Designation: E2461 – 12

Standard Practice for Determining the Thickness of Glass in Airport Traffic Control Tower Cabs[1]

This standard is issued under the fixed designation E2461; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This practice covers the determination of the thickness of glass installed in airport traffic control towers (ATCT) to resist a specified design loading with a selected probability of breakage less than or equal to either 1 lite per 1000 or 4 lites per 1000 at the first occurrence of the design wind loading.

1.2 The procedures apply to common outward sloping cab glass designs for which the specified loads do not exceed 10 kPa (210 psf).

1.3 The procedures assume control tower cab glass has an aspect ratio no greater than 2.

1.4 The procedures assume control tower cab glass has an area no less than 1.86 square metres (20 square feet).

1.5 The procedures apply only to annealed monolithic, annealed laminated, or annealed insulating glass having a rectangular or trapezoidal shape.

1.6 The use of the procedures assumes the following:

1.6.1 Annealed monolithic and annealed laminated glass installed in ATCTs shall have continuous lateral support along two parallel edges, along any three edges, or along all four edges;

1.6.2 Insulating glass shall have continuous lateral support along all four edges; and

1.6.3 Supported glass edges are simply supported and free to slip in plane.

1.7 The procedures do not apply to any form of wired, patterned, etched, sandblasted, or glass types with surface treatments that reduce the glass strength.

1.8 The procedures do not apply to any form of heat treated glass, chemically strengthened glass, or any type of glass with surface treatments intended to increase the glass strength.

1.9 The procedures address the determination of thickness and construction type to resist a specified design wind load at a selected probability of breakage. The final glass thickness and construction determined also depends upon a variety of other factors (see 5.3).

1.10 These procedures do not address blast loading on glass.

1.11 The values stated in SI units are to be regarded as standard. The values given in parentheses are mathematical conversions to inch-pound units that are provided for information only and are not considered standard.

1.12 *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 to determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

C162 Terminology of Glass and Glass Products

C1036 Specification for Flat Glass

E631 Terminology of Building Constructions

E1300 Practice for Determining Load Resistance of Glass in Buildings

2.2 *American Society of Civil Engineers Standard:*[3]

ASCE 7 Minimum Design Loads for Buildings and Other Structures

3. Terminology

3.1 *Definitions:*

3.1.1 For definitions of general terms related to building construction used in this test method refer to Terminology E631, and for general terms related to glass and glass products, refer to Terminology E1300.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *annealed (AN) glass, n*—a flat, monolithic, glass lite of uniform thickness; it is formed by a process whereby the magnitudes of the residual stresses are nearly zero.

[1] This practice is under the jurisdiction of ASTM Committee E06 on Performance of Buildings and is the direct responsibility of Subcommittee E06.52 on Glass Use in Buildings.

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[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.

[3] Available from American Society of Civil Engineers (ASCE), 1801 Alexander Bell Dr., Reston, VA 20191, http://www.asce.org.

3.2.2 *aspect ratio (AR), n*—the ratio of the long dimension to the short dimension for rectangular glass or the ratio of the long dimension to the short dimension of the rectangle that completely encloses trapezoidal glass. In these procedures, AR is always equal to or greater than 1.0.

NOTE 1—The rectangle that completely encloses the trapezoid has two sides parallel to the horizontal edges of the trapezoid and the other two sides perpendicular to the horizontal edges of the trapezoid. All dimensions shall be measured from edge to edge of glass.

3.2.3 *equivalent rectangular area (ERA), n*—the product of the longest horizontal glass dimension and the length of the edge perpendicular to the horizontal dimension in the plane of the glass. All dimensions shall be measured from edge to edge of glass.

3.2.4 *designated thickness for laminated glass (LG), n*—the designated thickness for LG as Table 1 specifies.

3.2.5 *designated thickness for monolithic glass, n*—the designated or nominal thickness commonly used in specifying a particular glass product, based on the minimum thicknesses presented in Table 2 and Specification C1036.

3.2.6 *glass breakage, n*—the fracture of any lite or ply in monolithic, laminated, or insulating glass resulting from stress that an applied uniform lateral load induces.

3.2.7 *insulating glass (IG) unit, n*—consists of any combination of two glass lites, as defined herein, that enclose a sealed space filled with air or other gas.

3.2.8 *laminated glass (LG), n*—a flat-lite of uniform thickness that is fabricated by bonding two or more monolithic glass lites or plies of equal thickness, as defined herein, together with polyvinyl butyral (PVB) interlayer(s).

3.2.9 *lateral, adj*—perpendicular to the glass surface.

3.2.10 *load, n*—a uniformly distributed lateral pressure.

3.2.10.1 *design load, n*—the magnitude of the 3-second duration load used to design glass for ATCT cabs. Equations used herein for computing magnitudes for design loads adjust glass self weight to a magnitude consistent with a 3-second duration.

3.2.10.2 *specified design load, n*—the magnitude in kPa (psf), type (for example, wind or self-weight) and duration of the load. The wind load has a duration of approximately 3 seconds. Glass self-weight (Table 2) has a long duration, typically equal to the in-service life of the window glass lite. Earth facing cab glass is only subjected to wind load and its self-weight.

3.2.10.3 *long duration load, n*—any load lasting approximately 30 days or longer.

3.2.10.4 *short duration load, n*—any load lasting approximately 3 seconds, such as, wind load.

3.2.11 *minimum thickness of monolithic glass, n*—the minimum allowable thickness associated with a nominal or designated glass thickness as given in Table 2 and Specification C1036.

TABLE 2 Thickness Designations, Minimum Glass Thickness, and Unit Self-Weight

Nominal thickness or designation. mm (in.)	Minimum thickness, mm (in.)	Glass weight Pa (psf)
2.7 (lami)	2.59 (0.102)	67.0 (1.40)
3.0 (⅛)	2.92 (0.115)	74.2 (1.55)
4.0 (5⁄32)	3.78 (0.149)	99.1 (2.07)
5.0 (3⁄16)	4.57 (0.180)	124 (2.59)
6.0 (¼)	5.56 (0.219)	149 (3.11)
8.0 (5⁄16)	7.42 (0.292)	199 (4.15)
10.0 (⅜)	9.02 (0.355)	248 (5.18)
12.0 (½)	11.91 (0.469)	298 (6.22)
16.0 (⅝)	15.09 (0.595)	397 (8.29)
19.0 (¾)	18.26 (0.719)	472 (9.85)
22.0 (⅞)	21.44 (0.844)	546 (11.4)
25.0 (1)*	24.4 (0.969)	622 (13.0)
32 (1 – ¼)[A]	27.38 (1.22)	795 (16.6)
38 (1 – ½)[A]	31.6 (1.47)	943 (19.7)

[A] Not a glazing industry standard thickness designation.

TABLE 1 Thickness Designations for Laminated Glass

Laminated glass designation, t, mm (in.)	Laminated glass construction nominal thickness, mm (in.) [glass/PVB/glass]	Laminated glass thickness designation for use in these procedures mm (in.)
6 (¼)	2.7/0.76/2.7 {(lami)/0.030/(lami)} 3/0.76/3 {(⅛)/0.030/(⅛)} 3/1.52/3 {(⅛)/0.060/(⅛)}	6 (¼)
8 (5⁄16)	4/0.76/4 {(5⁄32)/0.030/(5⁄32)}	8 (5⁄16)
10 (⅜) 11 (7⁄16)	5/0.76/5 {(3⁄16)/0.030/(3⁄16)} 5/1.52/5 {(3⁄16)/0.060/(3⁄16)}	10 (⅜)
12 (½) 13 (9⁄16)	6/0.76/6 {(¼)/0.030/(¼)} 6/1.52/6 {(¼)/0.060/(¼)}	12 (½)
16 (⅝)	8/0.76/8 {(5⁄16)/0.030/(5⁄16)} 8/1.52/8 {(5⁄16)/0.060/(5⁄16)} 8/2.28/8 {(5⁄16)/0.090/(5⁄16)}	16 (⅝)
19 (¾)	10/0.76/10 {(⅜)/0.030/(⅜)} 10/1.52/10 {(⅜)/0.060/(⅜)} 10/2.28/10 {(⅜)/0.090/(⅜)}	19 (¾)
25 (1)	12/1.52/12 {(½)/0.060/(½)} 12/2.28/12 {(½)/0.090/(½)}	25 (1)
32 (1¼)	16/1.52/16 {(⅝)/0.060/(⅝)} 16/2.28/16 {(⅝)/0.090/(⅝)}	32 (1¼)
38 (1½)	19/1.52/19 {(¾)/0.060/(¾)} 19/2.28/19 {(¾)/0.090/(¾)}	38 (1½)