD-118 Interference Fringes In Insulating Glass Units

A discussion and explanation of the phenomenon of interference fringes in insulating glass units.

TD-119 Guidelines for Glass Edge Cut Quality

A review of glass cut edge quality characteristics, and their effect on glass strength.

TD-120 Flat Glass Trade Thicknesses and Weights

Table of thicknesses and thickness ranges and corresponding weights for flat glass.

TD-121 Center of Glass U-Values for Double and Triple Glazed Insulating Glass Units with Solarban® 60 Low-E Glass with 100% Air, Argon, or Krypton, or Mixtures of These Gases

A discussion of how U-values vary in double glazed and triple glazed insulating glass units using Solarban 60 Solar Control Low-E glass.

TD-122 Surface Orientation of Low Light Transmittance Glasses

Discusses the importance of consistent surface orientation when fabricating and glazing low light transmittance glasses, such as Graylite 14 and Optigray 23.

TD-123 Turtle Glass

Discusses the marine turtle protection ordinance and glass products that meet the requirements of the ordinance.

TD-124 Fabrication of Heat Treated Glass

PPG's recommendations concerning further fabrication of heat strengthened and tempered glass.

TD-125 Sandblasting of Tempered Glass

Discussion of the effect of sandblasting on tempered glass. Includes PPG

recommendation that sandblasting be done before tempering.

TD-126 Ergonomics

Discussion of the benefits of using Argon in insulating glass units. Describes the importance of good unit design and workmanship in retaining the argon in the unit.

TD-127 V-Grooving

Discusses strength of V-grooved glass, compares glass that is tempered then grooved vs. glass that is grooved then tempered.

TD-128 Center of Glass U-Values for Double and Triple Glazed Insulating Glass Units with Sungate® 100 Low-E Glass with 100% Air, Argon, or Krypton, or Mixtures of These Gases

Discusses how U-values vary in double glazed and triple glazed insulating glass units, using Sungate 100 Low-E glass.

TD-129: Temporary Protective Overcoat

Discusses the proper handling, washing and disposal of the TPO overcoat. Presents Health & Safety Issues and Environmental Practices. Offers graphs pertaining to % by weight of TPO dissolved in rinse tank and detergent tank.

TD-130 Insulating Glass U-Values In Sloped Glazing Applications

Outlines how U-values change as the slope of the glazing system changes.

TD-131 Design Conditions with Low-E Coated Glass

Discusses the need to evaluate the effect of building materials on each other.

TD-132 The Difference Between Structural Silicone Glazing and Butt Joint Glazing

Discusses the difference between Structural Silicone Glazing and Butt Joint Glazing.

TD-133 Condensation on Indoor Glass Surface

Discusses the factors that influence the formation of condensation on the indoor glass surface. References test methods to determine the AAMA CRF and NFRC CR. Includes graphs to assist in preliminary product selection.

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TD-134 Designing Glass to Resist Wind and Snow Loads

Describes ASTM E1300-02 procedures for determining the load resistance of glass under uniform lateral wind and snow loads. Presents a detailed example. Also, references available software based on ASTM E1300-02.

TD-135 Glass Acoustical Performance

Discusses the acoustical properties of glass, methods of rating, applicable standards and the relationship between glass and other glazing components in determining an overall rating.

TD-136 Recycled Glass Use

An explanation of PPG's use of recycled glass.

TD-137 Glass, Solar Radiation and Their Effects on Vinyl Cladding Materials

Brief background of subject with a link to the published article.

TD-138 Heat Treated Glass for Architectural Glazing

Discussion of the appropriate use of heat strengthened and tempered glass, including the occurrence of spontaneous breakage. Discusses the use of heat soaking of tempered glass. Offers PPG's recommendations.

TD-139 Field Application of Materials to Glass

Reaffirmation of PPG policy regarding the field application of materials to glass.

TD-140 Large Insulating Glass Units

Discusses issues and design considerations related to the fabrication, installation and performance of large insulating glass units.

TD-141 Edge Deletion of PPG Coated Glass

A discussion of PPG's recommendations concerning the edge deletion of PPG's MSVD Low-E coated glass. The document discusses PPG's non-deletion policy requirements. Also a discussion of environment Health and Safety is included.

TD-142 Glass Cleaning Recommendations

Recommended cleaning practices for PPG glass products, including Solarcool coated glass.

TD-144 Recommended Techniques for Washing Glass

Discusses procedures and recommendations for cleaning glass using machine washing techniques. Also, describes different types of glass contamination and remedies.

TD-145 Spandrel Glass - Types and Recommendations

Discusses alternatives for glass spandrels, including monolithic, insulating glass unit, and shadow box types. Includes descriptions of the three basic types, sketches, and a discussion of potential issues with the shadow box concept.

TD-146 Approved Sealants for use with PPG Coated glass products in non-deleted applications

A list of approved Sealants that can be used with non-deleted MSVD coated glass. This only applies to IG assemblies for non-Commercial use.

TD-147 Compatible Gloves for use with PPG's MSVD Sungate and Solarban Coated Glass Products

A list of compatible gloves for use while handling MSVD coated glass products.

TD-148 Reducing Fading Caused By Solar Radiation Exposure

Describes different measures of fading potential and explains why the traditional focus on UV transmittance may not be the best indicator of protection against interior solar damage.

TD-149 Acceptable Cutting Fluids and Detergents for use with PPG's MSVD Sungate and Solarban Coated Glass Products

A list of acceptable cutting fluids and detergents for use while fabricating MSVD coated glass products.