Designation: ~~E2461 – 12 (Reapproved 2017)~~ E2461 – 22

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~~ 15 kPa (313 psf).

1.3 The procedures assume control tower cab glass has an aspect ratio no greater than ~~2.~~3.

1.4 The procedures assume control tower cab glass has an area no less than ~~1.86~~1.86 m^2 ~~square~~ (20 ft^2~~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.~~

1.5 The use of the procedures assumes the following:

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

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

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

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

1.7 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.~~drilled, notched, or grooved glass.

[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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1.8 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~~5.4).

1.9 These procedures do not address blast loading on glass.

1.10 These procedures do not apply to triple-glazed insulating glass units.

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~~ after SI units 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~~safety, health, and environmental practices and to determine the applicability of regulatory limitations prior to use.*

1.13 *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.*

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 practice, refer to Terminology E631, and for general terms related to glass and glass products, refer to Terminology C162.

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.

3.2.2 *aspect ratio (AR), n*—for glass simply supported along four sides, 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~~ For rectangular glass supported continuously along all four edges, AR always equals or exceeds 1.0. For glass simply supported along three sides, the ratio of the length of the longer parallel supported edge to the dimension perpendicular to the parallel supported sides, equal to or greater than ~~1.0.~~0.5.

~~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.~~

3.2.2.1 *Discussion—*
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*~~*encompassing 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~~

[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.

~~of glass.~~area of the smallest rectangle that will encompass a trapezoidal glass lite. The value of the ERA shall be used as the area when determining deflection in Figs. A2.1-A2.19.

3.2.4 ~~*designated thickness for laminated glass (LG),*~~*glass breakage, n*—the ~~designated thickness for LG as~~fracture of any lite or ~~Table 1 specifies.~~ ply in monolithic, laminated, or insulating glass resulting from stress that an applied uniform lateral load induces.

3.2.5 ~~*designated thickness for monolithic glass,*~~ *Glass Thickness*—~~*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.~~

3.2.5.1 *thickness designation for laminated glass (LG), n*—a term used to specify an LG construction based on the combined thicknesses of its component plies.

(1) Add the minimum thicknesses of the individual glass plies and the nominal interlayer thickness. If the sum of all interlayer thicknesses is greater than 1.52 mm (0.060 in.), use 1.52 mm (0.060 in.) in the calculation.

(2) Select the nominal thickness or designation in Table 1 having the closest minimum thickness that is equal to or less than the value obtained in 3.2.5.1.

(3) Exceptions—The construction of two 6 mm (¼ in.) glass plies plus 0.38 mm (0.015 in.) or 0.76 mm (0.030 in.) interlayer shall be defined as 12 mm (½ in.). The construction of two 2.5 mm (3⁄32 in.) glass plies plus 1.52 mm (0.060 in.) interlayer shall be defined as 5 mm (3⁄16 in.). The construction of two 4 mm (5⁄32 in.) glass plies plus any thickness interlayer shall be defined as 8 mm (5⁄16 in.).

3.2.5.2 *thickness designation 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 1 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.~~

3.2.6 *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.

3.2.7 *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).

3.2.7.1 *Discussion—*

Many different interlayer materials are used in LG. The information in this practice applies to polyvinyl butyral (PVB) interlayer or those interlayers that demonstrate equivalency according to Appendix X8 in Practice E1300.

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

TABLE ~~2~~1 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)~~
25.0 (1)	24.4 (0.969)	622 (13.0)
~~32 (1 – ¼)[A]~~	~~27.38 (1.22)~~	~~795 (16.6)~~
32 (1¼)[A]	27.38 (1.22)	795 (16.6)
~~38 (1 – ½)[A]~~	~~31.6 (1.47)~~	~~943 (19.7)~~
38 (1½)[A]	31.6 (1.47)	943 (19.7)
44 (1¾)[A]	44.3 (1.75)	1070 (22.3)
52 (2)[A]	50.3 (2.00)	1220 (25.5)
57 (2¼)[A]	57 (2.25)	1390 (29.1)

[A] Not a glazing industry standard thickness designation.

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

3.2.9.1 *design load, n*—the magnitude of the 3-second3 second duration load used to design glass for ATCT cabs. Equations used herein for computing magnitudes for design loads adjust glass self weight self-weight to a magnitude consistent with a 3-second3 second duration.

3.2.9.2 *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 21) 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.

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

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

3.2.10 *minimum thickness of monolithic glass, n*—the minimum allowable thickness associated with a nominal or designated glass thickness as given in Table 21 and Specification C1036.

3.2.11 *probability of breakage (P_b), n*—the theoretical fraction of glass lites or plies that would break at the first occurrence of the resistance load, typically expressed in lites per thousand.

3.2.12 *specifying authority, n*—the design professional responsible for interpreting applicable regulations of authorities having jurisdiction and considering appropriate site-specific factors to determine the proper values used to calculate the specified design load and the selection of the Probability of Breakage (P_b) to be used with this practice.

4. Summary of Practice

4.1 The use of these procedures requires a specified design load that shall consist of the wind load and the factored lateral component of glass weight. The total design load shall not exceed 10 kPa (21015 kPa (313 psf).

4.2 The procedures specified herein facilitate determination of the thickness of an annealed window glass construction required to resist the specified design loading for the selected probability of breakage.

4.3 This standard procedure uses methods in Practice provides E1300 to determine the approximate lateral deflection of the geometric center of the window glass construction. deflection charts in Annex A2 provides deflection charts for laminated glass thicknesses larger than those contained in Practice to facilitate determination of approximate center of glass deflection.E1300.

5. Significance and Use

5.1 This standard procedure facilitates determination of the thickness of a glass construction required to resist a specified design load with a selected probability of breakage.

5.2 For optical purposes, ATCT cab glass typically utilize only annealed glass products. For this reason, some specifying authorities mandate its use and prohibit heat-strengthened and tempered glass in control cabs. This standard procedure therefore addresses the following glass constructions: annealed monolithic, annealed laminated, and insulating glass fabricated with annealed monolithic or annealed laminated glass, or both. In cases where the specifying authority approves the use of heat-strengthened or fully tempered glass in the control cab or in areas where optical characteristics do not apply but are deemed critical to the facility operation, the NFL values obtained from standard may be adjusted using appropriate Glass Type Factors (GTF) and procedures for their use as specified in Practice E1300.

5.3 Use of these procedures assume:

5.3.1 The glass is free of edge damage and is properly glazed,

5.3.2 The glass has not been subjected to abuse,

5.3.3 The surface condition of the glass is typical of glass that has been in service for several years,years and is significantly weaker than freshly manufactured glass due to minor abrasions on exposed surfaces, 5.3.4 The glass edge support system is sufficiently stiff to limit the lateral deflections of the supported glass edges to less than 1⁄175 of their lengths. The specified design load shall be used for this calculation, and

5.3.5 The center of glass deflection shall not result in loss of edge support. Typically maintaining center of glass deflection at or below the magnitude of three times the nominal glass thickness assures that no loss of edge support will occur.

5.4 Many other factors affect the selection of glass type and thickness. These factors include but are not limited to: thermal stresses, the effects of windborne debris, excessive deflections, behavior of glass fragments after breakage, seismic effects, heat flow, edge bite, noise abatement, potential post-breakage consequences, and so forth. In addition, considerations set forth in federal, state, and local building codes along with criteria presented in safety glazing standards and site specific site-specific concerns may control the ultimate glass type and thickness selection.

6. Procedure

6.1 Select a probability of breakage, glass type or construction, and glass thickness(es).

6.2 Compute the design load for monolithic or single laminated glass according to:

$$L_D = L_W + 2L_G \cos\theta \quad (1)$$

$$L_D = L_W + 3.2L_G \cos\theta \quad (1)$$

where:

L_D = denotes the design load,
L_W = denotes the wind load,
L_G = denotes the weight of the glass, and
θ = denotes the acute angle the glass makes with the horizontal. For monolithic or single laminated glazing, the user shall obtain L_G from Table 1 for the nominal glass thickness. For insulating glass, L_G shall consist of the weights of both glass lites as determined from Table 1.

where:

L_D = denotes the design load,
L_W = denotes the wind load,
L_G = denotes the weight of the glass, and
θ = denotes the acute angle the glass makes with the horizontal. For monolithic or single laminated glazing, the user shall obtain L_G from Table 2 for the nominal glass thickness. For insulating glass, L_G shall consist of the weights of both glass lites as determined from Table 2.

6.3 *Monolithic Single Glazing Continuously Supported Along all Four Edges:Sides:*

6.3.1 Determine the ERA.AR.

6.3.2 Determine the AR.

6.3.2 Determine the required glass thickness from Fig. A1.1Figs. A1.1-A1.8 (P_B = 0.001) or Fig. A1.2Figs. A1.9-A1.16 (P_B = 0.004) for the design load, ERA, and AR.load and long and short dimensions of glass.

6.3.2.1 The required glass thickness from is the smallest thickness with load resistance greater than or equal to the design load.

6.3.3 Determine the approximate maximum center of glass deflection using procedures from Practice ERA.E1300.

6.3.3.1 Determine the approximate maximum center of glass deflection under the design load from Figs. A2.1-A2.8.

6.4 *Laminated Single Glazing Continuously Supported Along All Four Sides:*

6.4.1 Determine the AR.

6.4.2 Determine the required glass thickness from Fig. A1.17a-Fig. A1.28 (P_B = 0.001) or Fig. A1.29a-Fig. A1.40 (P_B = 0.004) for the design load and long and short dimensions of glass.

6.4.2.1 The required glass thickness is the smallest thickness with load resistance greater than or equal to the design load.

6.4.3 Determine the ERA.

6.4.3.1 Determine the approximate maximum center of glass deflection under the design load from Fig. A2.9a-Fig. A2.20.

6.5 *Monolithic Single ~~Laminated~~ Glazing Continuously Supported Along ~~all Four Edges:~~Any Three Sides:*

6.5.1 Determine the ~~ERA.~~AR.

~~6.4.2 Determine the AR.~~

6.5.2 Determine the required glass thickness from ~~Fig. A1.3~~Figs. A1.41-A1.48 (P_B = 0.001) or ~~Fig. A1.4~~Figs. A1.49-A1.56 (P_B = 0.004) for the design ~~load, ERA,~~ load and AR.

6.5.2.1 The required glass thickness is the smallest thickness with load resistance greater than or equal to the design load.

6.5.3 Determine the approximate maximum center of glass deflection ~~using procedures from Practice~~under the design load from Figs. A2.21-A2.28~~E1300~~.

6.6 *~~Monolithic~~Laminated Single Glazing ~~Simply Supported~~ Continuously ~~Along Two Opposite Sides or any~~ Supported Along Any Three Sides:*

6.6.1 Determine the ~~Unsupported Glass Length.~~AR.

6.6.2 Determine the required glass thickness from Fig. ~~A1.5~~A1.57a-Fig. A1.68 (P_B = 0.001) or Fig. ~~A1.6~~A1.69a-Fig. A1.80 (P_B = 0.004) for the design ~~load, ERA,~~ load and AR.

6.6.2.1 The required glass thickness is the smallest thickness with load resistance greater than or equal to the design load.

6.6.3 Determine the approximate maximum center of glass deflection ~~using procedures~~ under the design load from Fig. A2.29~~Practice~~ a-~~E1300~~Fig. A2.40.

6.7 *Monolithic Single Glazing Simply Supported Continuously Along Two Opposite Sides:*

6.7.1 Determine the Longer Horizontal (Supported) Glass Length and the Unsupported Glass Length.

6.7.2 Determine the required glass thickness from Figs. A1.81-A1.88 (P_B = 0.001) or Figs. A1.89-A1.96 (P_B = 0.004) for the design load.

6.7.2.1 The required glass thickness is the smallest thickness with load resistance greater than or equal to the design load.

6.7.3 Determine the approximate maximum center of glass deflection under the design load using procedures from Fig. A2.41.

6.8 *~~Single Laminated Glazing Simply Supported Continuously Along Two Opposite Sides or any Three Sides:~~Laminated Single Glazing Simply Supported Continuously Along Two Opposite Sides:*

6.8.1 Determine the ~~unsupported glass length.~~ Longer Horizontal (Supported) Glass Length and the Unsupported Glass Length.

6.8.2 Determine the required glass thickness from Fig. ~~A1.7~~A1.97a-Fig. A1.108 (P_{BB} = 0.001) or Fig. ~~A1.8~~A1.109a-Fig. A1.120 (P_{BB} = 0.004) for the design ~~load, ERA, and AR.~~load.

6.8.2.1 The required glass thickness is the smallest thickness with load resistance greater than or equal to the design load.

6.8.3 Determine the approximate maximum center of glass deflection under the design load using procedures from ~~Practice~~Fig. A2.42~~E1300~~.

6.9 *~~Insulating Glass (IG) with Monolithic Glass Lites of Equal (Symmetric) Glass Type and Thickness.~~Insulating Glass (IG) with Monolithic Glass Lites of Equal (Symmetric) Glass Thickness:*

6.9.1 Compute the design load for IG as ~~$L_{DIG}=5(L_W+2L_G\cos\theta)/9$~~$L_{DIG}=5(L_W+3.2L_G\cos\theta)/9$ in which all terms are previously defined. The ~~weigh~~weight of the glass, L_G, consists of the weight of both glass lites.

6.9.2 Determine the ~~ERA.~~AR.

~~6.7.3 Determine the AR.~~

6.9.3 Determine the required glass thickness for a single lite in the IG unit from ~~Fig. A1.1~~Figs. A1.1-A1.8 (P_B = 0.001) or ~~Fig. A1.2~~Figs. A1.9-A1.16 (P_B = 0.004) for the ~~design load, ERA, and AR.~~specified design load and long and short dimensions of glass.

6.9.3.1 The required glass thickness is the smallest thickness with load resistance greater than or equal to the specified design load.

6.9.4 Determine the ~~approximate maximum center of glass deflection as the deflection of one lite in the IG unit under the design load 0.9~~ERA.~~L_{DIG} using procedures from Practice E1300~~.

6.9.4.1 Determine the approximate maximum center of glass deflection as the deflection of one lite in the IG unit under the design load $0.9L_{DIG}$ using Figs. A2.1-A2.8.

6.10 *Insulating Glass (IG) with Laminated Glass Lites of Equal (Symmetric) Glass* ~~*Type and*~~ *Thickness.*

6.10.1 Compute the design load for IG as ~~$L_{DIG}=5(L_W+2L_G\cos\theta)/9$~~$L_{DIG}=5(L_W+3.2L_G\cos\theta)/9$ in which all terms are previously defined. The ~~weigh~~weight of the glass, L_G, consists of the weight of both glass lites.

6.10.2 Determine the ~~ERA.~~AR.

~~6.8.3 Determine the AR.~~

6.10.3 Determine the required glass thickness for a single lite in the IG unit from Fig. ~~A1.1~~A1.17a-Fig. A1.28 (P_B = 0.001) or Fig. ~~A1.4~~A1.29a-Fig. A1.40 (P_B = 0.004) for the design ~~load, ERA, and AR.~~load and long and short dimensions of glass.

6.10.3.1 The required glass thickness is the smallest thickness with load resistance greater than or equal to the specified design load.

6.10.4 Determine the ERA.

6.11 Determine the approximate maximum center of glass deflection as the deflection of one lite in the IG unit under the design load $0.9L_{DIG}$ using Fig. A2.9~~procedures~~ a-~~fromPractice~~~~E1300~~Fig. A2.20.

7. Report

7.1 Report the following information:

7.1.1 Date of calculation;

7.1.2 The probability of breakage, design wind load, drawing of the glass shape with dimensions, glass edge support conditions, ~~longest~~longer horizontal dimension of the glass, the length of the edge perpendicular to the horizontal dimension in the plane of the glass, aspect ratio, ~~equivalent~~encompassing rectangular area, glass type(s) and thickness(es), weight of the glass, glass type factor(s), approximate lateral deflection; and

7.1.3 A statement that the procedure followed was in accordance with this practice or a full description of any deviations.

8. Precision and Bias

8.1 The ~~non-factored~~ load resistance charts ~~(the~~ (Fig. A1.1~~upper~~ -~~chartsof~~~~Figs. A1.1-A1.8~~Fig. A1.114) are based upon a theoretical glass breakage model that relates the strength of glass to the surface condition. Complete discussions of the formulation of the model are presented elsewhere.[4].

8.1.1 A conservative estimate of the surface condition and, as appropriate, edge condition for glass design was used in generation of the charts. This surface ~~condition estimate is~~and edge condition estimates are based upon the best available glass strength data and engineering judgment. It is possible that the information presented in the ~~non-factored~~ load resistance charts may change as further data becomes available.

9. Keywords

9.1 annealed glass; deflection; flat glass; glass; insulating glass; laminated glass; load resistance; monolithic glass; probability of breakage; strength; wind load

[4] Norville, ~~H.S., El-Shami, M.M.,~~ H. S., El-Shami, M. M., Jackson, R., and Johnson G., "Design Methodology for Large Trapezoidal Window Glass Lites," *The Use of Glass in Buildings*, ASTM STP 1434.

ANNEXES

(Mandatory Information)

A1. ~~DESIGN~~ LOAD RESISTANCE CHARTS

A1.1 ~~Figs. A1.1-A1.8~~Fig. A1.1-Fig. A1.120 present ~~design~~ load resistance charts in both SI and inch-pound units. The design charts were developed using failure prediction models for glass. Practice E1300 discusses the failure prediction models for glass. The ~~design~~ load resistance charts presented herein are predicated on the same surface flaw parameters as the non-factored load charts in Practice E1300. The design charts are based on minimum glass thicknesses referenced in Specification C1036. The load resistance charts for laminated glass are based on a shear modulus for the PVB interlayer G=300 kPa (43.5 psi). Note that each set of laminated load resistance charts contains two charts for nominal 6 mm (¼ in.) laminated glass. The "a" load resistance chart represents laminated glass comprised of two nominal 2.7 mm (lami) glass plies and a 0.76 mm (0.060 in.) PVB interlayer. The "b" load resistance chart represents laminated glass comprised of two nominal 3 mm (⅛ in.) glass plies and a 0.76 mm (0.060 in.) PVB interlayer.

~~A1.2 In Design charts for glass simply supported continuously along four sides (Figs. A1.1-A1.4), solid lines represent glass with AR = 1.0 and dashed lines represent glass with AR = 2.0. For aspect ratios falling between 1.0 and 2.0, interpolation is acceptable.~~

~~A1.3 Design charts for laminated glass assume an interlayer temperature of 50°C (122°F).~~

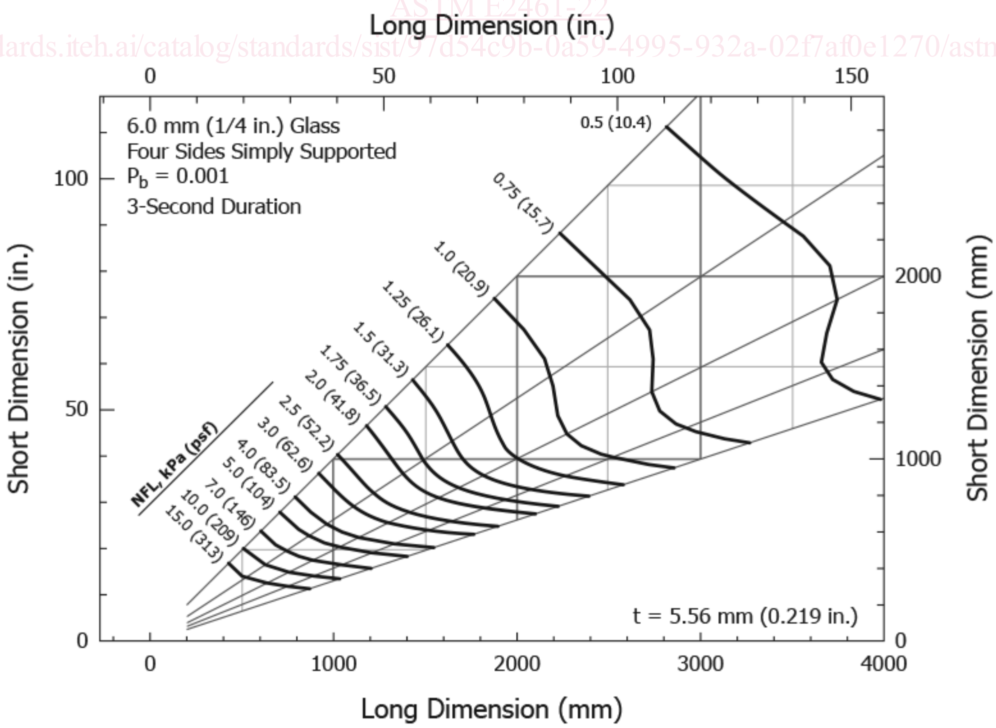

FIG. A1.1 ~~Design~~ Load Resistance Chart for 6 mm (¼ in.) Annealed ~~Glass with Four Sides Simply Supported~~ Monolithic Glass Continuously Supported Along Four Sides (P_{b} = 0.001)

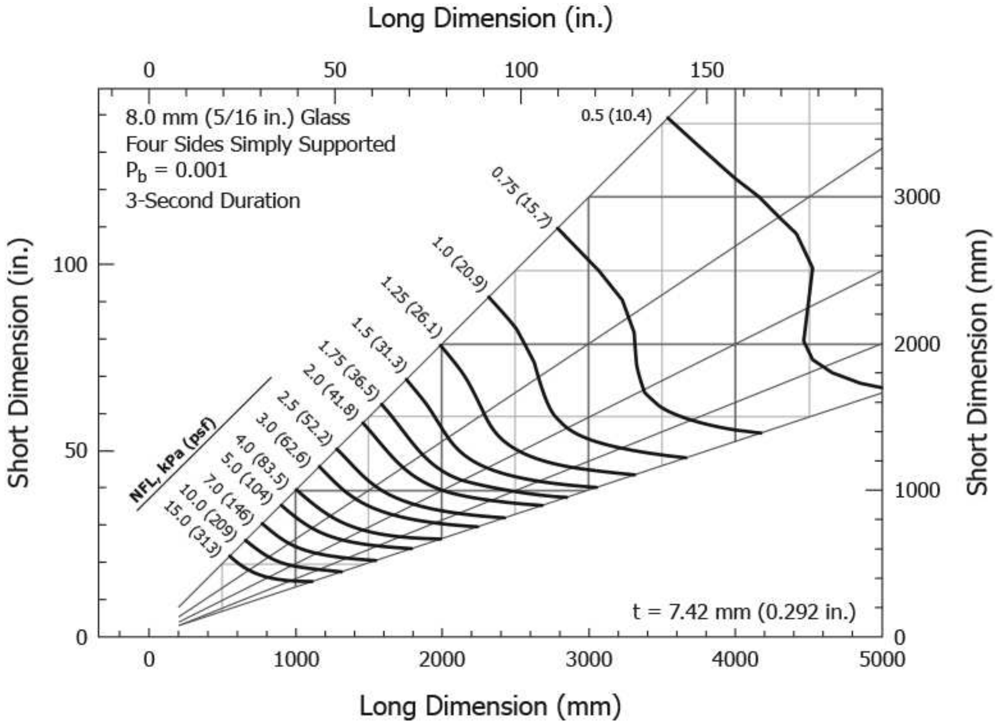

FIG. A1.2 ~~Design~~ Load Resistance Chart for 8 mm (5⁄16 in.) Annealed ~~Glass with Four Sides Simply Supported~~ Monolithic Glass Continuously Supported Along Four Sides (P_{bb} ~~= 0.004)~~ = 0.001)

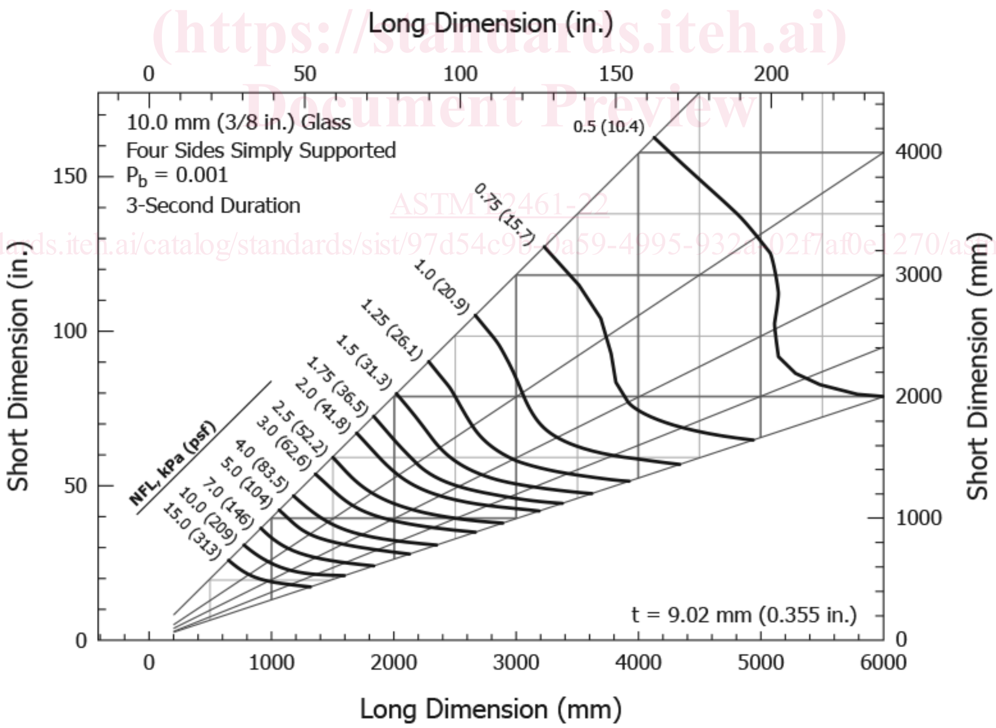

FIG. A1.3 ~~Design~~ Load Resistance Chart for 10 mm (3⁄8 in.) Annealed ~~Laminated Glass with Four Sides Simply~~ Monolithic Glass Continuously Supported Along Four Sides (P_b ~~Supported (P~~= 0.001)~~b=0.001)~~

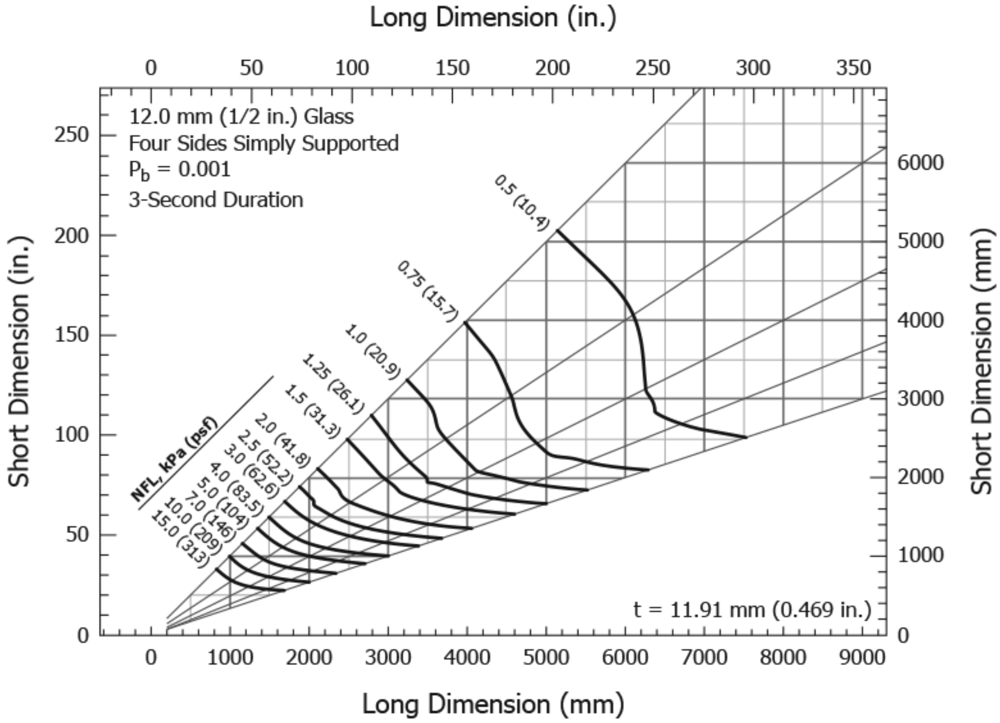

FIG. A1.4 ~~Design~~ Load Resistance Chart for 12 mm (½ in.) Annealed ~~Laminated Glass with Four Sides Simply Supported~~ Monolithic Glass Continuously Supported Along Four Sides (P_{b} ~~= 0.004~~) = 0.001)

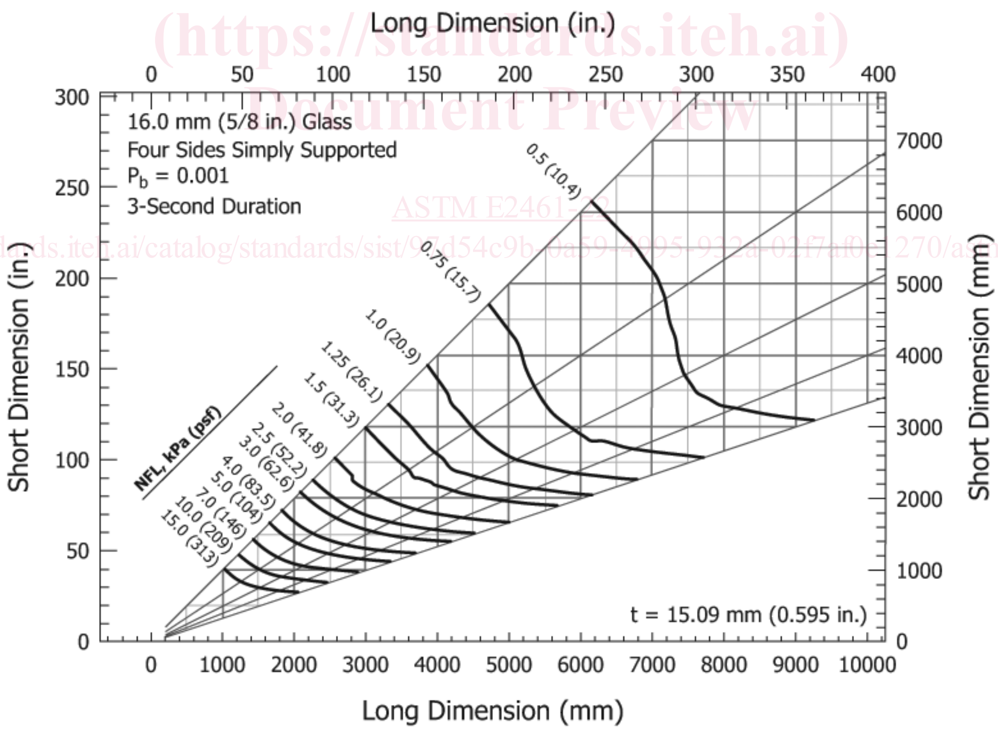

FIG. A1.5 ~~Design~~ Load Resistance Chart for 16 mm (⅝ in.) Annealed ~~Glass with Two and Three Sides Simply Supported~~ Monolithic Glass Continuously Supported Along Four Sides (P_{b} = 0.001)

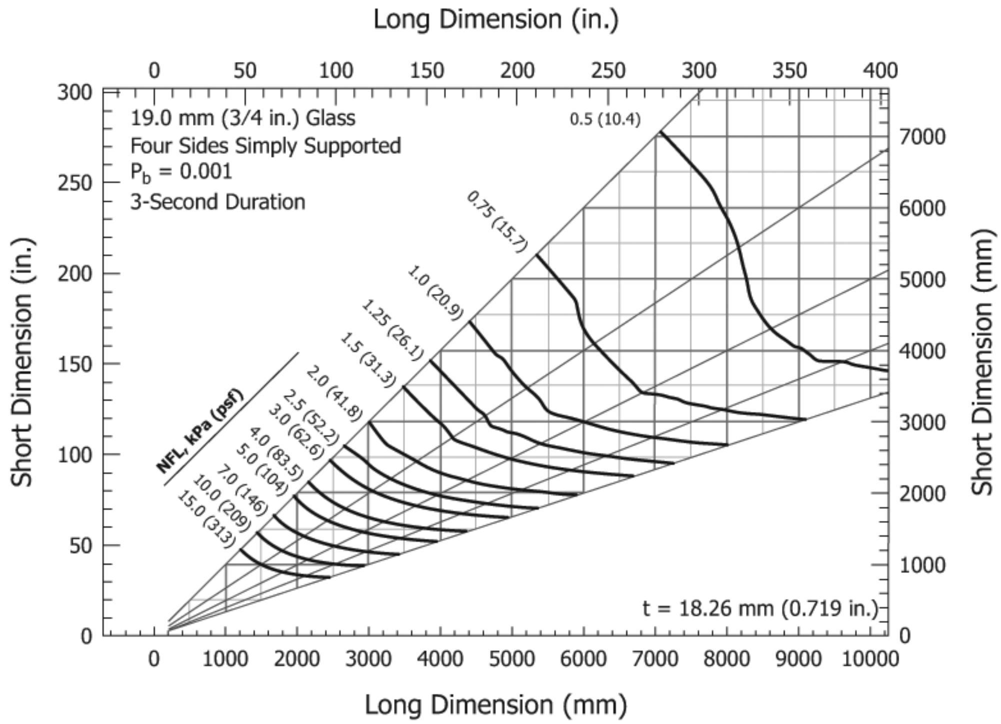

FIG. A1.6 ~~Design~~ Load Resistance Chart for 19 mm (¾ in.) Annealed ~~Glass with Two and Three Sides Simply~~ Monolithic Glass Continuously Supported Along Four Sides (P_b ~~Supported (P= 0.001)~~$_b$~~=0.004~~)

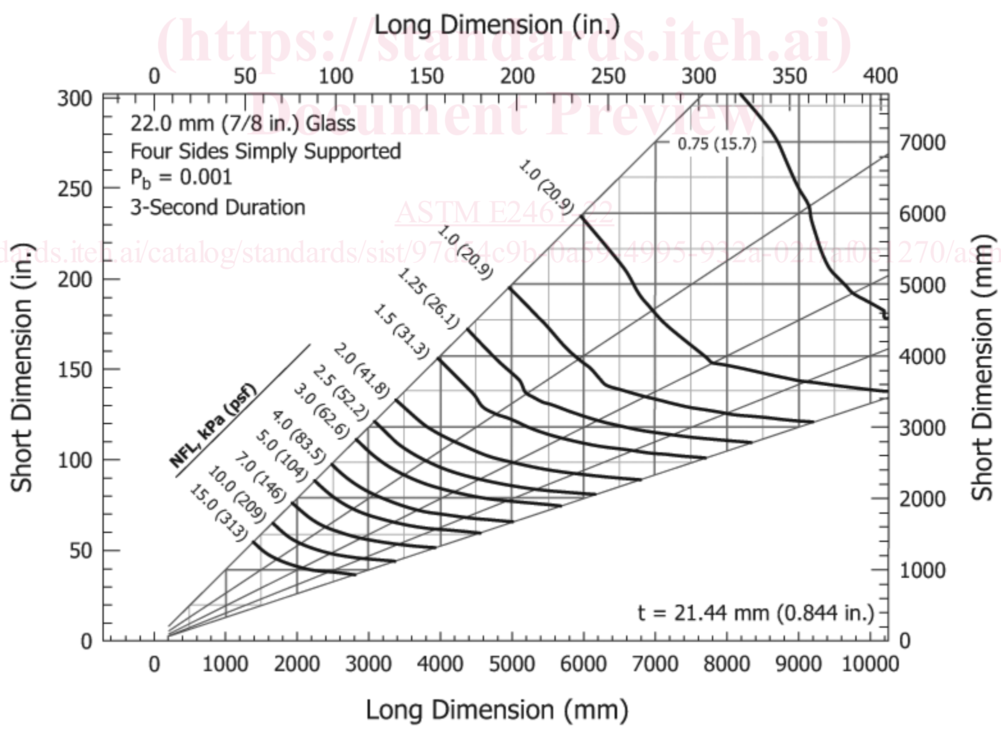

FIG. A1.7 ~~Design~~ Load Resistance Chart for 22 mm (⅞ in.) Annealed ~~Laminated Glass with Two and Three Sides Simply Supported~~ Monolithic Glass Continuously Supported Along Four Sides (P_b = 0.001)

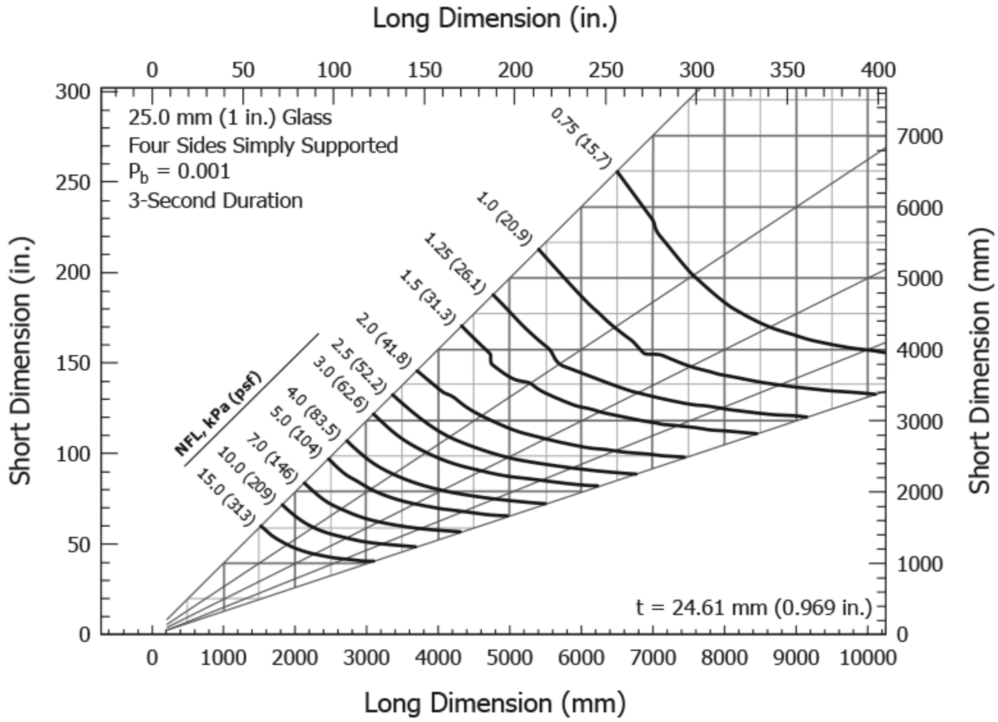

FIG. A1.8 ~~Design~~ Load Resistance Chart for ~~Annealed Laminated Glass with Two and Three Sides Simply Supported~~ 25 mm (1 in.) Annealed Monolithic Glass Continuously Supported Along Four Sides (P_{b} ~~= 0.004~~) = 0.001)

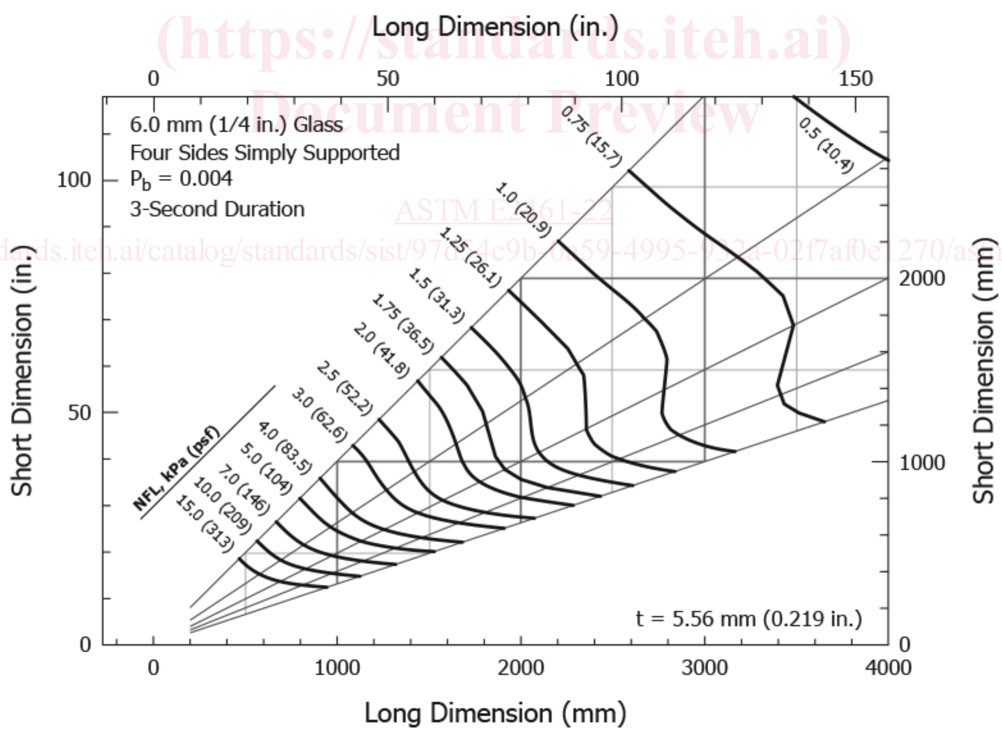

FIG. A1.9 Load Resistance Chart for 6 mm (¼ in.) Annealed Monolithic Glass Continuously Supported Along Four Sides (P_b = 0.004)

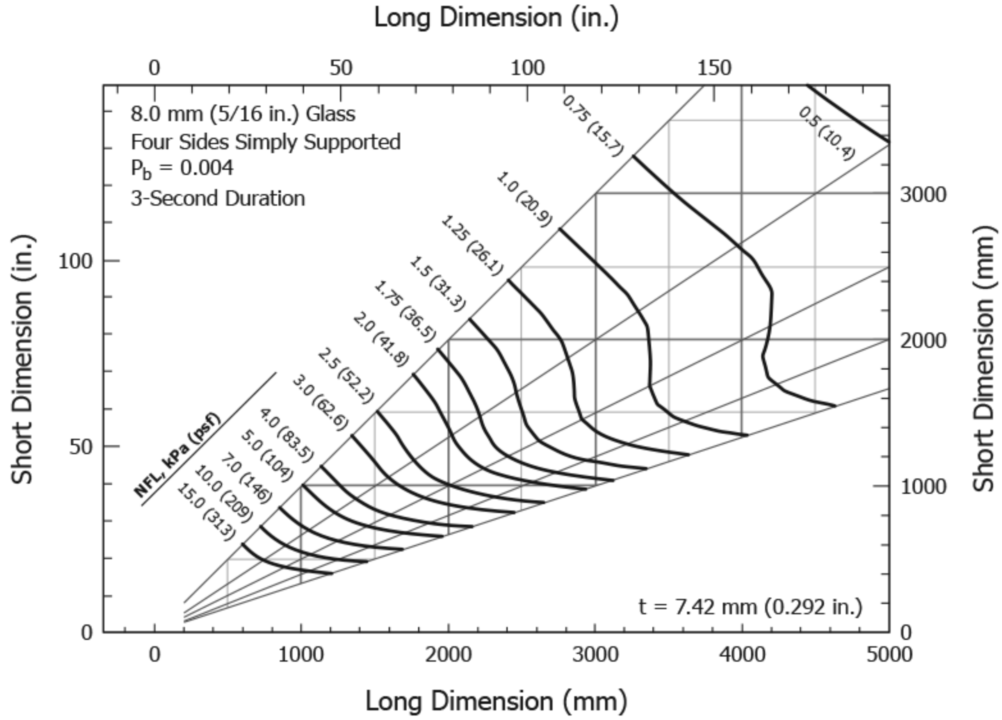

FIG. ~~A3.3~~A1.10 ~~Design~~ Load Resistance Chart for 8 mm (5⁄16 in.) Annealed ~~Glass with Four Sides Simply Supported~~ Monolithic Glass Continuously Supported Along Four Sides (P_{bb} ~~= 0.001), with Projected Lines for the Revised Design Load and Opening Area in Example~~ = 0.004)

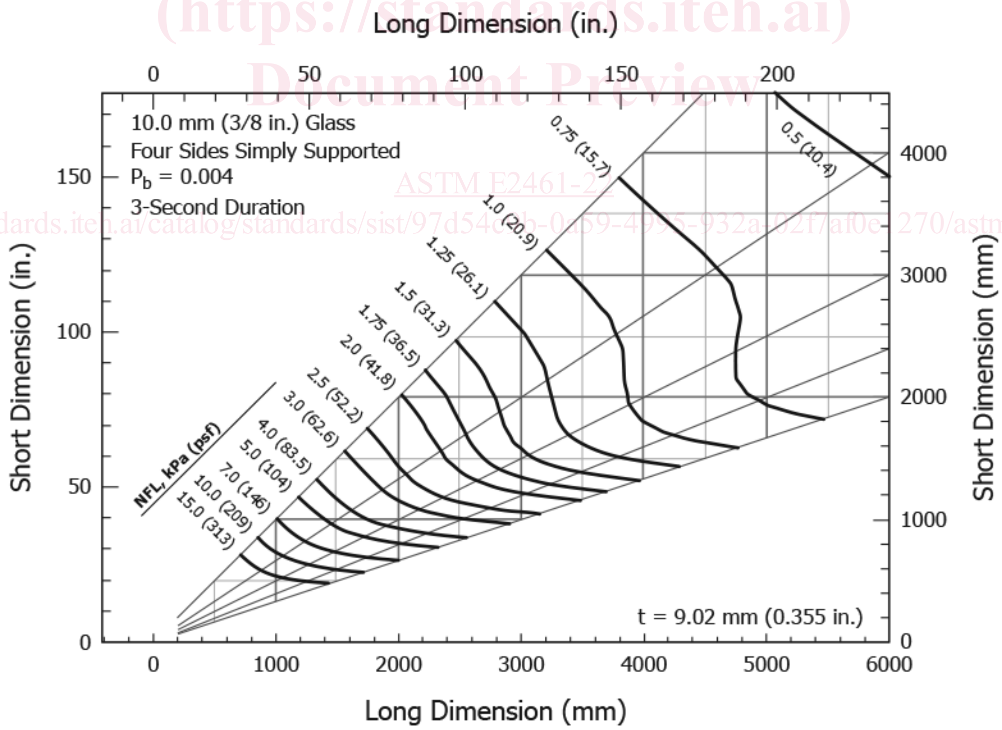

FIG. A1.11 Load Resistance Chart for 10 mm (3⁄8 in.) Annealed Monolithic Glass Continuously Supported Along Four Sides (P_b = 0.004)

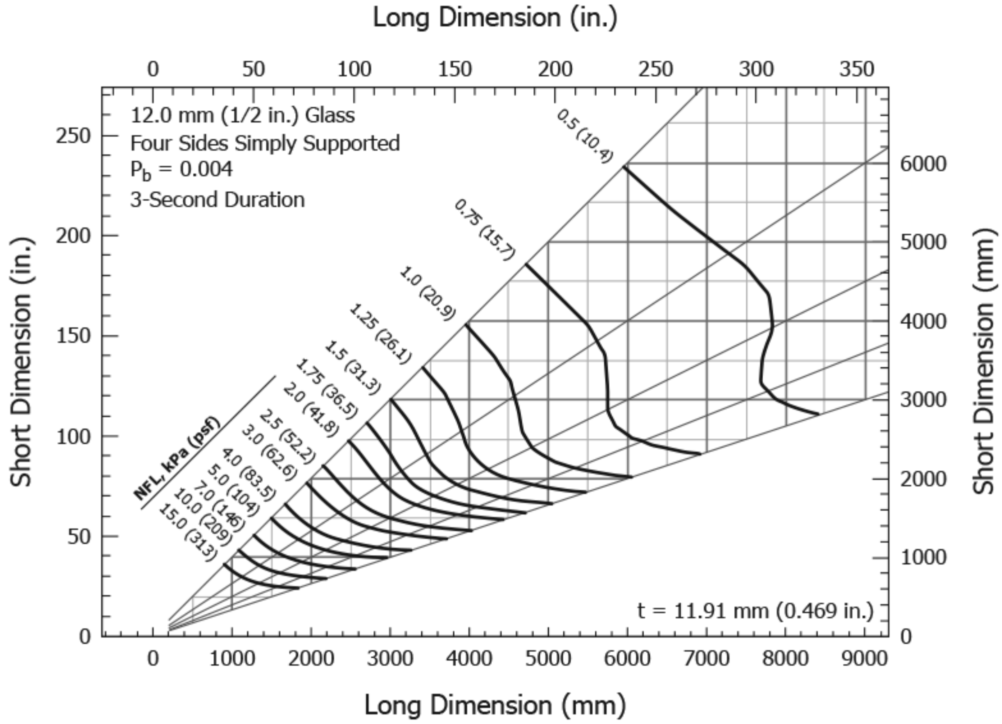

FIG. A1.12 Load Resistance Chart for 12 mm (½ in.) Annealed Monolithic Glass Continuously Supported Along Four Sides (P_b = 0.004)

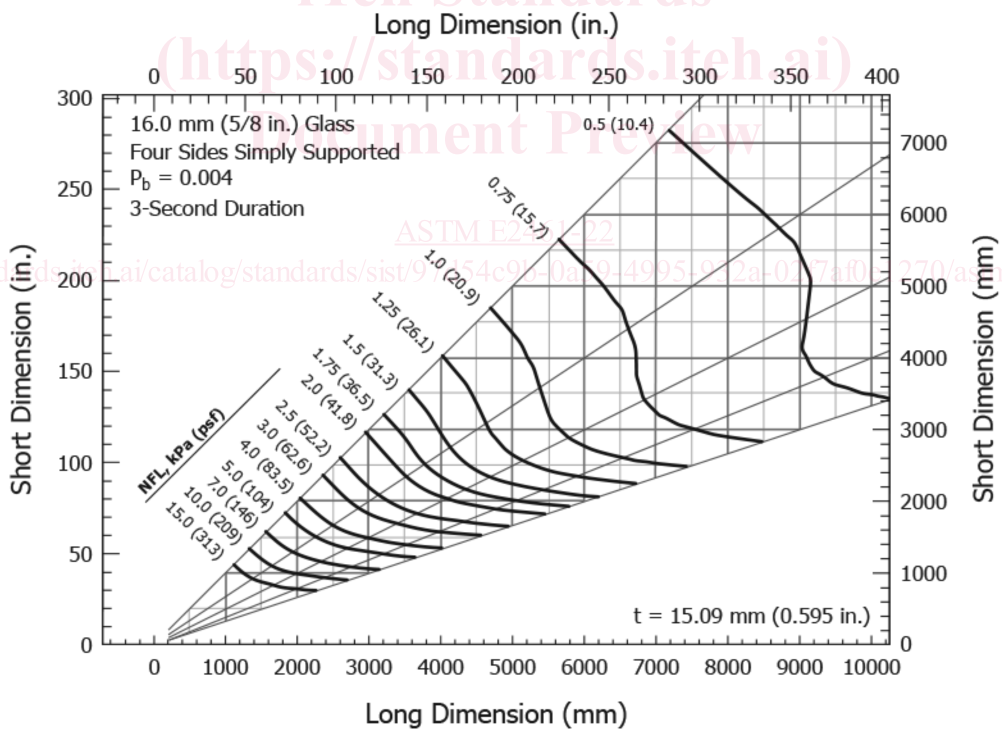

FIG. A1.13 Load Resistance Chart for 16 mm (⅝ in.) Annealed Monolithic Glass Continuously Supported Along Four Sides (P_b = 0.004)