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.ppgglazing.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.ppgglazing.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.ppgideascapes.com/glasstechnical** for further information.
- **Availability -** available software, such as the LBL Window program, permit 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.

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.

GLASS DESIGN GUIDELINES

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 Argonomics
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.

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 occurence of spontaneous breakage. Discusses the use of heat soaking of tempered glass. Offers PPG's recommendations.

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