

WALKER

Provider Number: K216

How to Effectively Integrate Acid-etched Glass in Exterior Glazing Systems

Course Numbers
AIA: WA1703-23
USGBC: 0920013125



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Walker Glass Company Ltd.

WALKER



COURSE DESCRIPTION

Acid-etched glass can be used in a variety of exterior applications. This presentation will help you understand how design, function, performance and sustainable objectives can be achieved with this type of product. The session will focus on the integration of acid-etched glass in exterior glazing systems and will cover daylighting, properties, specifications and constructability, to facilitate and improve the decision making process. The course also covers how acid-etched glass can support the LEED certification process.

LEARNING OBJECTIVES

The participants will :

- Understand the design, functionality, performance and sustainable properties of acid-etched glass
- Evaluate how acid-etched glass impacts different elements of exterior glazing systems, including daylighting, color rendering, visual appearance and bird collision deterrence
- Understand how acid-etched glass can meet the glazing performance and sustainability objectives of a project.
- Review acid etched glass specifications that are critical to maintaining the objectives of the project



UNDERSTANDING
ACID-ETCH GLASS



THE PROCESS

WHAT IS ACID-ETCHED GLASS?

The surface of which has been treated with an aqueous solution of hydrofluoric acid, resulting in a smooth satin texture and a matted translucent appearance.

- Acid-etching is a smoothing process providing various levels of translucency
- Acid-etching is not a coating

THE BENEFITS

- No impact on visible light transmittance
- No significant impact on solar performance
- No impact on structural strength
- Significant glare reduction
- Excellent light diffusion
- Enhance rendering of color on glass
- Add a measure of privacy

ACID-ETCHED GLASS



THE BENEFITS

- Apply a Low-E coating on the opposite side
- Provide appropriate concealment for spandrel conditions
- Unique design
- Brilliance on the surface
- Depth in the glass
- Closed-pore surface, does not trap dirt & particles
- Cleaning & maintenance similar to un-etched glass

ACID-ETCHED GLASS





GLASS FABRICATION

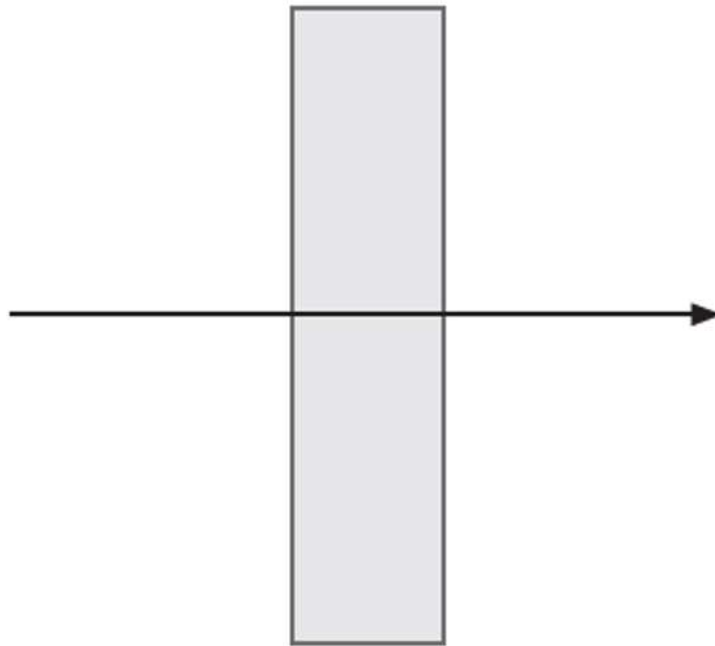
PROCESSES COMPATIBLE WITH ACID-ETCHED GLASS

- Cutting
- Polishing
- Beveling
- Laminating*
- Insulating
- Bending
- Drilling
- Tempering
- Fire rating

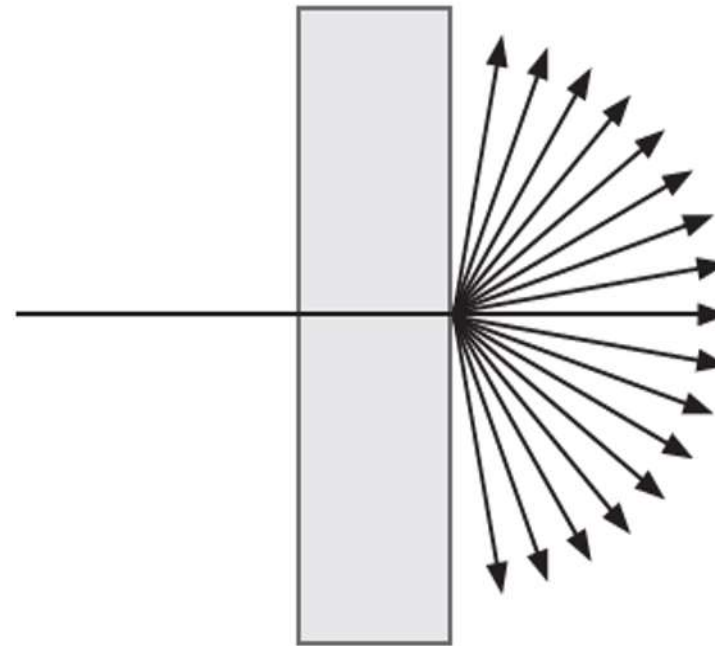
** Acid-etched glass may be laminated in the same manner as unetched glass providing that the laminate is applied to the unetched surface.*

LIGHT DIFFUSION

Un-etched Glass
Direct Light



Acid-etched Glass
Diffuse Transmittance & Haze



LIGHT DIFFUSION PROPERTIES

Test/Standard: ASTM D1003-13

Acid-etched Finish	Glass Substrate	Thickness mm (in)	Total Luminous Transmittance	Diffuse Transmittance	Haze
Opaque	Clear	6mm (1/4")	82.5%	75.09%	90.73%
Velour	Clear	6mm (1/4")	88.44%	79.00%	89.30%
Satin	Clear	6mm (1/4")	72.75%	32.66%	44.89%
Satinlite	Clear	6mm (1/4")	75.41%	9.73%	12.90%

Total Luminous Transmittance is the ratio of transmitted light to the incident light and is influenced by absorption and reflection properties.

Diffuse Transmittance is the portion of light that is scattered or diffused by the glass surface.

Haze is the percentage of light which in passing through deviates from the incident beam greater than 2.5 degrees on average. Haze is equal to the diffuse transmittance divided by the total luminous transmittance.

LIGHT DIFFUSION

- Enhanced natural light dispersion into the building interior
- Glowing and diffusion effects of artificial light (light boxes, backlit panels)

APPLICATION





H & M Store – Toronto, ON
Insulated Glass Unit – 8mm Starphire Ultra-Clear™ Opaque Surface #1, 2, 3 & 4



H & M Store – Toronto, ON
Insulated Glass Unit – 8mm Starphire Ultra-Clear™ Opaque Surface #1, 2, 3 & 4



EMERGENCY

EMERGENCY

RONALD O. PERELMAN
Center for Emergency Services

NYU Langone Medical Center – New York, NY
12mm Starphire Ultra-Clear™ Glass Velour 2 Faces Tempered



RONALD O. PERELMAN
Center for Emergency Services

NYU Langone Medical Center – New York, NY
12mm Starphire Ultra-Clear™ Glass Velour 2 Faces Tempered

SURFACE RESISTANCE

Test/Standard		Select acid-etched glass products	Float glass	Unit of Measure
Resistance to Wear	ASTM-C501	198 to 215	183.29	Abrasive Wear Index (Ix)
Resistance to Staining	ASTM-C1378	A	A	Classification
Scratch Hardness	MOHs	5 to 7	5,5	Out of a possible 10

Applications

- Surface 1 applications
- High traffic areas such as storefronts
- Railings and balustrades
- Structural glass façade
- Shelters
- Walkways



National Institute of Scientific Research (INRS) - Laval, QC
Insulated Glass Unit – 6mm Starphire Ultra-Clear™ Satin Surface #1, Solarban® 60 Surface #3



National Institute of Scientific Research (INRS) - Laval, QC
Insulated Glass Unit – 6mm Starphire Ultra-Clear™ Satin Surface #1, Solarban® 60 Surface #3



Aquarium of the Pacific – Long Beach, CA
6mm Starphire Ultra-Clear™ Glass Velour 1 face on surface 1 laminated to two other glass substrates



Aquarium of the Pacific – Long Beach, CA
6mm Starphire Ultra-Clear™ Glass Velour 1 face on surface 1 laminated to two other glass substrates



ACID-ETCHED GLASS
EXTERIOR GLAZING SYSTEMS



ACID-ETCHED GLASS

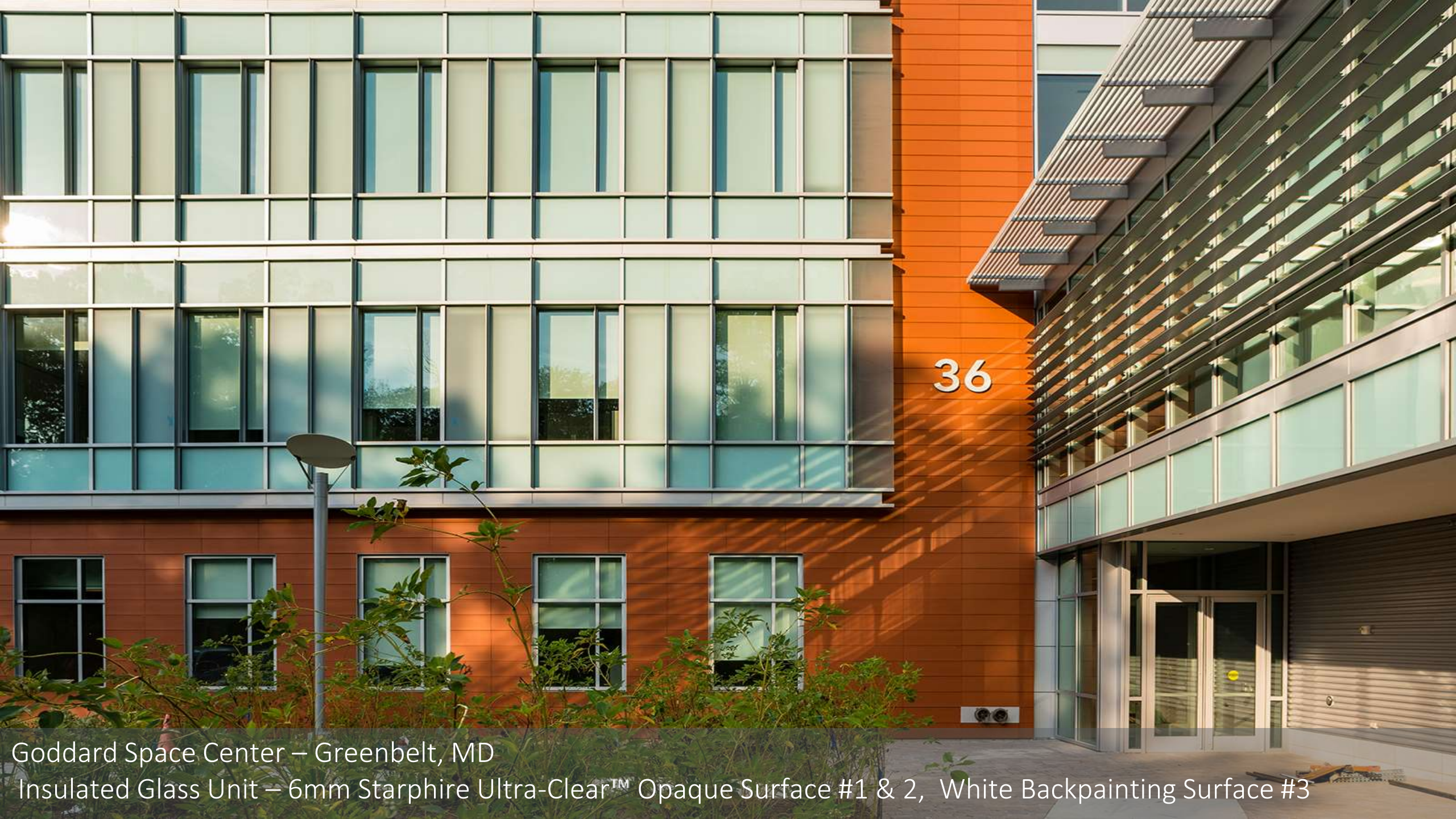
APPROPRIATE CONCEALMENT

- Use an Opaque etch finish on one or two surfaces
- Harmonize the look of spandrel units with vision areas
- Applications
 - Spandrel
 - Structural glass façade



Goddard Space Center – Greenbelt, MD

Insulated Glass Unit – 6mm Starphire Ultra-Clear™ Opaque Surface #1 & 2, White Backpainting Surface #3



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Goddard Space Center – Greenbelt, MD
Insulated Glass Unit – 6mm Starphire Ultra-Clear™ Opaque Surface #1 & 2, White Backpainting Surface #3



University of Iowa Health Care - Iowa City, IA
Insulated Glass Unit – 6mm Clear Glass Velour Surface #3, SunGuard SN62 Surface #2

PRIVACY WITH UNRESTRICTED LIGHT FLOW

Visible Light Transmittance Monolithic Glass

	6mm Clear	6mm Starphire
Un-etched glass	89.0%	91.0%
Satinlite acid-etched glass	88.0%	90.0%
Satin acid-etched glass	89.0%	90.0%
Velour acid-etched glass	91.0%	92.0%
Opaque acid-etched glass	91.0%	93.0%

VISIBLE LIGHT TRANSMITTANCE

Visible Light Transmittance

Description	VLT
6mm clear glass with acid-etched - full surface	91%
6mm clear glass with acid-etched - 35% pattern coverage	91%
6mm clear glass with grey frit - 20% coverage	72%
6mm clear glass with grey frit - 40% coverage	55%



ABB Canada Campus – Montreal, QC
Insulated Glass Unit – 6mm Starphire Ultra-Clear™ Opaque Surface #2



ABB Canada Campus – Montreal, QC
Insulated Glass Unit – 6mm Starphire Ultra-Clear™ Opaque Surface #2

Johnson

VOLVO

Johnson Volvo - Durham, NC
6mm Starphire Ultra-Clear™ Velour Surface #1



Johnson Volvo - Durham, NC
6mm Starphire Ultra-Clear™ Velour Surface #1



National Aviary - Wetlands
Prior to the renovation – photo September 2019



VLT 45%

National Aviary - Wetlands
Prior to the renovation – photo September 2019



National Aviary - Wetlands

Roof 3mm Starphire Ultra-Clear™ glass Velour on surface 1 – 5mm Starphire Ultra-Clear glass pattern 214 on surface 1



VLT 89%

National Aviary - Wetlands

Roof 3mm Starphire Ultra-Clear™ glass Velour on surface 1 – 5mm Starphire Ultra-Clear glass pattern 214 on surface 1

ENHANCED COLOR RENDERING

Use a light etch surface to reduce reflection and enhance the color integrated in the glazing system

Applications

- IGU with a ceramic paint on the back surface of the glass
- Laminate with colored interlayer

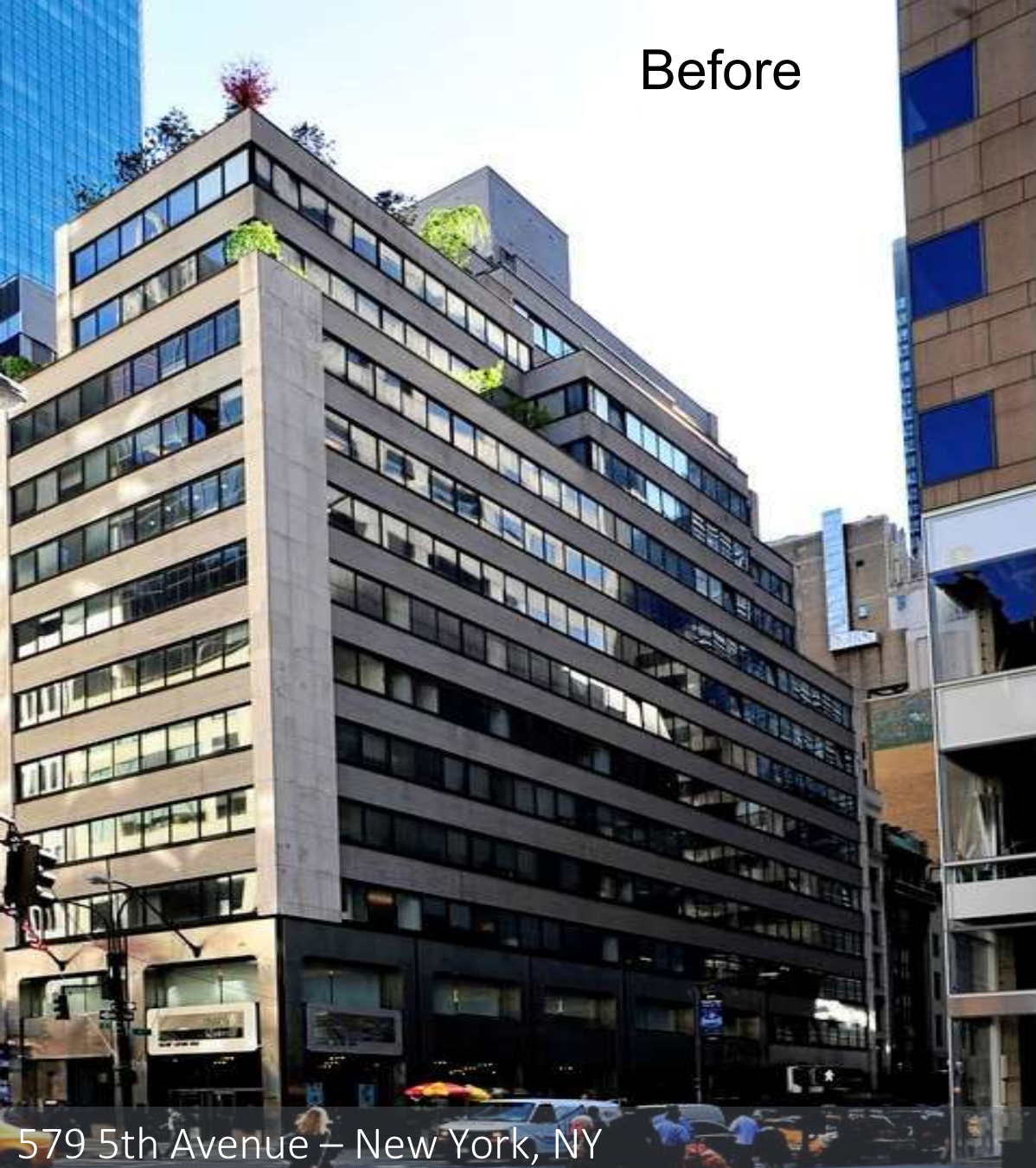
ACID-ETCHED GLASS





Diana Center Barnard College – New York, NY
Insulated Glass Unit – 6mm Starphire Ultra-Clear™ Glass Velour Surface #1, Terracotta Ceramic Paint Surface #2,
Tempered , Solarban® 60 Surface #3

Before



After

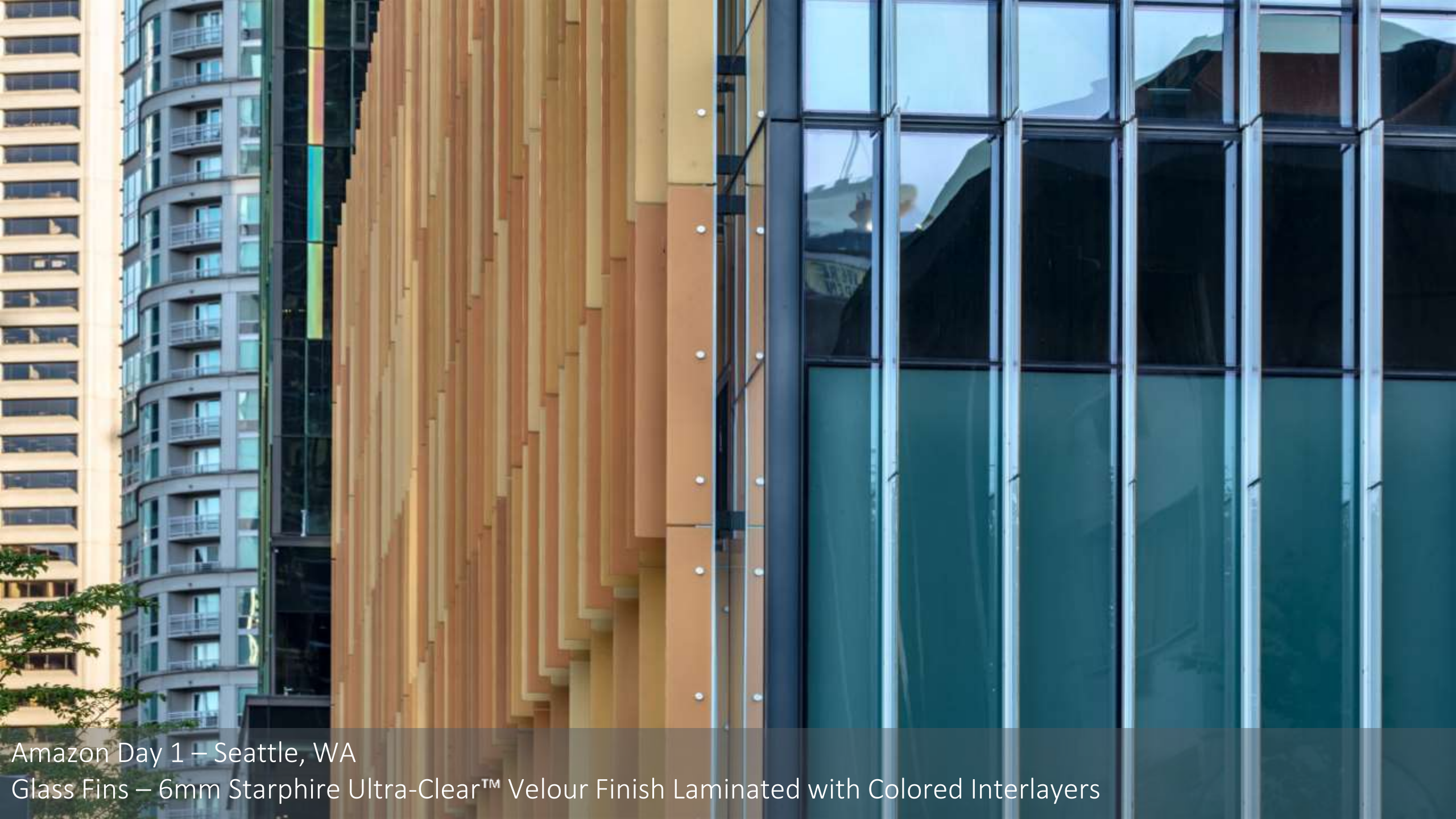


579 5th Avenue – New York, NY
6mm low-iron acid-etched glass on surface 1, laminated with white interlayer



Amazon Day 1 – Seattle, WA

Glass Fins – 6mm Starphire Ultra-Clear™ Velour Finish Laminated with Colored Interlayers



Amazon Day 1 – Seattle, WA

Glass Fins – 6mm Starphire Ultra-Clear™ Velour Finish Laminated with Colored Interlayers



APPLICATION / INTENT

DESIGN & MODULATION

- Add a design element to the glass envelope of the building
- Create a modulation effect on the building façade
- Reduce glare



Oakland University – Rochester, MI
Insulated Glass Unit – Mix of Clear Glass Satin, Velour and Opaque Surface #3, Low-e coating Surface #2



Oakland University – Rochester, MI
Insulated Glass Unit – Mix of Clear Glass Satin, Velour and Opaque Surface #3, Low-e coating Surface #2



CUPE Building – Ottawa, ON
Insulated Glass Unit – 6mm Clear & Blue Glass Satin Surface #3, Solarban® 60 Surface #2



CUPE Building – Ottawa, ON
Insulated Glass Unit – 6mm Clear & Blue Glass Satin Surface #3, Solarban® 60 Surface #2



University of Pennsylvania – Philadelphia, PA
Insulated Glass Unit – 6mm Starphire Ultra-Clear™ Nuance Custom Velour Stripes Surface #1



University of Pennsylvania – Philadelphia, PA
Insulated Glass Unit – 6mm Starphire Ultra-Clear™ Nuance Custom Velour Stripes Surface #1



Maurice Richard Arena – Montreal, QC
6mm clear glass Satinlite on surface 1 with 6mm grey glass Pilkington Mirropane™ on surface 3 backpainted in grey
on surface 4

BIRD COLLISION DETERRENCE

- Bird friendly building façade
- Railings & balustrades
- Exterior walls
- Wind and sound barriers
- Shelters

APPLICATIONS



BIRD COLLISION DETERRENCE

BIRD DETERRENCE PERFORMANCE		
Test Method	Product	Threat Factor (*)
Tunnel Test - American Bird Conservancy	AviProtek® Pattern 211 Position 1 - Monolithic	23
Tunnel Test - American Bird Conservancy	AviProtek® Pattern 213 Position 1 - Monolithic	29.8
Tunnel Test - American Bird Conservancy	AviProtek® Pattern 214 Position 1 – Monolithic	30
Tunnel Test - American Bird Conservancy	AviProtek® Pattern 217 Position 1 – Monolithic	15
Field Experiment - Dr. Daniel Klem, Acopian Center for Ornithology, Muhlenberg College, PA	AviProtek® Pattern 213 Position 1 - Double-glazed unit	5
Field Experiment - Dr. Daniel Klem, Acopian Center for Ornithology, Muhlenberg College, PA	AviProtek® T Position 1 - Double-glazed unit	31
(*) % of times birds will not avoid collision		



Swarthmore College Maxine Signer Hall – Swarthmore, PA
Insulated Glass Unit – 6mm Clear Glass AviProtek® E pattern 215, Solarban® 60 on surface 2



Swarthmore College Maxine Signer Hall – Swarthmore, PA
Insulated Glass Unit – 6mm Clear Glass AviProtek® E pattern 215, Solarban® 60 on surface 2



The Boulevard Club – Toronto, ON

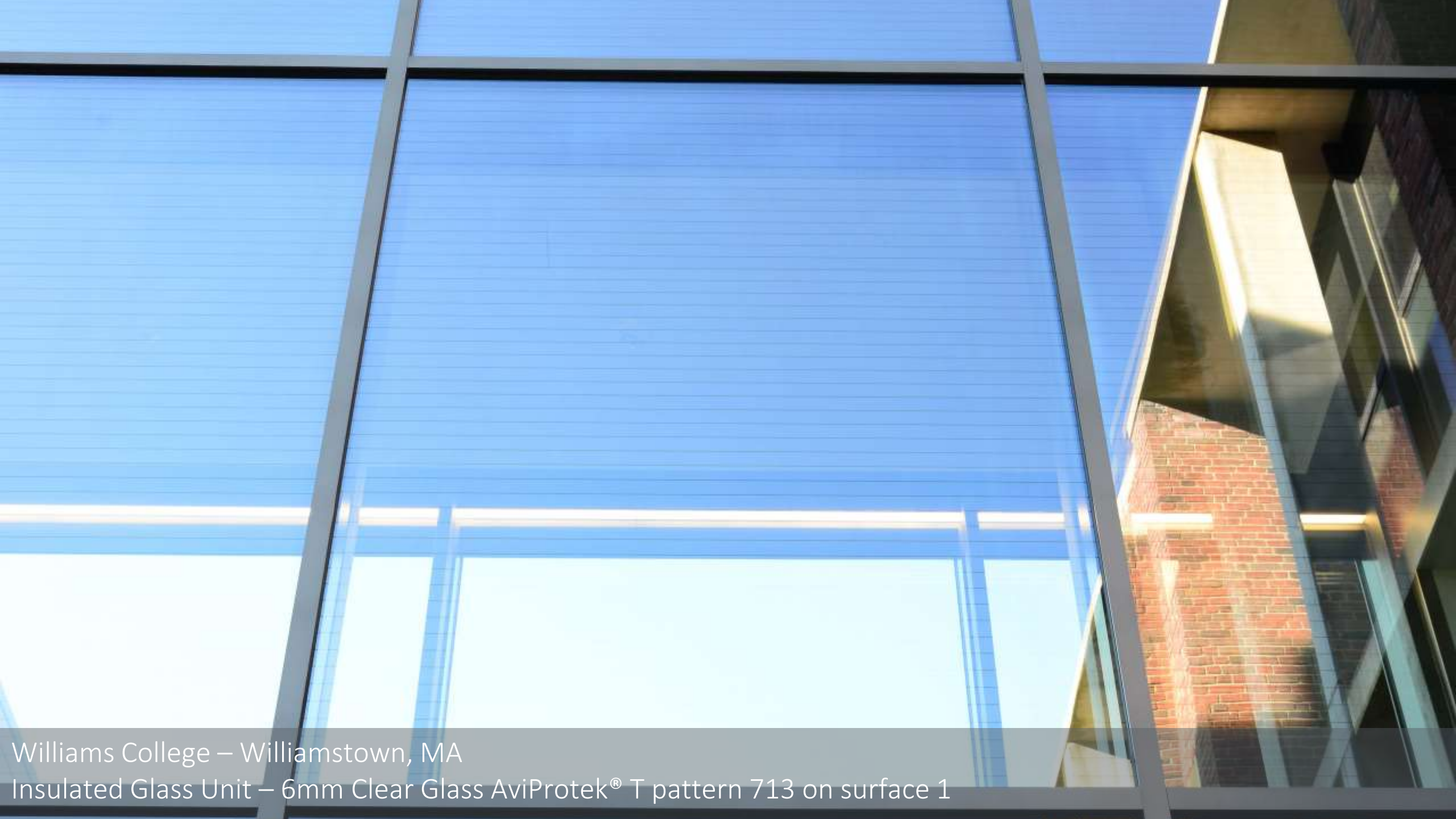
Insulated Glass Unit – 6mm Clear Glass AviProtek® E pattern 216, Solarban® 60 Surface #2



The Boulevard Club – Toronto, ON
Insulated Glass Unit – 6mm Clear Glass AviProtek® E pattern 216, Solarban® 60 Surface #2



Williams College – Williamstown, MA
Insulated Glass Unit – 6mm Clear Glass AviProtek® T pattern 713 on surface 1



Williams College – Williamstown, MA
Insulated Glass Unit – 6mm Clear Glass AviProtek® T pattern 713 on surface 1



APPLICATIONS

SLIP RESISTANCE FOR WALKWAY APPLICATIONS

- Walkways
- Stair treads


SLIP RESISTANCE FOR WALKWAY APPLICATIONS

According to the ANSI A137.1 standard for ceramic tile:

"Unless otherwise specified, tiles suitable for level interior spaces expected to be walked upon when wet shall have a (minimum) wet DCOF of 0.42 ..."



TKTS Stairs – New York (Times Square), NY
12mm Starphire Ultra-Clear™ Glass with Anti-slip Pattern, Tempered & Laminated



TKTS Stairs – New York (Times Square), NY
12mm Starphire Ultra-Clear™ Glass with Anti-slip Pattern, Tempered & Laminated



ACID-ETCHED GLASS
GLAZING PERFORMANCE
& SUSTAINABILITY

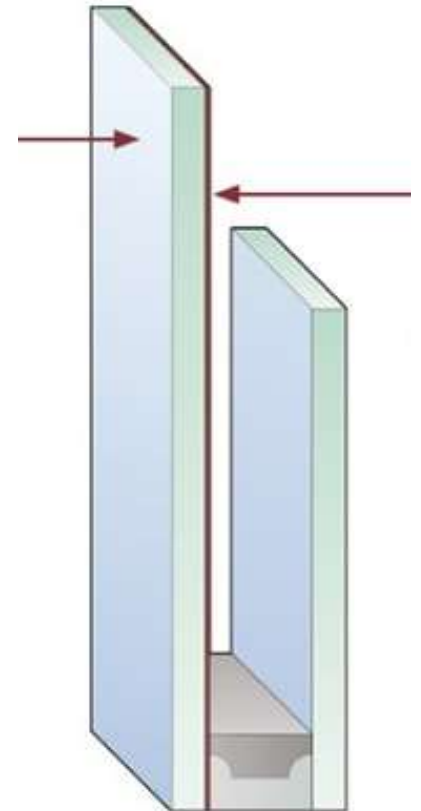
INTEGRATION IN INSULATED GLASS UNITS

Acid etching can be used on any surface within an IGU, including those exposed to weather conditions on # 1

Integration must take into account the surface(s) on which a Low-E coating is required

Acid etching can be applied to position 1 with a Low-E coating on position 2

Decision is based on design and functional intents



INTEGRATION IN INSULATED GLASS UNITS

Glass Performance Data

One-Inch Insulating Glass without Acid-etched Glass			U-Value (Btu/h-ft ² -F)		SHGC ⁴
Glass 1	Space	Glass 2	Winter	Summer	
6mm clear SB70XL (2)	1/2" air	6mm clear	0.280	0.260	0.270
One-Inch Insulating Glass with Acid-etched Glass			U-Value (Btu/h-ft ² -F)		SHGC ⁴
Glass 1	Space	Glass 2	Winter	Summer	
6mm clear Opaque (1) SB70XL (2)	1/2" air	6mm clear	0.280	0.260	0.276
6mm clear Velour (1) SB70XL (2)	1/2" air	6mm clear	0.280	0.260	0.281
6mm clear Satin (1) SB70XL (2)	1/2" air	6mm clear	0.280	0.260	0.274
6mm clear Satinlite (1) SB70XL (2)	1/2" air	6mm clear	0.280	0.260	0.275

Data is similar with acid-etched glass in position #3


INTEGRATION IN INSULATED GLASS UNITS

Glass Performance Data One-Inch Insulating Glass with Bird-Friendly Glass

With Invisible Markers on Surface 1

With Invisible Markers on Surface 1			U-Value (Btu/h-ft ² -F)		SHGC ⁴
Glass 1	Space	Glass 2	Winter	Summer	
6mm clear Aviprotek T (1)	1/2" air	6mm clear Solarban 60 (3)	0,29	0,27	0,43
6mm clear Aviprotek T (1)	1/2" air	6mm clear Solarban 70XL (3)	0,28	0,27	0,35
6mm clear Aviprotek T (1)	1/2" air	6mm clear Solarban 90 (3)	0,29	0,27	0,31

INTEGRATION IN IGU – Case Study



Mc Master University Peter George Center for Living and Learning – Hamilton, ON
Insulated Glass Unit – 6mm clear glass custom pattern on surface 1 with low-e on surface 2



CUSTOM ETCH with LOW-E ON 2

GLASS COMPOSITION

6 mm clear glass

Walker Textures®
custom pattern on surface 1

Solarban® 67 and 70
low-e coating on surface 2





Mc Master University Peter George Center for Living and Learning – Hamilton, ON
Insulated Glass Unit – 6mm clear glass custom pattern on surface 1 with low-e on surface 2

INTEGRATION IN IGU – Case Study



National Aquarium – Baltimore, MD

Insulated Glass Unit – 6mm low-iron glass Opaque on surface 1 with Solarban 60 on surface 2



FULL SURFACE ETCH with LOW-E ON 2

GLASS COMPOSITION

6 mm Starphire Ultra-Clear® glass

Walker Textures®
Opaque finish on surface 1

Solarban® 60
low-e coating on surface 2





National Aquarium – Baltimore, MD

Insulated Glass Unit – 6mm low-iron glass Opaque on surface 1 with Solarban 60 on surface 2

RELEVANCE OF ACID-ETCHED GLASS & MIRROR PRODUCTS TO LEED®

- Building Product Disclosure and Optimization
Environmental Product Declaration (EPD)
(1 point)

Report describing a product's potential environmental impacts, according to the life cycle assessment criteria and in conformity with ISO protocol 14025.

- Building Product Disclosure and Optimization - Material Ingredients
Health Product Declaration® (HPD®)
(1 point)

A declaration that includes a complete list of a product's ingredients and their associated effects on health.

RELEVANCE OF ACID-ETCHED GLASS & MIRROR PRODUCTS TO LEED®

- Low-Emitting Materials
 - Product Category Calculation (1-3 points)
 - Glass is a non-emitting source
- Daylight
 - Design to maximize daylight (1-3 points)
- Innovation – Bird Collision Deterrence (1 point)

The background of the image is a close-up of a notebook page. At the top, there are four small, simple line drawings of buildings. Below these, a larger architectural sketch of a building is visible, featuring a grid of windows and a blue-tinted facade. To the left of this larger sketch is a green tree. Several markers are scattered across the page: a blue marker on the left, a grey marker with a blue tip in the center, and two grey markers with black and green tips on the right. The overall scene suggests a creative or professional workspace.

ACID-ETCHED GLASS SPECIFICATIONS

SUMMARY ANALYSIS

- Does not restrict light flow
- Surface does not degrade
- Surface does not discolor
- Visual appearance is uniform and consistent
- Does not reduce the structural strength of the glass
- No significant impact on solar performance

PROPERTIES



KEY ACID-ETCHED GLASS SPECIFICATIONS

- Validate glass specifications at the design development stage
 - Surface finish
 - Substrate
 - Size
 - Thickness
- Surfaces to etch
- Glass performance properties
- Gloss tolerance of the etch finish
- Warranty on etched surface degradation

KEY PROPERTIES of ACID-ETCHED GLASS in EXTERIOR APPLICATIONS

Test/Standard		6mm clear with Selected Acid-etch Finish	6mm clear unetched
Visible Light Transmittance	Lab test	91.00%	89.00%
Light Diffusion (Haze)	ASTM D1003-13	90.73%	0.00%
Resistance to Wear (Abrasive wear index)	ASTM-C501	210	183.29
Resistance to Staining	ASTM-C1378	A	A
Scratch Hardness	MOHs	5	5.5
Strength			
	6mm Tempered with selected etch		6mm Tempered unetched
	Etched surface in Tension	Unetched surface in Tension	
Modulus of rupture / ASTM C-158			
Max Load (pounds)	357	351	338
Flexural Strength	1.07	1.05	1
Modulus of Rupture (psi)	28720	28370	26720

DESIGN DEVELOPMENT PROCESS

- Involve the acid-glass manufacturer in the early stages
- Validation
 - Product Availability
 - Constructability
 - Fabrication
 - Budget
 - Samples
 - Testing

This concludes The American Institute of Architects
Continuing Education Systems Course

WALKER

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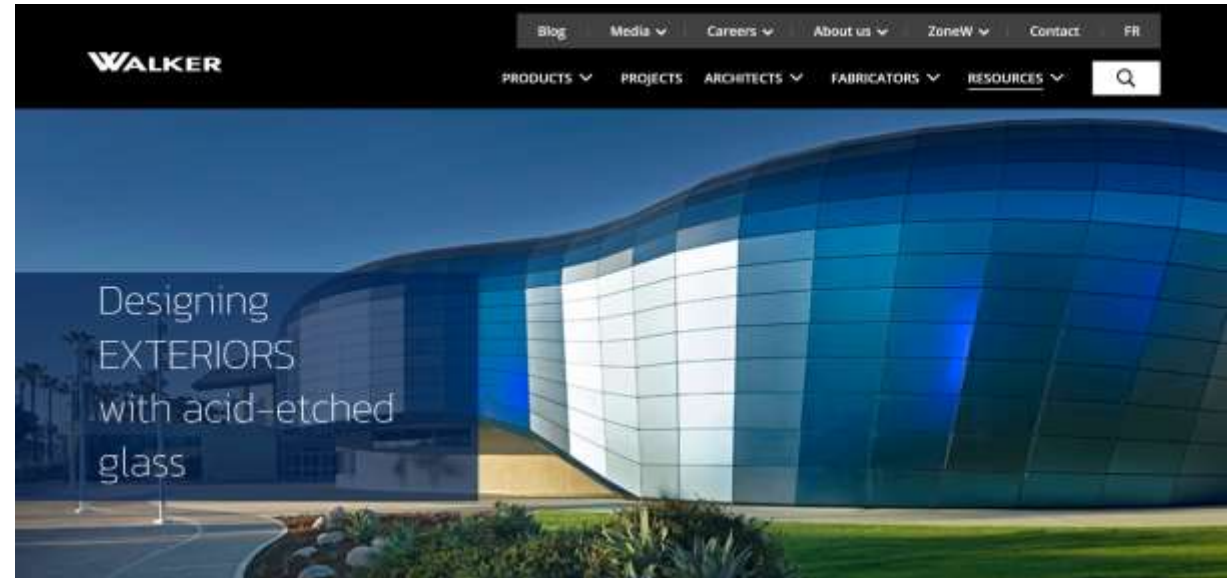
Designing
EXTERIORS
with acid-etched glass

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first edition

To access the eGuide

The eGuide of designing exteriors with acid-etched glass is available for download from **walkerglass.com**

Head to Resources / eGuide of Exterior Design in the top menu



[Download the eGuide](#)



The eGuide of Designing Exteriors with Acid-Etched Glass

The versatile nature of acid-etched glass makes it an excellent choice for enhancing your projects' exteriors. Our eGuide showcases the multitude of possibilities this material offers.

This eGuide is your key to the most important characteristics of this hard-working material. You'll discover how this glass can be used on the building's exterior, with benefits supported by thorough testing and case studies. You'll see how it can optimize an exterior's durability, sustainability and visible light transmittance, a crucial aspect when designing with natural light. You may also draw inspiration from the project features and case studies included in this book. These projects highlight how acid-etched glass can add value and help architects meet their goals, in architectural projects of all kinds.