



Designation: C1036 – 06

Standard Specification for Flat Glass¹

This standard is issued under the fixed designation C1036; 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.

This standard has been approved for use by agencies of the Department of Defense.

1. Scope

1.1 This specification covers the requirements for annealed, monolithic flat glass supplied as cut sizes or stock sheets.

1.2 This specification is applicable for laboratory and field evaluation only to the extent that such evaluation can be carried out in accordance with the test method(s) prescribed herein.

1.3 This specification covers the quality requirements of flat, transparent, clear, and tinted glass. This glass is intended to be used primarily for architectural glazing products including: coated glass, insulating glass units, laminated glass, mirrors, spandrel glass, or similar uses.

NOTE 1—Reflective distortion is not addressed in this specification.

1.4 This specification covers the quality requirements of patterned or wired glasses intended to be used primarily for decorative and general glazing applications.

1.5 The values given in SI units are to be regarded as the standard. The values given in parentheses are for information only.

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 and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards*:²

C162 *Terminology of Glass and Glass Products*

2.2 *NFRC Standard*:³

NFRC 300 Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems

3. Terminology

3.1 *Definitions*—For additional definitions of terms, refer to Terminology C162.

3.2 *Definitions of Terms Specific to This Standard*:

3.2.1 *associated distortion, n*—alteration of viewed images caused by variations in glass flatness or inhomogeneous portions within the glass.

3.2.2 *bevel, n*—angled surface at the edge of a lite of glass.

3.2.3 *blemish, n*—imperfection in the body or on the surface of the glass; for the purpose of this specification, blemishes are divided into two categories:

3.2.3.1 *linear blemish, n*—scratches, rubs, digs, and other similar imperfections.

3.2.3.2 *point blemish, n*—crush, knots, dirt, stones, gaseous inclusions, and other similar imperfections.

3.2.4 *chip depth, n*—measured distance of a chip from the face of the glass into the thickness.

3.2.5 *chip length, n*—distance parallel to the edge of the glass from one edge of a chip to the other.

3.2.6 *chip width, n*—perpendicular distance from the edge of the glass to the inner edge of the chip.

3.2.7 *crush, n*—lightly pitted condition with a dull gray appearance.

3.2.8 *cut size, n*—glass ordered cut to its final intended size.

3.2.9 *dig, n*—deep, short scratch.

3.2.10 *dirt, n*—small particle of foreign matter embedded in the surface of flat glass.

3.2.11 *fire crack, n*—small, sometimes microscopic fissure in the edge of wired or patterned glass.

3.2.12 *flare, n*—protrusion on the glass edge or corner of an otherwise rectangular surface.

3.2.13 *gaseous inclusion, n*—round or elongated bubble in the glass.

3.2.14 *knot, n*—inhomogeneity in the form of a vitreous lump.

3.2.15 *line, n*—fine cords or string, usually on the surface of flat glass.

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 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 National Fenestration Rating Council, 84884 Georgia Ave., Suite 320, Silver Spring, MD 20910.

TABLE 1 Allowable Shell Chip Size and Distribution (Type I Glass) for Cut Size and Stock Sheet Qualities

Description	Q1	Q2	Q3	Q4
Chip depth	Chip depth \leq 25 % of glass thickness	Chip depth \leq 50 % of glass thickness	Chip depth \leq 50 % of glass thickness	Chip depth \leq 50 % of glass thickness
Chip width ^A	Chip width \leq 25 % of glass thickness or 1.6 mm (1/16 in.) whichever is greater	Chip width \leq 50% of glass thickness or 1.6 mm (1/16 in.) whichever is greater	Chip width \leq glass thickness or 6 mm (1/4 in.) whichever is greater	Not limited
Chip length ^A	Chip length \leq 2 times the chip width	Chip length \leq 2 times the chip width	Chip length \leq 2 times the chip width	Not limited

^A Chip width and length are not applicable to stock sheets.

TABLE 2 Dimensional Tolerance for Rectangular Shapes of Type 1 Transparent, Flat Glass^A

Nominal Designation		Thickness Range				Length and Width Tolerance ^A				Squareness (D1–D2)			
SI Designation ^B mm	Traditional Designation	mm		in.		Cut Size		Stock Sheet		Cut Size		Stock Sheet	
		min	max	min	max	\pm mm	(\pm in.)	\pm mm	(\pm in.)	mm	(in.)	mm	(in.)
1.0	microslide	0.79	1.24	0.031	0.049	1.6	(1/16)	6.4	(1/4)	2.0	(5/64)	3.0	(1/8)
1.5	photo	1.27	1.78	0.05	0.07	1.6	(1/16)	6.4	(1/4)	2.0	(5/64)	3.0	(1/8)
2	picture	1.80	2.13	0.071	0.084	1.6	(1/16)	6.4	(1/4)	2.0	(5/64)	3.0	(1/8)
2.5	single	2.16	2.57	0.085	0.101	1.6	(1/16)	6.4	(1/4)	2.0	(5/64)	3.0	(1/8)
2.7	lami	2.59	2.90	0.102	0.114	1.6	(1/16)	6.4	(1/4)	2.0	(5/64)	3.0	(1/8)
3 ^C	double, 1/8 in.	2.92	3.40	0.115	0.134	1.6	(1/16)	6.4	(1/4)	2.0	(5/64)	3.0	(1/8)
4	5/32 in.	3.78	4.19	0.149	0.165	1.6	(1/16)	6.4	(1/4)	2.0	(5/64)	3.0	(1/8)
5	3/16 in.	4.57	5.05	0.18	0.199	1.6	(1/16)	6.4	(1/4)	2.0	(5/64)	3.0	(1/8)
6	1/4 in.	5.56	6.20	0.219	0.244	1.6	(1/16)	6.4	(1/4)	2.0	(5/64)	3.0	(1/8)
8	5/16 in.	7.42	8.43	0.292	0.332	2.0	(5/64)	6.4	(1/4)	2.8	(7/64)	6.0	(1/4)
10	3/8 in.	9.02	10.31	0.355	0.406	2.4	(3/32)	6.4	(1/4)	3.4	(1/8)	6.0	(1/4)
12	1/2 in.	11.91	13.49	0.469	0.531	3.2	(1/8)	6.4	(1/4)	4.5	(11/64)	10.0	(3/8)
16	5/8 in.	15.09	16.66	0.595	0.656	4.0	(5/32)	6.4	(1/4)	5.7	(7/32)	12.0	(1/2)
19	3/4 in.	18.26	19.84	0.719	0.781	4.8	(3/16)	6.4	(1/4)	6.8	(1/4)	14.0	(9/16)
22	7/8 in.	21.44	23.01	0.844	0.906	5.6	(7/32)	6.4	(1/4)	7.9	(19/64)	16.0	(5/8)
25	1 in.	24.61	26.19	0.969	1.031	6.4	(1/4)	6.4	(1/4)	9.0	(11/32)	18.0	(3/4)

^A Length and width of cut size and stock sheets of flat glass include flares and bevels.

^B These designations apply only to ASTM International and may not reflect other international standards.

^C Within the 3.0 designation there are some applications that may require different thickness ranges such as DST. (Typical minimum thickness for DST is 0.120 in.)

3.2.16 *patterned glass, n*—rolled flat glass having a pattern on one or both surfaces.

3.2.17 *ream, n*—linear distortion as a result of nonhomogeneous layers of flat glass.

3.2.18 *rub, n*—abrasion of a glass surface producing a frosted appearance.

3.2.19 *scratch, n*—damage on a glass surface in the form of a line caused by the movement of an object across and in contact with the glass surface.

3.2.20 *shell chip, n*—circular indentation in the glass edge as a result of breakage of a small fragment out of an otherwise regular surface.

3.2.21 *stock sheets, n*—glass ordered in sizes intended to be cut to create final or cut size (that is, uncuts, intermediates, jumbos, and lehr ends).

3.2.22 *stone, n*—crystalline inclusion in glass.

3.2.23 *string, n*—straight or curled line, usually resulting from slow solution of a large grain of sand or foreign material.

3.2.24 *tinted glass, n*—glass formulated to have a uniform color throughout the glass, with the purpose of reducing glare, solar heat gain, or visible/ultraviolet (UV) transmittance.

3.2.25 *v-chip, n*—v-shaped imperfection in the edge of the glass lite.

TABLE 3 Allowable Point Blemish Size and Distribution For Cut Size Qualities^A

Blemish Size mm (in.) ^{B,C,D}	Q1 Quality 1	Q2 Quality 2	Q3 Quality 3	Q4 Quality 4
< 0.50 (0.02)	Allowed ^E	Allowed ^E	Allowed	Allowed
≥ 0.50 < 0.80 ≥ (0.02) < (0.03)	Allowed with a minimum separation of 1500 mm (60 in.) ^F	Allowed with a minimum separation of 600 mm (24 in.) ^F	Allowed	Allowed
≥ 0.80 < 1.20 ≥ (0.03) < (0.05)	None allowed	Allowed with a minimum separation of 1200 mm (48 in.) ^F	Allowed	Allowed
≥ 1.20 < 1.50 ≥ (0.05) < (0.06)	None allowed	Allowed with a minimum separation of 1500 mm (60 in.) ^F	Allowed with a minimum separation of 600 mm (24 in.) ^F	Allowed
≥ 1.50 < 2.00 ≥ (0.06) < (0.08)	None allowed	None allowed	Allowed with a minimum separation of 600 mm (24 in.) ^F	Allowed
≥ 2.00 < 2.50 ≥ (0.08) < (0.10)	None allowed	None allowed	None allowed	Allowed with a minimum separation of 600 mm (24 in.) ^F
≥ 2.5 ≥ (0.10)	None allowed	None allowed	None allowed	None allowed

^A Table values are for 6.0 mm (¼ in.) and less. For glass thicker than 6.0 mm (¼ in.) and less than or equal to 12.0 mm (½ in.), they may contain proportionally larger blemishes for the same minimum separation distances. (For example, a 12-mm Q3 sample with a blemish size of ≥ 3.0 < 4.0 mm, the allowable minimum separation would be 600 mm.) **Table 3** does not apply to glass thicker than 12.0 mm (½ in.). Allowable blemishes for glass thicker than 12.0 mm (½ in.) shall be determined by agreement between the buyer and the seller.

^B See 6.1.1.1 for detection of point blemishes.

^C See 6.1.1.2 for measurement of point blemishes.

^D For Q1 and Q2 only, the blemish size includes associated distortion (see 6.1.1.2).

^E Provided that normally nondetectable blemishes do not form a cluster that is detectable at 1800 mm (6 ft).

^F See 6.1.1.4 for minimum blemish separation.

TABLE 4 Point Blemishes Allowed for Stock Sheets

Glass Area	Point Blemishes Allowed	Quality	Typical Use
If glass area < 7 m ² (75 ft ²)	Allowable blemishes per Table 3 PLUS one rejectable point blemish	Quality-Q1 (cut-size or stock sheets)	Production of high-quality mirrors.
If glass area ≥ 7 m ² (75 ft ²) but < 14 m ² (150 ft ²)	Allowable blemishes per Table 3 PLUS two rejectable point blemishes	Quality-Q2 (cut-size or stock sheets)	Production of general use mirrors and other applications.
If glass area ≥ 14 m ² (150 ft ²)	Allowable blemishes per Table 3 PLUS three rejectable point blemishes	Quality-Q3 (cut-size or stock sheets)	Production of architectural glass products in- cluding coated, heat treated, laminated, and other select glass products.
		Quality-Q4 (cut-size or stock sheets)	General glazing applications.

3.2.26 *vision interference angle, n*—angle at which distortion in transmission first appears (see **Fig. 1**).

3.2.27 *wired glass, n*—flat glass with a layer of wire mesh embedded in the glass.

4. Classification and Intended Use

NOTE 2—When referencing this specification, the user shall indicate the title and date of the specification and the type, class, quality (including cut-size or stock sheets), size, and thickness of the glass.

4.1 *Types, Classes, Forms, Qualities, and Finishes*—Glass shall be of the following types, classes, forms, qualities, and finishes, as specified:

4.1.1 *Type I—Transparent Flat Glass:*

4.1.1.1 *Class 1—Clear:*

4.1.1.2 *Class 2—Tinted:*

Quality	Typical Use
Quality-Q1	Not available.
Quality-Q2 (cut-size or stock sheets)	Production of general use mirrors and other applications.
Quality-Q3 (cut-size or stock sheets)	Production of architectural glass products in- cluding coated, heat treated, laminated, and other select glass products.
Quality-Q4 (cut-size or stock sheets)	General glazing applications.

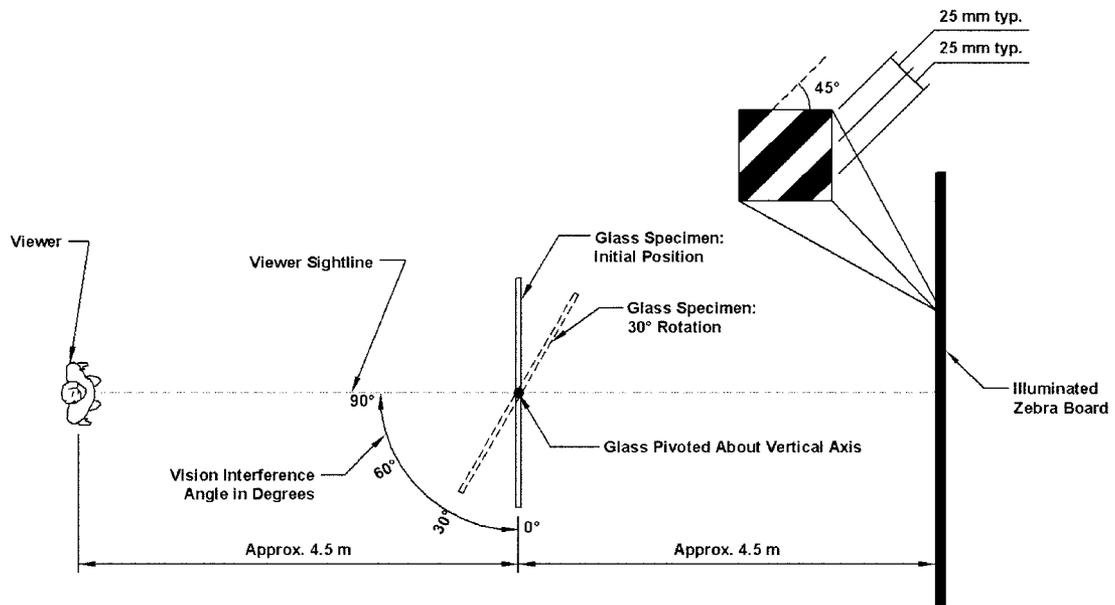


FIG. 1 Vision Interference Angle Procedure

TABLE 5 Allowable Linear Blemish Size and Distribution for Cut Size and Stock Sheet Qualities

Linear Blemish Size ^A Intensity Length	Q1 Quality 1 Distribution	Q2 Quality 2 Distribution	Q3 Quality 3 Distribution	Q4 Quality 4 Distribution
Faint ≤ 75 mm (3 in.)	Allowed with a minimum separation of 1500 mm (60 in.)	Allowed with a minimum separation of 1200 mm (48 in.)	Allowed	Allowed
Faint > 75 mm (3 in.)	None allowed	None allowed	Allowed	Allowed
Light ≤ 75 mm (3 in.)	None allowed	Allowed with a minimum separation of 1200 mm (48 in.)	Allowed	Allowed
Light > 75 mm (3 in.)	None allowed	None allowed	Allowed	Allowed
Medium ≤ 75 mm (3 in.)	None allowed	None allowed	Allowed with a minimum separation of 600 mm (24 in.)	Allowed
Medium > 75 mm (3 in.)	None allowed	None allowed	None allowed	Allowed
Heavy ≤ 150 mm (6 in.)	None allowed	None allowed	None allowed	Allowed with a minimum separation of 600 mm (24 in.)
Heavy > 150 mm (6 in.)	None allowed	None allowed	None allowed	None allowed

^A See 6.1.1.3 for detection of linear blemishes.