Laminated Glass Standards based on ASTM C1172

Blemishes in Laminated Glass

All visual inspections shall be made with the naked eye viewing samples in the vertical position at a viewing angle of 90° to the specimen using daylight (without direct sunlight) or other uniform diffused background lighting (see figure 1) that simulates daylight (minimum 1700 lux measured at the surface of the glass facing the light source). The glass shall be inspected at a distance of 39in (1.0 m). If a blemish is readily apparent under these viewing conditions, refer below to Table 3 to determine acceptability:

Blemish	<25 square feet			≥ 25 square feet		
	Central Area, in.	Outer Area, in.		Central Area, in.	Outer Area, in.	
		Covered Edge	Exposed Edge		Covered Edge	Exposed Edge
Bubbles	1/16	3/32		1/8	3/16	
Blow-in/edge bubble	N/A	1/4	1/16	N/A	1/4	1/16
Hair/Lint	Light*	Medium**		Light*	Medium**	
Inside dirt spot	1/16	3/32		3/32	5/32	
Concentrated lint	Light*	Medium**		Light*	Medium**	
Short interlayer/ unlaminated area chip	N/A	1/4	1/16	N/A	1/4	3/32
Scuff/streak	Light*	Medium**		Medium**	Medium**	

Table 3: maximum allowable laminating process blemishes (verticle glazing)

***Light indicates: barely noticeable at 39in (1m)**
****Medium indicates: noticeable at 39in (1m) but not at 10ft (3m)**

Bow and Warp in Laminated Glass

Bow/warp measurements shall take place with the glass in a free standing vertical position with the longest edge resting on blocks at the quarter points. With the laminate in this position, place a straightedge across the concave surface, parallel to and within 1in of the edge and measure the maximum deviation with a taper or feeler gage. A dial indicator may also be used. Below, Table 4 indicates the maximum allowable overall bow and warp for heat---treated laminated glass

14909 Calvert St. Los Angeles, CA 91411

800-280-7018 | www.LARailings.com

	Edge Dimension (in.)											
	0–18	>18–36	>36–48	>48–60	>60–72	>72–84	>84–96	>96–108	>108–120	>120–132	>132–144	>144–156
Laminate Make-up Two Glass lites of, (in.)	Maximum Bow (in.)											
1/8in to 3/16in	1/8	3/16	9/32	3/8	1/2	5/8	3/4	7/8	1	...	...	...
1/4in	1/16	1/8	3/16	9/32	3/8	1/2	5/8	3/4	7/8	1	1 1/8	1 1/4
5/16in	1/16	3/32	5/32	7/32	9/32	11/32	7/16	9/16	11/16	13/16	15/16	11/16
3/16in	1/16	3/32	1/8	3/16	1/4	5/16	3/8	1/2	5/8	3/4	7/8	1
1/2in	1/16	1/16	3/32	1/8	3/16	1/4	9/32	3/8	1/2	5/8	3/4	7/8

Table 4: maximum allowable overall bow and warp for heat-treated laminated Glass

Laminated Glass Mismatch

Mismatch indicates misaligned edges of two lights when laminated. Table 5 indicates length and width tolerances for rectangle shapes of symmetrically laminated glass including mismatch:

Overall Laminate Thickness	Transparent Glass	Patterned and Wired Glass	Heat Strength and Tempered Glass
≤1/4"	+5/32 , -1/16	+5/16 , -1/8	+7/32 , -3/32
1/4" --- 1/2"	+1/4 , -1/16	+5/16 , -1/8	'+1/4 , -1/8
1/2" --- 1"	+1/4 , -1/8	+5/16 , -1/8	+5/16 , -1/8

Table 5: maximum allowable mismatch of laminated glass

Please note that the above mismatch applies to symmetrical laminates without edgework. Add +1/8” and ---3/16” to the above length and width tolerances for symmetrical and non---symmetrical laminates requiring fabricated edgework and an additional +/---1/8” to the hole and notch tolerances listed in the fabrication section of this guide.

Uniformity and Color Variation in Laminated Glass

The iron content present in standard clear float glass imparts a slight green or blue--- green tint that may become more noticeable in glass thicknesses exceeding 3/8”(10mm). This effect may become more pronounced in certain applications, such as bullet resistant glazing, where the laminate contains numerous plies of clear glass. This coloration is not a cause for rejection. In cases that require high levels of optical clarity, low---iron glass should be considered.

14909 Calvert St. Los Angeles, CA 91411

800-280-7018 | www.LARailings.com

The lamination of certain low---E glass products to the interior of the laminate may affect the refractive index of the coating and could potentially cause a slight color shift to that of a non---laminated piece of the same low---E coated glass. Please consult your sales representative should you be installing laminated and non---laminated low---E coated products side---by---side.

Optical Distortion in Laminated Glass

When viewing images through or in reflection from laminated glass, the images may appear distorted. This distortion could arise from internal variations in the interlayer thickness, heat---treatment of the glass, differences in internal and external building pressures, and the manner in which the piece is glazed.

In an effort to increase the resistance to thermally and mechanically applied loads, multiple plies of heat---treated glass are often used in laminated. The inherent distortion characteristics (roller wave, bow, warp, and strain pattern – fully discussed in the following section) of heat---treated glass can accentuate the appearance of distortion and it is recommended that a full---size mock---up be viewed under typical job conditions for evaluation of distortion.

14909 Calvert St. Los Angeles, CA 91411

800-280-7018 | www.LARailings.com