

LAMINATED GLASS

Technical Data

- Safety
- Security
- Sound control
- Shatter resistance
- Optical clarity



Guardian Industries has been a leader in laminated glass for over 60 years. Guardian's first involvement with laminated glass was through our founding company, Guardian Glass. The safety benefits of laminated glass were quickly realized in the architectural market as well as in automotive windshields.

Guardian remains in the forefront of laminated glass development, with laminating facilities in the United States, Canada and Europe. At these plants, we have the capability to manufacture laminated glass in thicknesses from 1/4" (6mm) to bullet resistant thicknesses of 2" (50mm) or more.

Laminated glass has the capability to incorporate a variety of glass combinations of clear, tinted or reflective. In situations where added strength is needed, individual lites of the laminated glass can be heat-strengthened or tempered. Low-E glass, when laminated, loses its low emissivity properties. For the maximum effect of Low-E, the coating should be placed on the #2 or #3 surface of a laminated insulating glass unit.

Sloped Glazing

The use of sloped glazing, meaning installation of glass at an angle greater than 15° from a vertical plane, has increased significantly in recent years. Architects are realizing the advantages of an open and spacious appearance and the benefits of natural daylight.

The mere fact that glass can break has caused some concern in areas of overhead glazing. However, through the use of laminated glass, the concerns associated with annealed, heat-strengthened, tempered or wire glass are significantly reduced. Because of the added safety factor of laminated glass, Guardian has adopted the corporate posture that laminated glass must be used in all overhead applications. In line with this posture, Guardian will not knowingly supply unlaminated glass products for

sloped glazing applications. The safety of the building occupants is of prime concern.

Laminated glass in sloped glazing offers the design professional a wider degree of flexibility in product selection. Some common combinations of laminated glass available are described here.

- *Clear Laminated Glass* with two lites of clear annealed glass and a vinyl interlayer. Heat-strengthened glass is available for high-load areas.
- *Tinted Laminated Glass* with a lite of tinted heat-strengthened glass, a lite of heat-strengthened clear glass and a vinyl interlayer. (The tinted glass is placed to the outside.)
- *Reflective Laminated Glass* with a lite of reflective heat-strengthened glass, a lite of heat-strengthened clear glass and a vinyl interlayer. (The reflective coating is on the #2 surface.)
- *Clear Insulating Laminated Glass* with an outer lite of clear heat-strengthened glass, 1/2" (12mm) airspace, a laminated lite consisting of a lite of clear heat-strengthened glass, a vinyl interlayer and a lite of clear heat-strengthened glass.
- *Tinted Insulating Laminated Glass* with a lite of tinted heat-strengthened glass, 1/2" (12mm) airspace, a laminated lite consisting of a lite of clear heat-strengthened glass, a vinyl interlayer and a lite of clear heat-strengthened glass.
- *Reflective Insulating Laminated Glass* with a lite of reflective heat-strengthened glass, 1/2" (12mm) airspace, a laminated lite consisting of a lite of clear heat-strengthened glass, a vinyl interlayer and a lite of clear heat-strengthened glass. (The reflective coating is on the #2 surface.)
- Tempered glass is available where required to meet mechanical loads or regulated by code.

The chart shown on the reverse side has proven to be a reliable guide in determining laminated glass thicknesses for sloped glazing. Additional information is available in Volume 7 of the American Architectural Manufacturers Association (AAMA) "Skylight and Sloped Glazing" manual. Extreme wind or snow loads may dictate size limitations greater than shown.



GUARDIAN
A Company of Vision

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Properties

- Possesses approximately 75% of the strength of an annealed lite of glass of equal thickness. Additional strength can be gained with heat-strengthening or tempering.
- Reduces the transmission of sound.
- When broken, laminated glass has the tendency to remain in the opening.
- Selected thicknesses meet the requirements of the Consumer Product Safety Commission 16 CFR 1201 as a safety glazing material.
- Improves security.
- Reduces fading.
- Protects reflective glass coatings from scratches and other surface damage.
- In annealed form, laminated glass can be cut and drilled.

Precautions

In sloped glazing, the added weight of laminated glass must be taken into consideration when determining load limits and installation techniques. The practice of walking on any type of glass is extremely dangerous and may lead to serious injury. **This practice is prohibited.**

The edges of a laminated lite must not be exposed to any prolonged contact with moisture. Consideration must be given to the use of weep holes or other alternate glazing procedures to assure a dry framing cavity.

Edge delamination is possible in silicone structural glazing applications.

U-values may vary. For example, the U-value of a sloped laminated lite can be higher than a comparable vertically glazed lite. The following chart provides a comparison.

| Glass Type | Slope (degrees from horizontal) | | | | | |
|------------|---------------------------------|------|------|------|------|------|
| | 90 | 60 | 45 | 30 | 15 | 0 |
| Clear | 0.47 | 0.50 | 0.51 | 0.52 | 0.54 | 0.55 |
| SS-8 | 0.39 | 0.43 | 0.44 | 0.45 | 0.47 | 0.48 |
| Low-E | 0.31 | 0.36 | 0.38 | 0.39 | 0.41 | 0.43 |

Notes: Data based on an insulating glass construction of 1/4" glass, 1/2" air space and 1/2" laminated lite.

| Specified Laminated Glass Thickness | | Size Limitations | Weight psf |
|-------------------------------------|---------------------------|---------------------------------------------------------------------------------------------|------------|
| 1/4" | 2 lites 1/8" 0.060 vinyl | Less than 10 ft ² and a width dimension 36" or less | 3.40 |
| 7/16" | 2 lites 3/16" 0.060 vinyl | 11-20 ft ² and a width dimension 36" or less | 5.16 |
| 1/2" | 2 lites 1/4" 0.030 vinyl | Greater than 20 ft ² and/or a width dimension greater than 36" but less than 48" | 6.03 |
| 9/16" | 2 lites 1/4" 0.060 vinyl | Greater than 20 ft ² and/or a width dimension greater than 36" but less than 48" | 6.20 |

For glass dimensions greater than 48" in width, and/or 96" in length, and/or 40sq. ft. in area, consult your Guardian representative.

Conformances

- ASTM C 1036, Standard Specification for Flat Glass.
- ASTM C 1048, Standard Specifications for Heat-Treated Flat Glass: Kind H.S., Kind F.T., coated and uncoated.
- Consumer Product Safety Commission 16 CFR 1201.
- ANSI Z 97.1
- Independently certified by the Safety Glazing Certification Council (SGCC).

Additional Information

Additional references on laminated glass can be obtained by contacting the Laminated Glass division of the Glass Association of North America (GANA) (785) 266-7013.

- *Laminated Glass Design Guide 1994*

Additional references on sloped glazing can be obtained by contacting the American Architectural Manufacturers Association (AAMA) (847) 303-5664 or the Sealed Insulating Glass Manufacturers Association (SIGMA) (312) 644-6610.

- *AAMA Glass Design for Sloped Glazing (GDSG-1) (1987)*
- *SIGMA Voluntary Guidelines for Sloped Glazing of Organically Sealed Insulating Glass Units.*