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Standard Guide for Structural Sealant Glazing¹

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1. Scope

1.1 Structural sealant glazing, hereinafter referred to as SSG, is an application where a sealant not only can function as a barrier against the passage of air and water through a building envelope, but also primarily provides structural support and attachment of glazing or other components to a window, curtain wall, or other framing system.

1.2 This guide provides information useful to design professionals, manufacturers, contractors, and others for the design and installation of a SSG system. This information is applicable only to this glazing method when used for a building wall that is not more than 15° from vertical; however, limited information is included concerning a sloped SSG application.

1.3 Only a silicone chemically curing sealant specifically formulated, tested, and marketed for structural sealant glazing is acceptable for a SSG system application.

1.4 The committee with jurisdiction for this standard is not aware of any comparable standard published by other organizations.

1.5 The values stated in SI units are to be regarded as standard. The values given in parentheses after SI units are provided for information only and are not considered standard. SI units in this guide are in conformance with IEEE/ASTM SI 10.

1.6 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.7 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

¹ This guide is under the jurisdiction of ASTM Committee C24 on Building Seals and Sealants and is the direct responsibility of Subcommittee C24.10 on Specifications, Guides and Practices.

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2. Referenced Documents

2.1 ASTM Standards:²

- B117 Practice for Operating Salt Spray (Fog) Apparatus
- C99 Test Method for Modulus of Rupture of Dimension Stone
- C119 Terminology Relating to Dimension Stone
- C162 Terminology of Glass and Glass Products
- C503 Specification for Marble Dimension Stone
- C509 Specification for Elastomeric Cellular Preformed Gasket and Sealing Material
- C510 Test Method for Staining and Color Change of Single- or Multicomponent Joint Sealants
- C568 Specification for Limestone Dimension Stone
- C615 Specification for Granite Dimension Stone
- C717 Terminology of Building Seals and Sealants
- C719 Test Method for Adhesion and Cohesion of Elastomeric Joint Sealants Under Cyclic Movement (Hockman Cycle)
- C794 Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants
- C864 Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers
- C880 Test Method for Flexural Strength of Dimension Stone
- C920 Specification for Elastomeric Joint Sealants
- C1036 Specification for Flat Glass
- C1048 Specification for Heat-Strengthened and Fully Tempered Flat Glass
- C1087 Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems
- C1115 Specification for Dense Elastomeric Silicone Rubber Gaskets and Accessories
- C1135 Test Method for Determining Tensile Adhesion Properties of Structural Sealants
- C1172 Specification for Laminated Architectural Flat Glass
- C1184 Specification for Structural Silicone Sealants
- C1193 Guide for Use of Joint Sealants

² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

- C1201** Test Method for Structural Performance of Exterior Dimension Stone Cladding Systems by Uniform Static Air Pressure Difference
- C1248** Test Method for Staining of Porous Substrate by Joint Sealants
- C1249** Guide for Secondary Seal for Sealed Insulating Glass Units for Structural Sealant Glazing Applications
- C1253** Test Method for Determining the Outgassing Potential of Sealant Backing
- C1265** Test Method for Determining the Tensile Properties of an Insulating Glass Edge Seal for Structural Glazing Applications
- C1294** Test Method for Compatibility of Insulating Glass Edge Sealants with Liquid-Applied Glazing Materials
- C1330** Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants
- C1369** Specification for Secondary Edge Sealants for Structurally Glazed Insulating Glass Units
- C1392** Guide for Evaluating Failure of Structural Sealant Glazing
- C1394** Guide for In-Situ Structural Silicone Glazing Evaluation
- C1472** Guide for Calculating Movement and Other Effects When Establishing Sealant Joint Width
- C1487** Guide for Remediating Structural Silicone Glazing
- C1521** Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints
- C1564** Guide for Use of Silicone Sealants for Protective Glazing Systems
- D1566** Terminology Relating to Rubber
- D2203** Test Method for Staining from Sealants
- D4541** Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers
- E283** Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
- E330** Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference
- E331** Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference
- E547** Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Cyclic Static Air Pressure Difference
- E631** Terminology of Building Constructions
- E783** Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors
- E1105** Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference
- E1233** Test Method for Structural Performance of Exterior Windows, Doors, Skylights, and Curtain Walls by Cyclic Air Pressure Differential
- E1300** Practice for Determining Load Resistance of Glass in Buildings
- E1424** Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure and Temperature Differences Across the Specimen
- E1425** Practice for Determining the Acoustical Performance of Windows, Doors, Skylight, and Glazed Wall Systems
- E1825** Guide for Evaluation of Building Exterior Enclosure Materials, Products, and Systems
- E1886** Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials
- E1996** Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricanes
- E2128** Guide for Evaluating Water Leakage of Building Walls
- E2203** Specification for Dense Thermoplastic Elastomers Used for Compression Seals, Gaskets, Setting Blocks, Spacers and Accessories
- E2099** Practice for the Specification and Evaluation of Pre-Construction Laboratory Mockups of Exterior Wall Systems
- E2431** Practice for Determining the Resistance of Single Glazed Annealed Architectural Flat Glass to Thermal Loadings
- G15** Terminology Relating to Corrosion and Corrosion Testing (Withdrawn 2010)³
- 2.2 *IEEE/ASTM Standard*.²
- IEEE/ASTM SI 10** Standard for Use of the International System of Units (SI): The Modern Metric System
- 2.3 *Aluminum Association Manual: Aluminum Design Manual*⁴
- 2.4 *ANSI/ASCE Standard*:
- ANSI/ASCE 7**, Minimum Design Loads for Buildings and Other Structures⁵
- 2.5 *AAMA Standards*:
- 501.1** Standard Test Method for Metal Curtain Walls for Water Penetration Using Dynamic Pressure⁶
- 501.2** Field Check of Metal Curtain Walls for Water Leakage⁶
- TIR-A11-1996** Maximum Allowable Deflection of Framing Systems for Building Cladding Components at Design Wind Loads⁶
- 2.6 *ANSI Standard*:
- Z97.1** Safety Performance Specifications and Methods of Test for Glazing Materials Used in Buildings⁵
- 2.7 *CPSC Standard*:
- 16 CFR 1201** Standard on Architectural Glazing Materials⁷

³ The last approved version of this historical standard is referenced on www.astm.org.

⁴ Available from the Aluminum Association, 900 19th St., N.W. Washington, DC 20006.

⁵ Available from American National Standards Institute, 25 W. 43rd St., 4th Floor, New York, NY 10036.

⁶ Available from the Architectural Aluminum Manufacturers Association (AAMA).

⁷ Available from the Consumer Product Safety Commission (CPSC), Washington, D.C. 20207.

3. Terminology

3.1 Definitions:

3.1.1 Refer to Terminology **C119** for definitions of the following terms used in this guide: dimension stone, granite, hysteresis, limestone, and marble.

3.1.2 Refer to Terminology **C162** for definitions of the following terms used in this guide: chip, chipped glass, double glazing unit, flat glass, glass, heat-strengthened glass, heat-treated, laminated glass, lite, pyrolytic coating, safety glass, skylight, spandrel glass, tempered glass, thermal stress, toughened glass, and wave.

3.1.3 Refer to Terminology **C717** for definitions of the following terms used in this guide: adhesive failure, bicellular sealant backing, bite, bond breaker, butt glazing, cell, chemically curing sealant, closed cell, closed cell material, closed cell sealant backing, cohesive failure, compatibility, compound, cure, durability, durability limit, elastomeric, elongation, gasket, glazing, glazing construction site, hardness, joint, lite, modulus, open cell, open cell material, open cell sealant backing, outgassing, premature deterioration, primer, seal, sealant, sealant backing, secant modulus, service life, setting block, shop glazing, silicone sealant, spacer, standard conditions, structural sealant, substrate, thickness, and tooling.

3.1.4 Refer to Terminology **D1566** for the definition of the following term used in this guide: compression.

3.1.5 Refer to Terminology **E631** for the definitions of the following terms used in this guide: air-leakage, anchorage, anchorage system, building envelope, cladding system, curtain wall, glaze, mechanical connection, mockup, operable, panel, performance standard, sealed insulating glass, shop drawing, specification, static load, tolerance, water-vapor retarder, weephole, and working drawing.

3.1.6 Refer to Terminology **G15** for the definition of the following term used in this guide: chemical conversion coating.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *aspect ratio (AR), n*—the ratio of the long dimension of the glass to the short dimension of the glass. AR is always equal to or greater than 1.0.

3.2.2 *negative pressure, n*—an applied load, usually wind induced, that tends to pull a glass lite or panel away from a building surface.

3.2.3 *opacifier, n*—an opaque material applied to the interior facing surface of a glass spandrel panel, which can include materials, such as adhesively applied organic films, a liquid-applied silicone coating, or a fired-on ceramic enamel frit.

3.2.4 *panel, n*—a cladding material other than glass that is manufactured or fabricated from solid, laminated or composite assemblies of materials such as dimension stone, metal or plastic.

3.2.5 *positive pressure, n*—an applied load, usually wind induced, that tends to push a glass lite or panel inward from a building surface.

3.2.6 *snap time, n*—the time in minutes at which a multi-component sealant tears within itself and does not string when a spatula is removed from the curing sealant.

3.2.7 *stick system, n*—a metal framing system of numerous elements that is construction site assembled and field glazed, usually in-place on the face of a building.

3.2.8 *thermal bridge, n*—a method that transfers thermal energy, usually by means of a metallic path from the interior to the exterior of a window or curtain wall system.

3.2.9 *unitized system, n*—a panelized metal framing system that is preassembled and usually shop-glazed, with the panels transported to a construction site for erection on a building.

3.3 Symbols:

A	= solar absorptivity coefficient.
α	= coefficient of linear thermal movement mm/mm/°C (in./in./°F).
B	= structural sealant joint bite mm (in.).
C	= perpendicular distance between parallel sides m (ft).
ΔL	= thermal movement mm (in.).
ΔT_s	= summer temperature differential °C (°F).
ΔT_w	= winter temperature differential °C (°F).
F_d	= allowable structural sealant dead load stress kPa (psi).
F_t	= allowable structural sealant tension stress kPa (psi).
F_v	= allowable structural sealant shear stress kPa (psi).
f_t	= computed tensile stress kPa (psi).
f_v	= computed shear stress kPa (psi).
H	= heat capacity constant.
L	= side of lite or panel m (ft).
L_1	= long side of lite or panel m (ft).
L_2	= short side of the lite or panel m (ft).
$\%$	= shear movement percent.
P_w	= lateral load due to wind kPa (psf).
R	= radius of a lite or panel m (ft).
T	= structural sealant joint thickness mm (in.).
T_a	= ambient summer temperature °C (°F).
T_s	= summer surface temperature °C (°F).
T_w	= ambient winter temperature °C (°F).
W	= unit weight of lite or panel kg/m ² (lb/ft ²).
ϕ	= angle in degrees.

4. Summary of Guide

4.1 *General*—This guide has been subdivided into major headings. A very brief description of each major heading is provided to assist the reader in locating general areas of information. For a more detailed listing of guide topics and section headings, refer to **Appendix X1** for a complete listing of the numbered sections and their descriptors.

4.2 *Predesign Considerations (Section 6)*, in general, the responsibilities and relationships of the various participants in SSG system development and implementation.

4.3 *Performance Criteria Considerations (Sections 7 – 14)*, SSG system structural loads, movements, construction tolerances, weather tightness, sound transmission, fire resistance, and durability.

4.4 *System Design Considerations (Sections 15 – 18)*, information is provided about the basic types of SSG and related systems, as well as system weatherproofing concepts.