

# *Silk-screened Glass*

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**Oldcastle Glass®**

*Where glass becomes architecture™*



**Principal Financial Group**

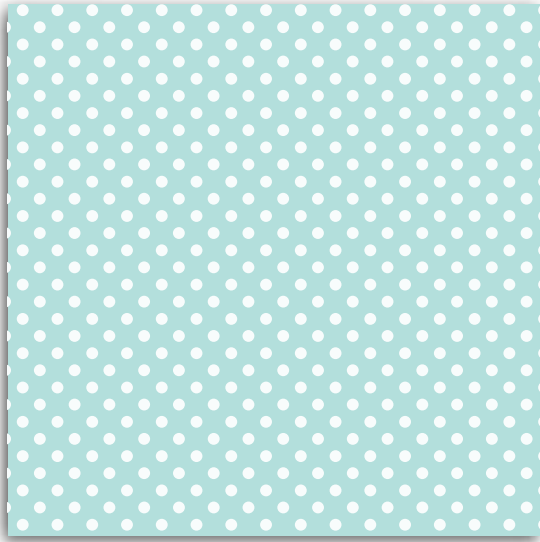
Des Moines, Iowa  
Architect: Murphy/Jahn

Silk-screened Glass



**Oldcastle Glass®**

*Where glass becomes architecture™*



## Silk-Screened Applications

*Silk-screened glass has a wide range of standard, decorative and custom applications including:*

- All-Glass Entrances
- Interior Partitions
- Signage
- Skylights
- Storefronts
- Exterior Window walls
- Commercial fixed and Operable Windows
- Canopies

**O**ldcastle Glass® silk-screened products offer building designers exciting and different ways to customize exterior and interior glass, by using standard and custom solid and screened patterns and colors. Silk-screened glass is offered monolithically, in insulating glass units, or as laminated glass, providing beauty, safety and functionality.

**Gonda Building, Mayo Clinic**  
Rochester, Minnesota, Architect: Ellerbe Becket



## Silk-screened Glass

### Introduction

Oldcastle Glass® provides today's design professional with a family of glass products that create that distinctive look—from refreshingly new exterior cladding designs to exciting interior applications. Oldcastle Glass® silk-screened decorative glass is available in a palette of colors and patterns, allowing the glass to become a critical design element that is not only functional, but also aesthetically important. Silk-screened glass can provide a truly unique architectural statement. The versatile nature of this product allows it to be produced in many colors, thereby making decorative glass an attractive product choice for owners, architects and designers who seek to attain unique features in the structures they create or refine.

Silk-screened glass can be specified for both exterior and interior applications. When used on building exteriors, the painted surface must be protected from direct contact with the environment and is normally found in an insulating glass unit. Combining silk-screened glass with clear, tinted, Low-E, or reflective glass,

can control light transmittance, reduce solar heat gain and provide a desired level of privacy.

Silk-screened decorative glass is fabricated by transferring images or geometric designs to a glass surface. By using the same basic technology as in spandrel glass, the ceramic frit is applied to the glass through a fine mesh screen containing a standard or custom design. More durable than acid-etched or sandblasted surfaces, silk-screened glass is less susceptible to staining, easier to clean and always heat-treated to withstand thermal and/or mechanical stress.

Whether designing for interior or exterior applications, privacy or openness, silk-screened glass is attractive, easy to clean and “more resistant to graffiti” than most building materials. Laminated silk-screened glass can also be used in skylight and canopy applications since it has a significant influence on natural light entering the area. By incorporating silk-screened glass into an insulating glass unit, its aesthetic and performance characteristics are enhanced.

### Description

Available in one-piece orders or high-volume runs, silk-screened decorative glass is custom-made by transferring a silk-screen image to the glass and then processing it through a horizontal tempering furnace. Each individual lite is screen-printed with the desired pattern and ceramic enamel frit color. The ceramic frit can be silk-screened onto the glass substrate in one of three standard patterns—dots, lines, holes—or in a full-coverage application. In addition, custom

patterns can be easily duplicated on the glass. Depending on the pattern and the color, the glass lite can be made transparent, translucent or opaque. *With a wide range of glass substrate and frit color options, the silk-screen process gives designers exceptional creative flexibility.*

*For a list of available glass products/colors, go to the White Glass Options Tab.*

## Silk-screened Glass

### Capabilities

**Thickness:** 1/8" through 1/2".

**Size**

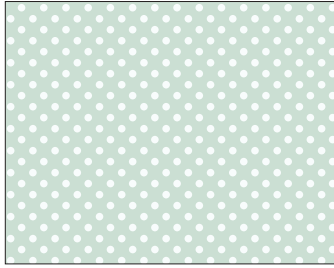
Maximum size is generally 72" x 120".  
Minimum size is 12" x 12".

The maximum glass size will vary with glass thickness and equipment capabilities.

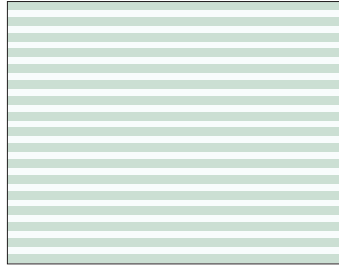
**Colors**

Oldcastle Glass® offers a ceramic enamel frit in the following standard color options: white, black and etch. A wide range of more traditional colors, as well as custom colors, may be special-ordered. While clear glass is a common substrate for silk-screened glass, there is a wide range of glass types for designers to choose from to achieve that special look.

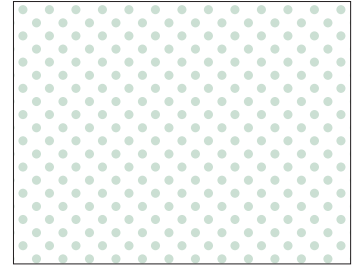
### Standard Silk-screened Patterns



**Dots**—40% coverage;  
1/8" dots staggered on 1/4" centers

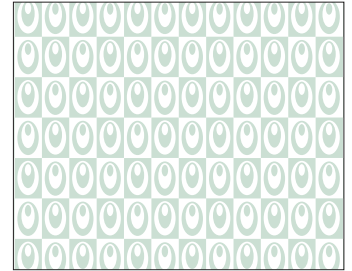
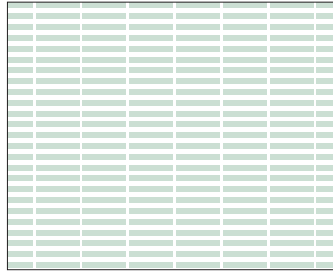
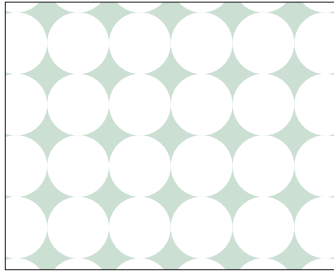


**Lines**—50% coverage;  
1/8" lines on 1/4" centers



**Holes**—60% coverage;  
1/8" holes staggered on 1/4" centers

### Custom Silk-screened Pattern Examples



**Custom Capabilities:** For design assistance with custom silk-screened options, call 1-866-OLDCASTLE(653-2278) or log on to [www.oldcastleglass.com](http://www.oldcastleglass.com).

*(continued on next page)*



## Silk-screened Glass: Monolithic Glass<sup>(1)</sup>



### Dot Pattern - 40% Coverage - White Frit

Glass Product	Transmittance %		Reflectance %			U-Value (or U-Factor)		Shading Coefficient	Solar Heat Gain Coefficient	Relative Heat Gain
	Visible	Total Solar	Visible Out	Visible In	Solar Out	Winter	Summer			
Clear	61	52	15	26	22	1.09	1.05	0.69	0.59	153
Green	53	32	12	26	10	1.09	1.11	0.56	0.48	128
Gray	31	28	6	24	9	1.09	1.12	0.53	0.46	122
Bronze	38	34	8	25	11	1.09	1.11	0.57	0.49	130
Blue	39	32	8	25	10	1.09	1.11	0.56	0.48	128
Blue-Green	52	33	12	25	11	1.09	1.11	0.57	0.49	130
Azuria™ (Azurlite®)	47	22	10	25	7	1.09	1.13	0.49	0.42	114
EverGreen™	46	23	10	25	7	1.09	1.13	0.50	0.43	116



### Line Pattern - 50% Coverage - White Frit

Glass Product	Transmittance %		Reflectance %			U-Value (or U-Factor)		Shading Coefficient	Solar Heat Gain Coefficient	Relative Heat Gain
	Visible	Total Solar	Visible Out	Visible In	Solar Out	Winter	Summer			
Clear	54	46	16	31	25	1.09	1.06	0.63	0.54	141
Green	47	28	13	30	12	1.09	1.11	0.52	0.45	120
Gray	27	25	7	29	10	1.09	1.12	0.50	0.43	116
Bronze	33	30	8	29	12	1.09	1.11	0.54	0.46	124
Blue	35	28	9	29	11	1.09	1.11	0.53	0.45	122
Blue-Green	46	29	13	30	12	1.09	1.11	0.53	0.46	122
Azuria™ (Azurlite®)	42	20	11	30	8	1.09	1.13	0.47	0.40	110
EverGreen™	41	20	10	30	8	1.09	1.13	0.47	0.40	110



### Hole Pattern - 60% Coverage - White Frit

Glass Product	Transmittance %		Reflectance %			U-Value (or U-Factor)		Shading Coefficient	Solar Heat Gain Coefficient	Relative Heat Gain
	Visible	Total Solar	Visible Out	Visible In	Solar Out	Winter	Summer			
Clear	47	40	17	35	28	1.09	1.07	0.57	0.49	129
Green	41	24	14	35	13	1.09	1.12	0.49	0.42	114
Gray	24	22	7	34	11	1.09	1.12	0.48	0.41	112
Bronze	29	26	9	34	14	1.09	1.11	0.50	0.43	116
Blue	30	24	9	34	13	1.09	1.12	0.49	0.42	114
Blue-Green	41	25	13	35	14	1.09	1.11	0.49	0.42	114
Azuria™ (Azurlite®)	37	17	12	34	8	1.09	1.13	0.45	0.38	106
EverGreen™	36	17	11	34	9	1.09	1.13	0.44	0.38	104

(1) 1/4" (6 mm) thick lite with a white frit pattern on surface No. 2 (inside surface).

Values based on measured samples. Actual values may vary with glass/frit thickness, paint lots and other process parameters.

Glass performance terms are defined in Section 18, page 13 and 14.

(continued on back)



## Silk-screened Glass: Laminated Glass<sup>(1)</sup>



### Dot Pattern - 40% Coverage - White Frit

Glass Product	Transmittance %		Reflectance %			U-Value (or U-Factor)		Shading Coefficient	Solar Heat Gain Coefficient	Relative Heat Gain
	Visible	Total Solar	Visible Out	Visible In	Solar Out	Winter	Summer			
Clear	53	37	15	27	23	1.00	1.02	0.55	0.47	124
Green	47	23	12	26	11	1.00	1.06	0.47	0.41	109
Gray	27	20	6	25	9	1.00	1.06	0.45	0.39	105
Bronze	33	24	8	25	12	1.00	1.06	0.48	0.41	111
Blue	34	23	8	25	11	1.00	1.06	0.47	0.41	109
Blue-Green	46	24	12	26	11	1.00	1.06	0.48	0.41	111
Azurite™ (Azurlite®)	41	16	10	26	7	1.00	1.07	0.43	0.37	101
EverGreen™	40	16	10	26	8	1.00	1.07	0.42	0.36	99



### Line Pattern - 50% Coverage - White Frit

Glass Product	Transmittance %		Reflectance %			U-Value (or U-Factor)		Shading Coefficient	Solar Heat Gain Coefficient	Relative Heat Gain
	Visible	Total Solar	Visible Out	Visible In	Solar Out	Winter	Summer			
Clear	47	33	16	30	26	1.00	1.02	0.51	0.44	116
Green	41	20	13	30	12	1.00	1.06	0.44	0.38	103
Gray	24	18	7	29	10	1.00	1.07	0.43	0.37	101
Bronze	29	21	8	29	13	1.00	1.06	0.45	0.36	105
Blue	30	20	9	29	12	1.00	1.06	0.44	0.38	103
Blue-Green	41	21	13	30	13	1.00	1.06	0.45	0.39	105
Azurite™ (Azurlite®)	37	14	11	30	8	1.00	1.07	0.41	0.35	97
EverGreen™	36	14	10	30	8	1.00	1.07	0.41	0.35	97



### Hole Pattern - 60% Coverage - White Frit

Glass Product	Transmittance %		Reflectance %			U-Value (or U-Factor)		Shading Coefficient	Solar Heat Gain Coefficient	Relative Heat Gain
	Visible	Total Solar	Visible Out	Visible In	Solar Out	Winter	Summer			
Clear	41	28	17	34	29	1.00	1.03	0.46	0.39	106
Green	36	17	14	34	13	1.00	1.06	0.42	0.36	99
Gray	21	15	7	33	11	1.00	1.07	0.41	0.35	97
Bronze	26	18	9	33	14	1.00	1.06	0.42	0.36	99
Blue	27	17	9	34	13	1.00	1.06	0.42	0.36	99
Blue-Green	36	18	13	34	14	1.00	1.06	0.42	0.36	99
Azurite™ (Azurlite®)	32	12	12	34	9	1.00	1.07	0.39	0.33	93
EverGreen™	31	12	11	34	9	1.00	1.05	0.30	0.26	75

(1) Outer lite: 1/4" (6 mm) thick with a white frit pattern on the No. 2 surface (inner surface of the outer lite).

Interlayer: 0.060" (1.52 mm), clear PVB. Inner lite: 1/4" (6 mm) clear.

Values based on measured samples. Actual values may vary with glass/frit thickness, paint lots and other process parameters. Glass performance terms are defined in Section 18, page 13 and 14.

(continued on next page)



## Silk-screened Glass: Insulating Glass Unit<sup>(1)</sup>



### Dot Pattern - 40% Coverage - White Frit

Glass Product	Transmittance %		Reflectance %			U-Value (or U-Factor)		Shading Coefficient	Solar Heat Gain Coefficient	Relative Heat Gain
	Visible	Total Solar	Visible Out	Visible In	Solar Out	Winter	Summer			
Clear	55	41	18	29	24	0.48	0.55	0.58	0.50	123
Green	47	25	14	29	11	0.48	0.57	0.43	0.37	93
Gray	28	22	7	27	10	0.48	0.58	0.39	0.34	87
Bronze	34	27	9	28	12	0.48	0.57	0.44	0.38	96
Blue	35	25	9	28	11	0.48	0.57	0.43	0.37	93
Blue-Green	47	26	14	28	12	0.48	0.57	0.43	0.37	95
Azuria™ (Azurlite®)	42	18	12	28	7	0.48	0.58	0.35	0.30	77
EverGreen™	41	18	12	28	7	0.48	0.58	0.36	0.31	79



### Line Pattern - 50% Coverage - White Frit

Glass Product	Transmittance %		Reflectance %			U-Value (or U-Factor)		Shading Coefficient	Solar Heat Gain Coefficient	Relative Heat Gain
	Visible	Total Solar	Visible Out	Visible In	Solar Out	Winter	Summer			
Clear	49	37	18	33	27	0.48	0.55	0.52	0.45	112
Green	43	22	15	32	13	0.48	0.57	0.39	0.34	86
Gray	24	20	8	31	11	0.48	0.58	0.37	0.32	82
Bronze	30	24	9	31	13	0.48	0.57	0.41	0.35	90
Blue	32	22	10	31	12	0.48	0.57	0.39	0.34	86
Blue-Green	42	23	15	32	13	0.48	0.57	0.40	0.34	88
Azuria™ (Azurlite®)	38	16	13	32	8	0.48	0.58	0.33	0.28	74
EverGreen™	37	16	11	32	8	0.48	0.58	0.33	0.28	74



### Hole Pattern - 60% Coverage - White Frit

Glass Product	Transmittance %		Reflectance %			U-Value (or U-Factor)		Shading Coefficient	Solar Heat Gain Coefficient	Relative Heat Gain
	Visible	Total Solar	Visible Out	Visible In	Solar Out	Winter	Summer			
Clear	43	32	19	36	29	0.48	0.56	0.47	0.40	101
Green	37	19	15	36	13	0.48	0.57	0.36	0.31	79
Gray	22	18	8	35	11	0.48	0.58	0.34	0.29	76
Bronze	26	21	10	35	15	0.48	0.57	0.37	0.32	82
Blue	27	19	10	35	13	0.48	0.57	0.35	0.31	79
Blue-Green	37	20	14	36	15	0.48	0.57	0.36	0.31	80
Azuria™ (Azurlite®)	34	14	13	35	8	0.48	0.58	0.30	0.26	69
EverGreen™	33	14	12	35	9	0.48	0.58	0.30	0.26	68

(1) **Outer lite:** 1/4" (6 mm) thick with a white frit pattern on the No. 2 surface (inner surface of the outer lite).

**Airspace:** 1/2" (12 mm) thick. **Inner lite:** 1/4" (6 mm) clear.

Values based on measured samples. Actual values may vary with glass/frit thickness, paint lots and other process parameters. Glass performance terms are defined in Section 18, page 13 and 14.

(continued on back)





## Silk-screened Glass

### Capabilities (continued)

#### Silk-screened Glass Performance Notes

Values are typical for Oldcastle Glass® products at the time of testing. Data will vary due to manufacturing tolerances as well as glass and ceramic frit variations. All data are Center of Glass (COG) values.

The optical properties for total solar and the visible spectrum were measured following the ASTM E1084-86 and ASTM E972-88 standards, respectively for the white frit coating at 100% coverage on 1/4" clear glass.

Total solar and visible optical properties for a 40%, 50% and 60% frit coating coverage were calculated following standard ASHRAE methodology. The solar

heat gain coefficient (SHGC) and U-Values were calculated using the LBNL's Window 4.1 program. The environmental conditions used for the calculations are:

**Summer** (U-Value and SHGC): Indoor/outdoor temperatures: 75/90°F; incident solar radiation: 248.2 Btu/hr-ft<sup>2</sup>; wind: 7.5 mph

**Winter** (U-Value): Indoor/outdoor temperatures: 70/0°F; no sun; wind: 15.0 mph

The relative heat gain (RHG) values were calculated using the formula:  

$$RHG = 200 \text{ Btu/hr-ft}^2 \times \text{Shading coefficient} + (14^\circ\text{F} \times \text{summer U-Value})$$

### Applications

Oldcastle Glass® offers a variety of silk-screened decorative glass products to satisfy a wide range of applications. Light frit colors and certain pattern designs can cause enhanced brightness when viewed from indoors under certain daylight and background sky conditions, while dark frit colors will tend to reduce glare. Applications include transparent and translucent silk-screened glass for interior applications, including glass doors, partitions, handrails, glass ceilings, bathrooms, elevator walls, shower enclosures, court walls for racket sports and sneeze guards for food service.

*See the White Glass Selector Tab for some typical applications.*

#### Insulating Glass

When used in an insulating glass (IG) unit, silk-screened decorative glass provides an attractive, easily cleaned building component. The silk-screened pattern can be applied to the #2, #3 or #4 surface of an insulating glass unit to provide the desired aesthetic and performance characteristics. For optimum solar performance, the silk-screened

pattern should be applied to the #2 surface. Some glass types may not be available with a second surface frit application. Applications with the silk-screened pattern on the #3 or #4 surface will result in an increase in solar absorption on the interior lite and a higher shading coefficient.

#### Laminated Glass

When incorporated into laminated glass make-ups, silk-screened decorative glass can be used in interior partitions, handrails, doors, glass art, canopies and skylights. For exterior applications, the silk-screened pattern can be applied to the #2, #3 or #4 surface of a laminated glass assembly that provides an element of safety in addition to desirable aesthetics and performance levels. For interior applications, the silk-screened pattern can be applied to the #1, #2, #3 or #4 surface of a laminated glass assembly.

#### Design Considerations

The correct choice of silk-screened decorative glass for a particular application requires the consideration of a number of different

*(continued on next page)*



## Silk-screened Glass

### Applications (continued)

evaluated: color and appearance, thermal and acoustic insulation, strength, deflection under design load and code or safety requirements. Other properties such as flatness, and ease of cleaning, which can make silk-screened decorative

glass the material-of-choice, may also need to be considered.

*See the White Glass Selector Tab for some typical applications.*

### Characteristics

Most heat-treated silk-screened glass is not permanently marked with a logo unless it is specifically requested at the time of placing an order. The design professional is responsible for specifying the use of a logo as required to meet the governing building codes. Heat-treated glass (fully tempered or heat-strengthened) complies with ASTM Standards C1036 and C1048, and tempered glass meets ANSI Z97.1 and CPSC 16 CFR 1201 safety glazing standards. Silk-screened decorative glass supplied in Canada complies with CAN/CGSB-12.1-M90.

#### Inspection Guidelines

View silk-screened glass from a distance of 6' (1.8 m) under natural daylight conditions. Pinholes larger than 1/16" (1.6 mm) are not allowed if noticeable from a distance of 10' (3 m) or greater. On close viewing, small "sawtooth" edges are characteristic of and acceptable in the screen printing process.

The color and opacity of the ceramic frit may vary slightly due to paint thickness and glass substrate variations.

Screened patterns may be located up to 1/16" (1.6 mm) off parallel from the locating glass edge, which should be identified on the customer's engineering or shop drawings. Due to glass dimension and squareness tolerances, printed patterns may be up to 1/8" (3 mm) off parallel from the edges other than the locating glass edge. A maximum variation of +/- 1/32" (0.8 mm) in dot, line or hole location is acceptable. Dots of any diameter up to 1/8" (3 mm) may be missing, up to a maximum of two in one location. Patterns covering the entire glass surface will require a 3/8" (10 mm) border at the edge. A 1/8" (3 mm) border can be obtained for structural glazing applications, but must be specified on the purchase order. A print image of a 1/32" (0.8 mm) indefinite border is acceptable.

## Silk-screened Glass

### Additional Important Information

#### Design Criteria:

*Details on the following important topics can be found in the Black Design Criteria Tab: Glazing Instructions, Thermal Stress, Deflection, Glass Design Loads, Glass Thickness Selection, Spontaneous Breakage of Tempered Glass, Roller Wave Distortion in Heat-treated Glass, Mock-ups and Warranties.*

#### Specifications:

*A sample Section 08800 Specification for North America can be found in the Black Specifications Tab. Information specific to silk-screened glass can be found in Part 2 Products, 2.02 Materials.*

#### Contact Us

For any additional information, including details, technical data, specifications, technical assistance and samples, or to speak with an architectural specialist, call 1-866-OLDCASTLE(653-2278).

#### Visit Us on the Web

Log on to [www.oldcastleglass.com](http://www.oldcastleglass.com) for project photos, product colors, general inquiries and project assistance.

To view performance data on a wide range of glass makeups, or to build your own product specification, log on to [www.oldcastleglass.com](http://www.oldcastleglass.com) and choose GlasSelect™ 