dreamwalls

# Standard Guidelines and Tolerances

GLASS AND MIRROR PRODUCTS

MADE IN THE USA

## ACCEPTABILITY

Our flat annealed, laminated, or tempered laminated glass products boast superior optical qualities, meeting or exceeding the following industry standards:

1. **ANSI Z97.1** – American National Standard for Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test.
2. **ASTM C162** - Standard Terminology of Glass and Glass Products.
3. **ASTM C1036 (Q3)** - Standard Specification for Flat Glass.
4. **ASTM C1048** - Standard Specification for Heat-Treated Flat Glass -- Kind HS, Kind FT Coated and Uncoated Glass.
5. **ASTM C1172** - Standard Specification for Laminated Architectural Flat Glass.

The tolerances and specifications provided here should be viewed as general guidelines for acceptability. Occasionally, specified tolerances may seem slightly exaggerated due to viewing angles. In some cases, it may be feasible to reduce these tolerance levels. Special or unusual shapes may necessitate increased tolerance levels.

Any glass manufactured within the tolerance levels specified in this document will be deemed acceptable and will not be considered objectionable.

## MOCKUPS

To make a more informed decision regarding any specified limitations, tolerances, or standards in this document, we highly recommend installing full-size mock-ups at the job site. These mock-ups should include representative materials and/or lighting effects that will be present in the actual installation of the finished panels.

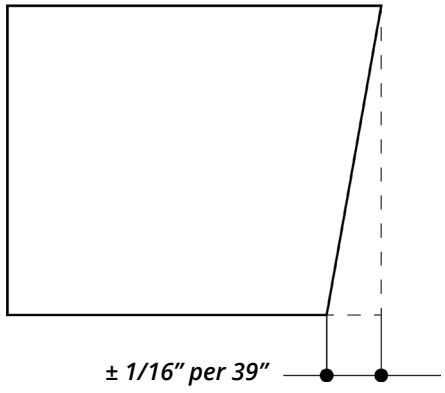
## DIMENSIONS

Acceptable dimensional tolerances based on glass thicknesses, according to ASTM 1036 - Standard Specification for Flat Glass:

| Glass Thickness | Tolerance |
|---|---|
| 1/8” (3mm) | ±1/16” (1.6mm) |
| 5/32” (4mm) | ±1/16” (1.6mm) |
| 3/16” (5mm) | ±1/16” (1.6mm) |
| 1/4” (6mm) | ±1/16” (1.6mm) |
| 5/16” (8mm) | ±5/64” (2.0mm) |
| 3/8” (9.5mm) | ±3/32” (2.4mm) |
| 1/2” (12.7mm) | ±1/8” (3.2mm) |
| 5/8” (16mm) | ±5/32” (4.0mm) |
| 3/4” (19mm) | ±3/16” (4.8mm) |

## TWISTING / SQUARENESS

Acceptable tolerance: ± 1/16” per 39” (2mm per 1m)

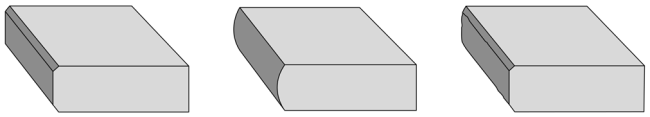


## EDGES

When glass is cut:

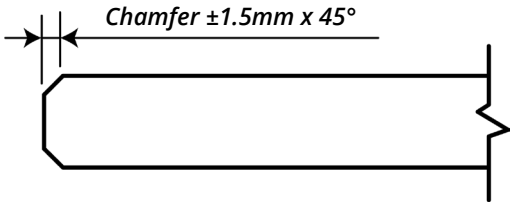
1. The edges are sharp.
2. The appearance is not as aesthetically pleasing.
3. The rough finish may conceal micro fissures that can lead to breakage when heated in the oven.

To address these issues, Dreamwalls can finish the edges of the glass using the following processes:



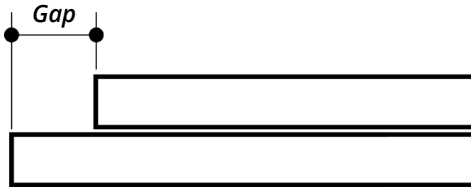
**Flat-Polished Edge** **Pencil-Polished Edge** **Seamed Edge** (sanded only)

For a flat-polished edge, unless otherwise specified, the edge is finished with a 45° chamfer (arris) on both sides. The dimensional tolerance for the chamfer width is approximately ±1.5mm:



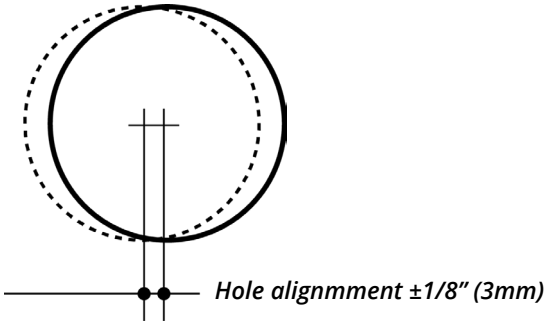

## EDGE ALIGNMENT

Gap tolerance for laminated products glass edges: ±1/8" (3mm)



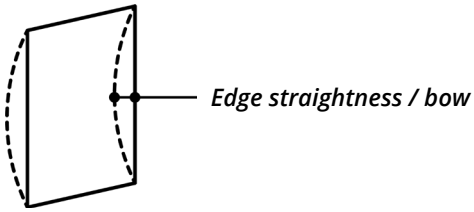

## HOLE TOLERANCES

1. Hole placement: ± 1/16" (1.5mm)
2. Hole alignment (laminated products): ± 1/8" (3mm)
3. Hole dimensions according to ASTM C1048: ±1mm




## EDGE STRAIGHTNESS

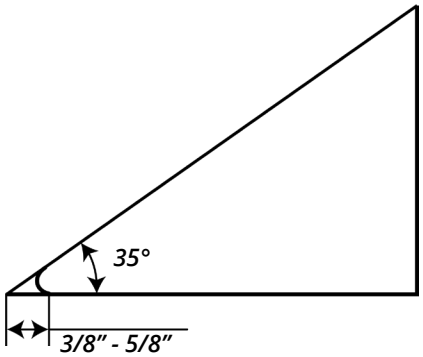
Based on glass measure and thickness according to ASTM C1048 – Standard Specification for HeatTreated Flat Glass, here are the max allowable tolerances for overall bow and warp:




| | **Edge Dimension** cm (in.) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0-50 (0-20) | >50-90 (>20-35) | >90-120 (>35-47) | >120-150 (>47-59) | >150-180 (>59-71) | >180-210 (>71-83) | >210-240 (>83-94) | >240-270 (>94-106) | >270-300 (>106-118) | >300-330 (>118-130) | >330-370 (>130-146) | >370-400 (>146-158) |
| **Glass Thickness** mm (in) | **Maximum Bow** mm (in) | | | | | | | | | | | |
| 3 (1/8) | 3.0 (0.12) | 4.0 (0.16) | 5.0 (0.20) | 7.0 (0.28) | 9.0 (0.35) | 12.0 (0.47) | 14.0 (0.55) | 17.0 (0.67) | 19.0 (0.75) | --- | --- | --- |
| 4 (5/32) | 3.0 (0.12) | 4.0 (0.16) | 5.0 (0.20) | 7.0 (0.28) | 9.0 (0.35) | 12.0 (0.47) | 14.0 (0.55) | 17.0 (0.67) | 19.0 (0.75) | --- | --- | --- |
| 5 (3/16) | 3.0 (0.12) | 4.0 (0.16) | 5.0 (0.20) | 7.0 (0.28) | 9.0 (0.35) | 12.0 (0.47) | 14.0 (0.55) | 17.0 (0.67) | 19.0 (0.75) | --- | --- | --- |
| 6 (1/4) | 2.0 (0.08) | 3.0 (0.12) | 4.0 (0.16) | 5.0 (0.20) | 7.0 (0.28) | 9.0 (0.35) | 12.0 (0.47) | 14.0 (0.55) | 17.0 (0.67) | 19.0 (0.75) | 21.0 (0.83) | 24.0 (0.94) |
| 8 (5/16) | 2.0 (0.08) | 2.0 (0.08) | 3.0 (0.12) | 4.0 (0.16) | 5.0 (0.20) | 6.0 (0.24) | 8.0 (0.31) | 10.0 (0.39) | 13.0 (0.51) | 15.0 (0.59) | 18.0 (0.71) | 20.0 (0.79) |
| 10 (3/8) | 2.0 (0.08) | 2.0 (0.08) | 2.0 (0.08) | 4.0 (0.16) | 5.0 (0.20) | 6.0 (0.24) | 7.0 (0.28) | 9.0 (0.35) | 12.0 (0.47) | 14.0 (0.55) | 17.0 (0.67) | 19.0 (0.75) |
| 12 - 22 (1/2 - 7/8) | 1.0 (0.04) | 2.0 (0.08) | 2.0 (0.08) | 2.0 (0.08) | 4.0 (0.16) | 5.0 (0.20) | 5.0 (0.20) | 7.0 (0.28) | 10.0 (0.39) | 12.0 (0.47) | 14.0 (0.55) | 17.0 (0.67) |

## ACUTE CORNERS

Acute corners with angles smaller than 35° will need to have a flattened tip of approximately 3/8” to 5/8” to prevent breakage during manufacturing and to minimize excessive surface bow and distortion.




## THICKNESS TOLERANCE

All glass products have a thickness tolerance established by the primary glass manufacturer and recognized by ASTM 1036. Additionally, the interlayers for laminated glass may vary in thickness due to the lamination process.

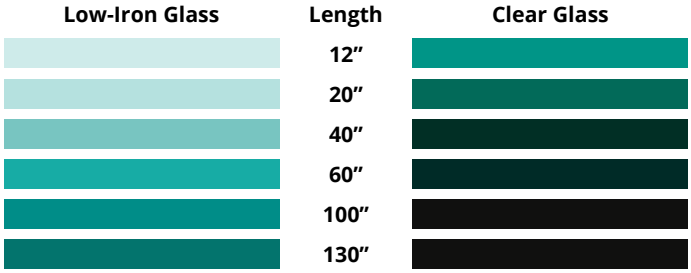
Dreamwalls will provide the specified components, and as such, any variations in unit thickness will not be grounds for rejection. Here are the tolerances for monolithic products per ASTM 1036:

| Glass Thickness | | Thickness Range | | | |
|---|---|---|---|---|---|
| mm | inches | mm | | inches | |
| | | min | max | min | max |
| 4 | 5/32 | 3.78 | 4.19 | 0.149 | 0.165 |
| 5 | 3/16 | 4.57 | 5.05 | 0.18 | 0.199 |
| 6 | 1/4 | 5.56 | 6.2 | 0.219 | 0.244 |
| 8 | 5/16 | 7.42 | 8.43 | 0.292 | 0.332 |
| 10 | 3/8 | 9.02 | 10.31 | 0.355 | 0.406 |
| 12 | 1/2 | 11.91 | 13.49 | 0.469 | 0.531 |
| 16 | 5/8 | 15.09 | 16.66 | 0.595 | 0.656 |
| 19 | 3/4 | 18.26 | 19.84 | 0.719 | 0.781 |

## EDGE COLOR

The edges of the glass may display varying colors based on several factors, including thickness, size, lighting conditions, edge finish, and the materials used in the glass composition. As the glass increases in thickness and dimensions, the green tint will deepen, appearing almost black, as illustrated in the chart below.

Consequently, perceived edge color differences are likely to occur. This variation is beyond our control, and therefore, perceived edge color differences are not grounds for rejecting the glass.




## STORAGE AND HANDLING

Mirrored, laminated, and decorative glass products must be stored in a secure, low-moisture/dry location, preferably a controlled climate environment.

In regard to all glass products care should also be taken to immediately clean off any foreign materials, liquids or gasses that may happen to spill, fall or otherwise come into contact with the glass. Liquids, even water or water vapor will stain the glass if not cleaned quickly. This may even occur during transit so it is very important to review glass carefully upon receipt.

Also, at no time should any metal hardware or tools, any sharp objects or hard, sticky substances be allowed to scratch, mark or otherwise be in prolonged contact with the glass, or with any part of the sealant at the perimeter.

Please note that we do not recommend storing any glass outdoors and the customer is responsible to follow industry common storage practices. We will not be held liable for any damage resulting from refusal to follow such storage practices developed by the industry or listed in our “Glass Cleaning and Maintenance Guidelines”. This guide is available upon request.

## INSTALLATION

The customer is solely responsible for glass installation, measurements, shop drawings, and structural calculations. Our responsibility is limited to manufacturing products according to the order confirmation and the drawings provided. We are not liable for any design, calculations, specifications, measurements, installation details, or knowledge of the product's final application, proper use, or prior design effects beyond our manufacturing processes.

We will only perform glass calculations and project revisions if the customer specifically requests this in writing. Otherwise, we will not conduct any project revisions or glass calculations, and the order will be manufactured with the understanding that the customer acknowledges their sole responsibility for performing structural and load calculations and ensuring the glass is installed safely and for long-term use.

The frame where the glass will be installed must be clean, free of liquids and debris, and equipped with functioning weep holes to allow excess moisture drainage. It should be well-finished according to the manufacturer's original standards, properly supported, securely fastened, entirely square, or flush with the intended and adjoining architecture according to the plan, and must allow for specified tolerances.

Neutral silicones are generally compatible with laminated glass. For further details on which silicone to use, please contact your sealant supplier or consult with us. The use of any unauthorized sealant will void all written, verbal, and/or implied warranties.

Regarding glazing sealants on frosted and decorative glass, such as acid-etched, frosted, or etched glass: If glazing sealants come into contact with the decorative surface, promptly remove the sealant residue using the proper cleaning methods outlined in our "Glass Cleaning & Maintenance" document. Failure to remove the residue promptly or using incorrect methods/tools may result in permanent damage to the decorative surface. We are not liable for any damage resulting from not following the proper cleaning methods.

Failure to comply with any of these guidelines will void our warranty.

## RECEIPT OF GOODS

Each individual lite in the delivery must be carefully inspected within 5 consecutive days of the delivery date reported by the freight company. This is to confirm that the pieces were manufactured according to the specifications outlined in the order acknowledgement. Claims made after this period will not be accepted.

## REGULAR CARE AND MAINTENANCE

Glass panels should be cleaned regularly using one of the following methods:

- A mixture of mild soap and water
- Commercial glass cleaner
- A solution of ½ Isopropyl Alcohol (IPA) and ½ water

Avoid cleaners with harsh chemicals like ammonia, which can damage the surface over time.

Regular cleaning and maintenance will help preserve the brilliance of the glass, maximize its heat-reflecting properties, and provide greater long-term value. For more details, please request our "Glass Care & Cleaning Instructions."

We are not liable for any damage, including scratches, rubs, stains, abrasion, or other issues caused by cleaning practices performed by the customer or any cleaning company, whether professional or amateur, certified or non-certified, after the product has been received.

The customer should not attempt to sandblast, etch, or acid wash any type of processed glass, as this will cause it to break. Processed glass includes laminated, tempered, or heat-strengthened glass.

## WARRANTIES

Standard warranties for all our products are available upon request and are valid from the date of purchase.

## CUSTOM REQUESTS

Please contact our sales team with any specific design criteria or quoting considerations you may have.

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# Standard Guidelines and Tolerances

BACKPAINTED PRODUCTS

MADE IN THE USA

## COLOR VARIATION

Managing color variance in decorative glass involves collaboration across the supply chain to establish and maintain color standards. The process includes defining a color standard, determining acceptable tolerances, and selecting appropriate measurement methods to ensure conformity.

## PERCEIVED COLOR

Understanding how perceived color differs from actual color, due to factors such as lighting, environment, and aging, is crucial in this process.

Perceived color is influenced by the interaction of light with the surface of the glass. Different light sources can significantly alter the appearance of the color, making it essential to evaluate glass samples under conditions that closely match the final installation environment.

## ENVIRONMENTAL FACTORS

Additionally, environmental factors like viewing angles, the background behind the glass, and the material's texture and gloss can further affect color perception.

Colors on higher gloss surfaces appear more saturated and vivid, while colors on etched surfaces appear more muted and flat.

As glazing ages, exposure to UV light, moisture, and pollution can cause color changes, making it important to consider these factors when matching new glazing to existing installations.

## GLASS SUBSTRATE

The glass used in backpainted products can influence the final color. Even glass of the same grade from the same float glass supplier may have slight color variations between batches.

Dreamwalls selects the highest quality low-iron glass for backpainted products and typically uses the same batch of glass for all pieces of the same color in a customer order to ensure consistency in color across glassboards.

However, if replacement or additional units are needed after the original batch is exhausted, slight color variations may occur due to differences in the glass substrate. These variations are inherent and cannot be completely eliminated, thus cannot be grounds for rejection.

To minimize these differences as much as possible, Dreamwalls uses a spectrophotometer to ensure the highest level of color consistency.

## EVALUATION AND MOCKUPS

Evaluating color can be done subjectively, by visually comparing samples, or objectively, using instruments like spectrophotometers that measure color in a three-dimensional color space. The CIE L*a*b* and CIE L*C*h systems are commonly used to define color coordinates, allowing for precise color matching.

However, even when colors are matched according to these systems, some visual differences may remain. Therefore, approving a full-size color mock-up before production and comparing it with actual production samples is recommended to ensure consistency.

***Reference**: NGA Glass Technical Paper "Guidelines and Best Practices on How to Manage Color Variance of Decorative Glazing"*

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# Standard Guidelines and Tolerances

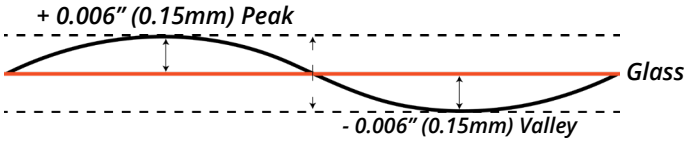
TEMPERED PRODUCTS

MADE IN THE USA


## DISTORTION

Standards for flatness in tempered glass products allow for a differential of up to 0.006" (0.15mm), as measured with a roller-wave gauge. Some level of roll distortion is inherent in all heat-strengthened and tempered glass products, and these effects can appear more pronounced depending on the viewing angle.

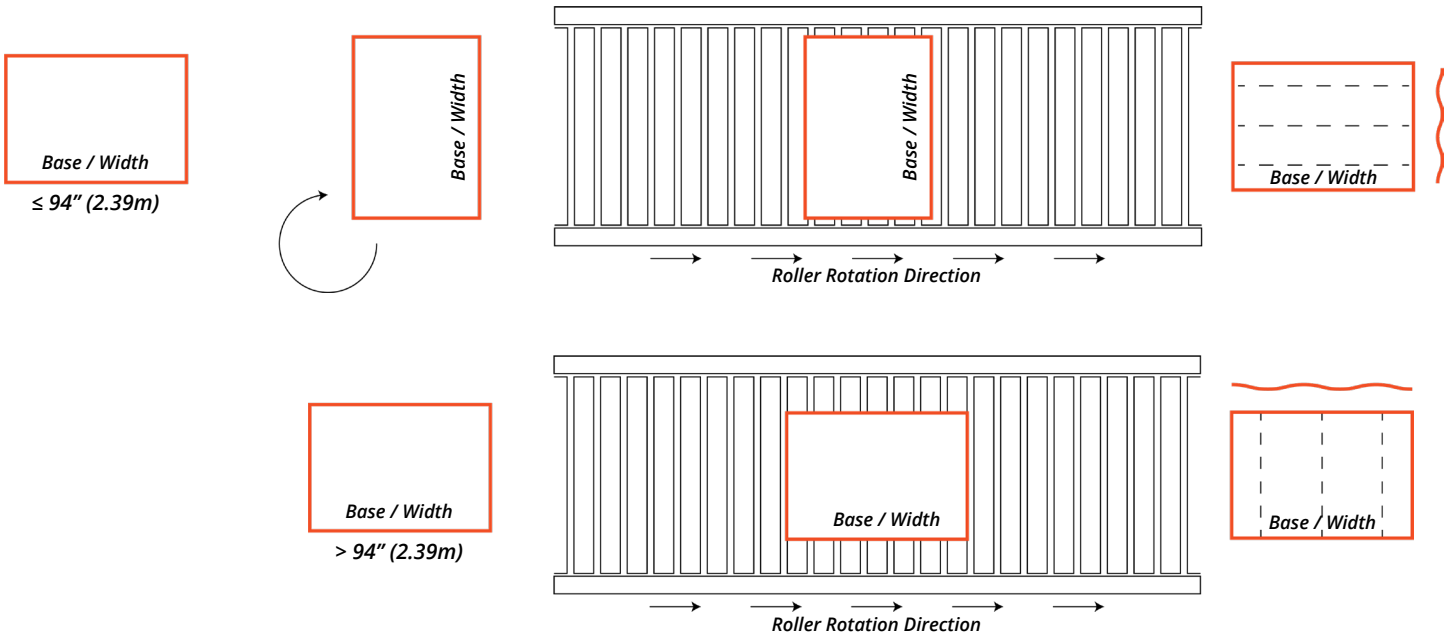
The term 'distortion' refers to the specific measurements and overall depth of the variations, from the height of the 'peaks' to the lowest point of the 'valleys' on the glass surface, caused by the rollers in the tempering oven.




## ROLLER WAVE

In tempered products, the glass can be rotated so that the roller direction can align the wave parallel to the base or width, when requested and feasible.

For pieces with a base or width dimension exceeding 94" (2.39m), roll wave distortion will be oriented parallel to the height, perpendicular to the base/width.



## IRIDESCENCE

Please note that according to ASTM C1048 "A strain pattern also known as iridescence is inherent in all heat-strengthened and fully tempered glass. This strain pattern may become visible under certain lighting conditions. It is a characteristic of heat-treated glass and should not be mistaken as discoloration or nonuniform tint or color, or a defect on the glass. The strain pattern does not affect any physical properties or performance values of the glass."

## HEAT MARKS

The heat-treating process can result in small marks on the glass surface, resembling fine salt grains. These marks are typically visible when viewing the glass at an angle or against a bright background. They tend to be more noticeable in thicker and larger glass pieces, especially those weighing over 300 pounds (140 kg). Glass that is 3/4" thick will consistently display these marks.

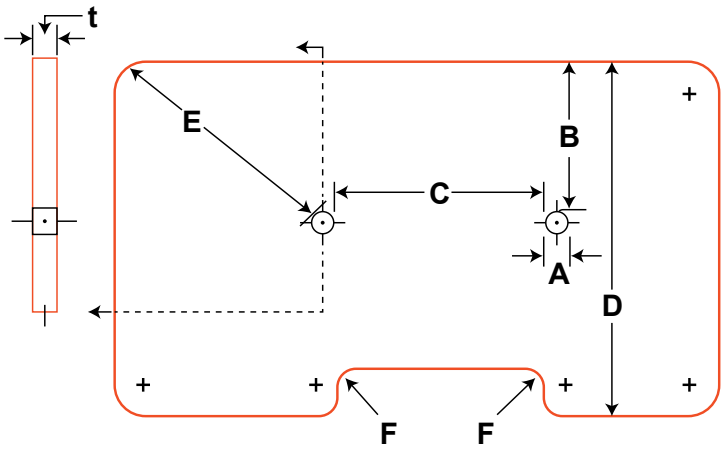
## BIREFRINGENCE

Also, per ASTM C1048, "A rainbow-type strain, or pattern known as birefringence, might be visible on heat treated glass (tempered, heat strengthened) or on any laminated product even when annealed, under certain types of indirect lighting or when viewing the glass at an angle approximately 45° or more. This phenomenon occurs very rarely but all heat-treated glass will show it under specific lighting conditions. It is not considered a defect, discoloration or a non-uniform tint or color, but is characteristic of this type of glass."

## HOLES, COUNTERSINKS, AND NOTCHES

Below are general guidelines for determining the minimum sizes and placement of holes and notches in heat-strengthened or tempered glass, as outlined in Section 7.8 of ASTM Standard Specification C 1048 (Standard Specification for Heat-Treated Flat Glass – Kind HS, Kind FT Coated and Uncoated Glass).

Special consideration is required for countersinks, which must be reviewed with the manufacturer before placing an order.




| | Glass Thickness (t) | | | | | | |
|---|---|---|---|---|---|---|---|
| | 1/8" | 3/16" | 1/4" | 3/8" | 1/2" | 3/4" | General Rule |
| A. Diameter of Holes | 3/16" | 1/4" | 5/16" | 7/16" | 9/16" | 13/16" | A ≥ t + 1/16" |
| B. Distance from Rim to Edge of Glass | 3/16" | 9/32" | 3/8" | 9/16" | 3/4" | 1 1/2" | B ≥ 1.5 x c except 3/4" B ≥ 2.0 x t |
| C. Distance between Rims of Holes | 13/16" | 1 7/32" | 1 5/8" | 2 7/16" | 3 1/4" | 4 7/8" | C ≥ 6.5 x t |
| D. Minimum Glass Width | 1" | 1 1/2" | 2" | 3" | 4" | 6" | D = 8 x t |
| E. Distance from Corner to Rim of Hole | 13/16" | 1 7/32" | 1 5/8" | 2 7/16" | 3 1/4" | 4 7/8" | E ≥ 6.5 x t |
| F. Minimum Fillet Radius | 1/8" | 3/16" | 1/4" | 3/8" | 1/2" | 3/4" | F ≥ t |

**NOTE**: The maximum hole diameter should not exceed 1/3 of the narrow dimension of the glass plate. For additional guidelines, refer to ASTM C 1048.

## BREAKAGE PATTERN

Tempered glass, like other types of glass, can break for various reasons, including damage during installation into a framing system, improper installation that places undue stress on the glass, impact damage, and other factors. In some cases, these conditions can cause the glass to break after some time has passed, rather than immediately.

Additionally, while tempered glass generally breaks into small, dice-like pieces, some longer, thinner fragments may be present when following the breaking procedure outlined in 16 CFR 1201. According to this procedure: “When breakage occurs, the 10 largest particles shall be selected within 5 minutes subsequent to the test and shall weigh no more than the equivalent weight of 10 square inches (64 square centimeters) of the original specimen.”

Therefore, the presence of longer, thinner pieces in a breakage pattern does not necessarily indicate a defect in the glass or the tempering process. This is especially true for laminated tempered glass.

## LOGOS

A permanent logo is applied on all tempered glass we manufacture, except for markerboards and backpainted glasss, to comply with ASTM and other international standards.

While we may accommodate special logo requests, any failure to place or write the logo exactly as specified, or even printing it when not required, will not be considered grounds for rejecting the glass.

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# Standard Guidelines and Tolerances

LAMINATED PRODUCTS

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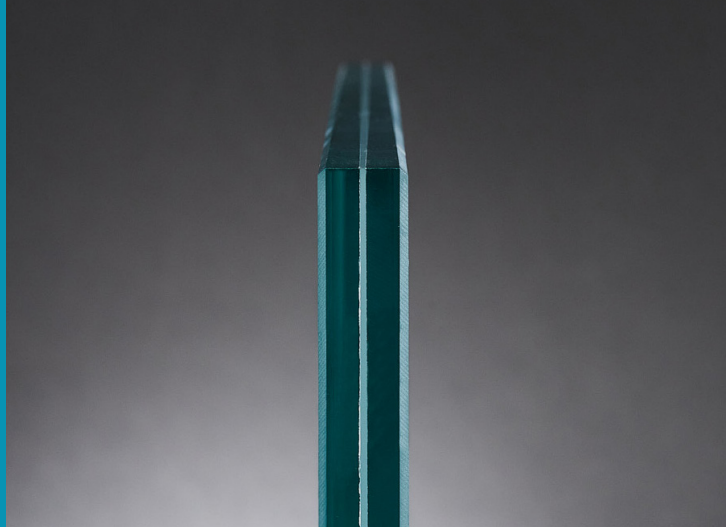


## SEALANTS

Neutral silicones are generally compatible with laminated glass. If you need additional information on which silicone to use, please contact your sealant supplier or reach out to us. The use of any unauthorized sealant will void all written, verbal, and/or implied warranties.

## GROUTING MATERIALS FOR HANDRAILS

It is common practice to use various grouting materials, such as Portland cement-based grouts or other aggressive substances, to secure glass baluster panels. However, the industry has found that these aggressive grouting materials, particularly in exterior applications, are likely to cause glass fractures or delamination when used with laminated glass.

It is essential to use sealants, gaskets, and wedges that are compatible with laminated glass and do not promote corrosion of the base channel. In addition to avoiding aggressive grouting materials, incorporating weeping systems in the base channel is crucial for properly evacuating water, preventing moisture accumulation, and protecting both the installation system and the laminated glass.

Technical support is provided only when the customer specifically requests, in writing, a review of installation details. However, the use of any grouting materials, including Portland cement-based grouts, will void any warranty.

## TRANSLUCENT / COLORED INTERLAYERS

When heat-treated glass (FT or HS) is laminated with colored interlayers, it may exhibit bands of darker or lighter color. This is not a defect but a characteristic of the product, provided the color differential does not exceed the allowed DE* 4.5.

## EDGE STABILITY

Laminated glass with exposed edges might develop small air pockets over time. These are not regarded as defects as long as they remain within 8mm (5/16”) from the edges.

## COLOR UNIFORMITY

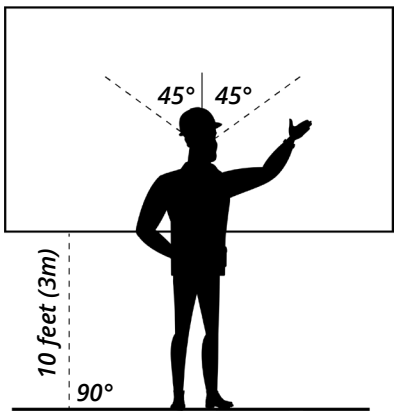
Laminated glass provides a very neutral appearance; however, it has a slight tint that may result in a minor difference in appearance compared to plain clear glass or glass with the same color composition.

Non-uniformity in coated and/or laminated glass products is assessed using DECMC, as outlined in ASTM Test Method D 2244 for CMC. For exterior reflectance, DE CMC should be less than 4.5 within a single lite or between adjacent lites compared to a reference target sample, according to the Measuring Color Uniformity Guidelines.

Differences in perceived color or lighting transmission when the glass is used as a lighting device will not be grounds for rejecting the product. The only acceptable method for measuring color uniformity is with a colorimeter or spectrophotometer under lighting conditions specified in ASTM 1048 or 1172.

## INSPECTION GUIDELINES

ASTM industry standards recommend that finished monolithic or laminated units be visually inspected from a distance of 10 feet (3m) at a 90-degree viewing angle. The glass should be placed against a bright, uniformly colored opaque background and viewed in natural daylight.




With these conditions met, the standards for acceptability regarding tempered or annealed laminated glass are as follows:

### Bubbles

According to ASTM 1172, if an air bubble or other visible impurity is present, the following criteria must be used to determine acceptability: air bubbles larger than 1/4" (6mm) in diameter are not permitted anywhere on the glass. Similarly, any blow-in or short interlayer larger than 1/4" (6mm) is not allowed unless the glass is framed or captured by more than 1/4" (6mm).

### Edges and Chips

The edges must be free from excess PVB, with a tolerance of up to 1/16" (2mm) of PVB protrusion. The cleanliness of the SGP or PVB interlayer around the edges of holes must not interfere with the fittings.

Chips on the edges are acceptable if they will be covered by the installation frame and are not visible through the glass surface once installed. If the edges are not captured, one chip per 3 feet (1.0m) is permissible, provided it is less than 3/8" (10mm) in length and 1/16" (2mm) in width, and not visible through the glass surface.

### Scratches

According to ASTM C1036 (Q3), all glass products should be inspected from a distance of 10 feet (3m). Scratches up to 3 inches (75 mm) in length are permitted, provided they are visible from this distance and are separated by at least 24 inches (600 mm).

Concentrated scratches or abraded areas are not acceptable. Scratches that are not visible from 10 feet (3m), even if larger than the specified dimensions, will not be grounds for rejection.

### Blemishes

According to ASTM 1172, a blemish is a defect present on the glass surface between the laminate and the glass. Blemish accumulation occurs when more than ten blemishes are found within an area no larger than 8" (200mm) in diameter.

### **Blemish Tolerances** (ASTM C1172)

| **Blemish** | **Up to 25ft²** (2.5m²) | | **25 to 75ft²** (2.5 to 7.0m²) | | **Over 75ft²** (7.0m²) | |
|---|---|---|---|---|---|---|
| | Central | Outer | Central | Outer | Central | Outer |
| Bubbles / Boil | 1/16" (1.6mm) | 3/32" (2.4mm) | 1/8" (3.2mm) | 3/16" (4.8mm) | 1/4" (6.4mm) | 1/4" (6.4mm) |
| Blow-in / Edge Boil | n/a | CE 1/4" (6.4mm)<br>EE 1/16" (1.6mm) | n/a | CE 1/4" (6.4mm)<br>EE 3/32" (2.3mm) | n/a | CE 5/16" (8.0mm)<br>EE 1/8" (3.2mm) |
| Fuse | 1/32" (0.8mm) | 1/16" (1.6mm) | 1/16" (1.6mm) | 3/32" (2.4mm) | 3/32" (2.4mm) | 5/32" (4.0mm) |
| Hair / Lint (single strand) | light intensity | medium intensity | light intensity | medium intensity | medium intensity | medium intensity |
| Inside Dirt (spot) | 1/16" (1.6mm) | 3/32" (2.4mm) | 3/32" (2.4mm) | 5/32" (4.0mm) | 1/8" (3.2mm) | 3/16" (4.8mm) |
| Lint Areas of Concentrated Lint | light intensity | medium intensity | light intensity | medium intensity | medium intensity | medium intensity |
| Short Interlayer / Un-Laminated Area / Chip | n/a | CE 1/4" (6.4mm)<br>EE 1/16" (1.6mm) | n/a | CE 1/4" (6.4mm)<br>EE 3/32" (2.4mm) | n/a | CE 1/4" (6.4mm)<br>EE 1/8 (3.2mm) |
| Scuff / Streak | light intensity | medium intensity | medium intensity | medium intensity | medium intensity | medium intensity |

**CE** = covered edge of glass edge bite and **EE** = exposed edge. (If CE or EE is unknown use CE tolerance.)
**Light intensity** = Barely noticeable at 39" (1m).
**Medium intensity** = Noticeable at 39" (1m) but not at 10 feet (3m).

### Ghost Circular Marks

Under certain lighting, temperature, and humidity conditions that cause condensation on glass—such as rainwater running down, fogged shower doors, or refrigerated rooms—circular marks may become visible that are normally not seen. These marks, known as “Ghost Circular Marks,” appear under specific conditions and fade away just as they appear.

These marks, typically ranging from 3 to 12 inches in diameter, do not obstruct vision through the glass but may create a contrast or alter the pattern of water running down the surface. They may also appear as circular images when the glass fogs. Such marks can arise during the manufacturing or fabrication process, particularly when glass is handled with suction cups, which, despite being made of soft rubber-like material, can microscopically abrade the glass surface.

This phenomenon is uncontrollable, does not affect the performance of the glass, does not obstruct vision, and is not addressed by industry standards. It is impossible to consistently and cost-effectively detect or reproduce these marks during manufacturing, so they are not considered defects.