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Standard Specification for Laminated Architectural Flat Glass¹

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1. Scope

1.1 This specification covers the quality requirements for cut sizes of flat laminated glass consisting of two or more lites of glass bonded with an interlayer material for use in building glazing.

1.2 Depending on the number, thickness and treatment of plies, and the number and thickness of interlayers, the glass shall be laminated for applications including but not limited to safety security, detention, hurricane/cyclic-wind resistance, blast resistant, bullet resistant and sound reduction glazing applications.

1.3 Optical distortion and the evaluation thereof is not currently within the scope of the standard. Mockups are recommended as a method to evaluate glass. (See Appendix X1.)

1.4 The dimensional values, except thickness designations, stated in inch-pound units are to be regarded as the standard. The values given in parenthesis are for information only.

1.5 The following safety hazards caveat pertains only to the test method portion, Section 7, of this specification. *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 and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 Reference to these documents shall be the latest revision unless otherwise specified by the authority applying this specification.

2.2 ASTM Standards:

- C 162 Terminology of Glass and Glass Products²
- C 1036 Specification for Flat Glass²
- C 1048 Specification for Heat-Treated Flat Glass—Kind HS, Kind FT Coated and Uncoated Glass²
- C 1376 Specification for Pyrolytic and Vacuum Deposition

¹ This specification is under the jurisdiction of ASTM Committee C14 on Glass and Glass Products and is the direct responsibility of Subcommittee C14.08 on Flat Glass.

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² Annual Book of ASTM Standards, Vol 15.02.

Coatings on Flat Glass²

C 1422 Specification for Chemically Strengthened Flat Glass²

C 1503 Specification for Silvered Flat Glass Mirror²

E 308 Practice for Computing the Colors of Objects by Using the CIE System³

E 1886 Test Methods for Performance of Exterior Windows, Curtain Walls, Doors and Storm Shutters Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials⁴

E 1996 Specification for Performance of Exterior Windows, Curtain Walls, Doors and Storm Shutters Impacted by Windborne Debris in Hurricanes⁴

F 1233 Test Method for Security Glazing Materials and Systems⁵

F 1642 Test Method for Glazing and Glazing Systems subject to Airblast Loading⁵

F 1915 Test Method for Glazing for Detention Facilities⁵

2.3 ANSI Standard:

Z97.1 Safety Glazing Materials Used in Buildings—Safety Performance Specifications and Methods of Tests⁶

2.4 Federal Document:⁷

CPSC 16CFR1201 Consumer Product Safety Commission Safety Standard for Architectural Glazing Materials

2.5 UL Standards:⁸

UL 752 Standard for Bullet Resisting Materials

UL 972 Standard for Burglary Resisting Glazing Materials

3. Terminology

3.1 *Definitions*—Refer to Terminology C 162, Specifications C 1036 or C 1048, as appropriate.

3.1.1 *blemishes in flat glass*—Refer to Specifications C 1036 or C 1048, as appropriate.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *adhesion chips*—See *fuse*.

³ Annual Book of ASTM Standards, Vol 06.01.

⁴ Annual Book of ASTM Standards, Vol 04.12.

⁵ Annual Book of ASTM Standards, Vol 15.08.

⁶ Available from American National Standards Institute, 11 W. 42nd St., 13th Floor, New York, NY 10036.

⁷ Available from Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

⁸ Available from Underwriters Laboratory, 333 Pfingsten Road, Northbrook, IL 60062.

3.2.2 *blow-in*—a separation of glass and interlayer at or close to the laminate edge caused by penetration of the autoclaving medium into the edge during manufacturing.

3.2.3 *boil (bubble)*—a gas pocket in the interlayer material or between the glass and interlayer.

3.2.4 *covered edge*—the perimetric area of the laminate covered by the channel or sash when installed.

3.2.5 *decorative glass*—glass with an ornamental appearance created by a textured glass surface (patterned glass), design printed interlayer, application of decal(s) to the glass or interlayer, or other embellishments performed on or to the glass or interlayer material to give the glass an ornamental appearance.

3.2.6 *delamination*—a condition in which one or two of the lites of glass loses the bond between the glass lite and the interlayer.

3.2.7 *discoloration*—a visibly noticeable color change (from original) in the appearance of a material.

3.2.8 *distortion*—the inability to see an image clearly; the image is twisted out of natural shape.

3.2.9 *edge boil*—See *boil (bubble)*.

3.2.10 *edge cover*—See *covered edge*.

3.2.11 *exposed edge*—the perimetric area of the laminate exposed to the environment after installation.

3.2.12 *fuse*—a glass particle or crystalline material that is permanently bonded to a surface of a lite.

3.2.13 *glass edge bite*—See *covered edge*.

3.2.14 *hair*—a slender, pigmented filament from human or animal epidermis or other thread-like filament.

3.2.15 *inside dirt*—foreign material trapped inside the laminate.

3.2.16 *interlayer*—a layer or multiple layers of material acting as an adhesive between plies of glass which adds additional performance to the finished product, for example, impact resistance, solar control, acoustical insulation.

3.2.17 *laminate*—See *laminated glass*.

3.2.18 *laminated bullet resistant glass*—multiple lites of flat glass, bonded by interlayer material, that resist penetration from medium- to super-power arms and high-power rifles.

3.2.19 *laminated glass*—an assembly consisting of two or more lites of glass, conforming to Specification C 1036 or C 1048 that are bonded together by interlayer material.

3.2.20 *laminated safety glass*—two or more lites of flat glass, bonded by interlayer material. In the case of breakage, the interlayer serves to retain the glass fragments, limit the size of the opening and reduce the risk of cutting or piercing injuries.

3.2.21 *laminated security glass*—two or more lites of flat glass, bonded by interlayer material, that resist manual penetration, including physical attack from hand-held or hand-thrown objects.

3.2.22 *lint*—short fibers of yarn or fabric trapped within the laminate.

3.2.23 *lite or light*—a panel or sheet of glass or a panel or sheet of laminated glass.

3.2.24 *mismatch*—misalignment of the edges of two lites of glass, when laminated.

3.2.25 *nonsymmetrical*—a term used to describe the construction of a laminate comprised of different glass types or thickness, or both.

3.2.26 *offset*—intentional mismatch (see *mismatch*).

3.2.27 *ply*—one sheet or panel of glass in a laminate.

3.2.28 *scuff*—See *streak*.

3.2.29 *separation*—an area of the laminate that has become delaminated (see *delamination*).

3.2.30 *shiner*—an area on a glass edge that has not been ground or polished.

3.2.31 *short interlayer*—a condition of the laminate in which the interlayer does not extend to the edge.

3.2.32 *slippage*—See *mismatch*.

3.2.33 *streak*—a noticeably visible deviation on or in the laminating unit.

3.2.34 *surfaces*—surfaces of glass faces are counted as Nos. 1, 2, 3, and 4, respectively. The No. 1 surface is the surface that is to the exterior; the Nos. 2 and 3 surfaces are those separated by and bonded to the interlayer material; the No. 4 surface is the surface that is to the interior.

3.2.35 *symmetrical*—a term used to describe the construction of a laminate comprised of only one glass type and thickness.

3.2.36 *template*—a pattern used as a guide to define the overall size and shape of a cut lite.

3.2.37 *two-ply flat glass (laminates)*—See *laminated glass*.

3.2.38 *unlaminated area*—an area of the laminate that failed to laminate during the laminating process. This blemish is discernible due to the textured appearance of the interlayer material.

4. Classification

4.1 *Kinds*—Laminated flat glass furnished under this specification shall be of the following kinds, as specified:

4.1.1 *Kind LA*—Two or more lites of flat annealed transparent glass conforming to the applicable requirements of Specification C 1036 and bonded by an interlayer material.

4.1.2 *Kind LC*—Two or more lites of flat glass, one or more of which are chemically strengthened glass bonded by an interlayer material.

4.1.3 *Kind LD*—Two or more lites of flat glass, bonded by an interlayer material yielding a decorative laminate.

4.1.4 *Kind LHS*—Two or more lites of flat glass, all of which are heat-strengthened glass conforming to the applicable requirements of Specification C 1048 and bonded by an interlayer material.

4.1.5 *Kind LM*—Two or more lites of flat glass, one or more of which are mirror glass conforming to the applicable requirements of Specifications C 1036, C 1048 (if one or more of the lites are tempered or heat-strengthened glass), and C 1503 and bonded by an interlayer material.

4.1.6 *Kind LP*—Two or more lites of flat glass, one or more of which are pattern glass conforming to the applicable requirements of Specifications C 1036 and C 1048 (if one or more of the lites are tempered or heat-strengthened glass) and bonded by an interlayer material.

4.1.7 *Kind LR*—Two or more lites of flat glass, one or more of which are reflective glass, conforming to the applicable requirements of Specifications C 1036 and C 1048 (if one or