AGNORA

Architectural Glass Handbook

GET IN TOUCH

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AGNORA is a customer service company that fabricates the largest architectural glass in North America. This sentence is our company-wide mantra that informs every process, policy and decision at AGNORA. It came from our realization that it is easy to confuse what you are producing with what you are actually doing. At AGNORA we produce a variety of fabricated glass panels, but what we are doing is **serving our customers.**

We design our processes based entirely on what's best for the customer not what's easiest for us. Our processes allow us to be responsive and flexible which is essential to our ability to be the industry-leader in both service and quality. While we make a great product, we have quickly differentiated ourselves by focusing on how we deliver the product, and by creating new industry standards for quality.

At AGNORA we are constantly innovating to find ways to push the boundaries of what is possible with architectural glass to meet the design objectives brought to us by our customers. Customers bring us their largest most technically complicated projects because they know and trust that we can achieve their goals. Our customers are consistently amazed by our commitment to ensuring their projects are successful.

The AGNORA culture is based on a team-oriented family atmosphere in which open communication, flexibility and innovation are prized as our greatest assets in achieving our goal of constantly exceeding our customers' expectations. The partnerships we build with our customers and suppliers are the foundation of our success – we look forward to the opportunity to partner with you in the success of your next project.

Richard Wilson
President, AGNORA

Brent Stannard, Plant Manager

Gregg Bartja, Lead Hand

AGNORA IS A CUSTOMER SERVICE COMPANY

that fabricates the largest architectural glass in North America.

Our 225,000 square foot production facility in Collingwood, Ontario, Canada functions as a custom fabrication shop providing glass to a variety of cultural, residential, commercial, and retail projects.

From Manhattan penthouses to Hollywood movie sets, airport control towers to woolly mammoths, our projects are unique, exciting, and always leave us in anticipation of the next big challenge.

Our passion for glass and design is only surpassed by the quality of our products. While our clients initially come to us for what our leading-edge technology can do, it's our dedication to craftsmanship and extraordinary service that keeps them coming back.

CONTACT US TODAY
sales@agnora.com

Our fabrication techniques include CNC fabrication, polishing and edgework, lamination, insulated glass, heat treatment, and digital ceramic printing, up to 130" x 300".

PROCESS	THICKNESS		MAXIMUM SIZE	
CNC Machining	5-50 mm	3/16"-2"	3.3x7.6 m	130x300 in
Straight Edge Polishing	5-100 mm	3/16"-4"	3.3x7.6 m	130x300 in
Digital Printing	5-19 mm	3/16"-3/4"	3.3x7.6 m	130x300 in
Painting	5-25 mm	3/16"-1"	2.2x7.6 m	84x300 in
Tempering	5-25 mm	3/16"-1"	3.3x7.6 m	130x300 in
Heat Strengthening	5-12 mm	3/16"-1/2"	3.3x7.6 m	130x300 in
Heat Soak Test	5-25 mm	3/16"-1"	3.3x7.2 m	130x275 in
Laminating	6-100 mm	1/4"-4"	3.3x7.6 m	130x300 in
Insulating	12-90 mm	1/2"-3-1/2"	3.3x7.6 m	130x300 in

TECHNICAL CAPABILITIES OF OUR FABRICATION LINES

CUTTING

Thickness	5 mm to 19 mm	1/8” to 1”
Minimum Dimension	100 mm x 100 mm	4” x 4”
Maximum Dimension	6096 mm x 3300 mm	240” x 130”
Maximum Weight	1260 Kg	2775 Lbs
Tolerance	± 0.5 mm	± 1/32”
Shape	Rectangle, 104 catalog shapes, .dxf files	

EDGEWORK - SINGLE EDGER

Glass Thickness	5 mm to 100 mm	1/8” to 4”
Minimum Dimension	85 mm x 150 mm	3 3/8” x 6”
Maximum Dimension	6000 mm (vertical), 8000 mm (horizontal)	236” (vertical), 315” (horizontal)
Maximum Weight	1500 Kg	3300 Lbs
Maximum Linear Weight	350 Kg / m	235 Lbs / ft
Tolerance	± 1.5 mm	± 1/16”
Shape	Straight Lines	

EDGEWORK - 5 AXIS CNC

Glass Thickness	5 mm to 19 mm	1/8” to 1”
Minimum Dimension	100 mm x 100 mm	4” x 4”
Maximum Dimension	8800 mm x 3300 mm	345” x 130”
Maximum Weight	1500 Kg	3300 Lbs
Tolerance	± 0.5 mm	± 1/32”
Shape	Rectangle, 105 catalog shapes, .dxf files	

DIGITAL CERAMIC INK PRINTING

Glass Thickness	5 mm to 19 mm	3/16” to 3/4”
Minimum Dimension	400 mm diagonal	16” diagonal
Maximum Dimension	8000 mm x 3300 mm	315” x 130”
Maximum Weight	1500 Kg	3300 Lbs
Color System	6 inks Dip-Tech Gamut (BGWORK)	
Printing Resolution	High Definition 720 DPI with drop fixation	

TEMPERING

Glass Thickness	5 mm to 19 mm	3/16” to 1”
Minimum Dimension	400 mm diagonal	16” diagonal
Maximum Dimension	7500 mm x 3300 mm	295” x 130”

HEAT STRENGTHENING

Glass Thickness - Uncoated	5 mm to 12 mm	3/16” to 1/2”
Glass Thickness - Coated	5 mm to 10 mm	3/16” to 3/8”
Minimum Dimension	400 mm diagonal	16” diagonal
Maximum Dimension	7500 mm x 3300 mm	295” x 130”

HEAT SOAK TEST

Glass Thickness	5 mm to 19 mm	3/16” to 1”
Maximum Dimension	7000 mm x 3300 mm	275” x 130”
Heat Soak Standard	EN 14179-2	Third Party Certified

LAMINATING

Overall Thickness	6 mm to 100 mm	1/4” to 4”
Minimum Dimension	100 mm x 100 mm	4” x 4”
Maximum Dimension	7620 mm x 3300 mm	300” x 130”
Maximum Weight	2500 Kg	5500 Lbs

INSULATED GLASS ASSEMBLY

Overall Thickness	12 mm to 90 mm	1/2” to 3 1/2”
Configuration	Double or triple insulated	
Max. thickness for middle lite	6 mm	1/4”
Minimum Dimension	350 mm x 180 mm	14” x 7”
Maximum Dimension	6000 mm x 3300 mm	236” x 130”
Maximum Weight	2500 Kg	5500 Lbs
Maximum Linear Weight	200 Kg / m	134 Lbs / ft
Step Side 1	50 mm	2”
Step Side 2-3-4	140 mm	5 1/2”
Gas	Argon available for all units (even step units)	

PAINTING

Glass Thickness	3 mm to 19 mm	1/8” to 3/4”
Minimum Dimension	350 mm x 180 mm	14” x 7”
Maximum Dimension	7620 mm x 2130 mm	300” x 84”
Maximum Weight	600 Kg	1320 Lbs

When looking for specifications for a project in its entirety, or for any sizes larger than indicated, consult your AGNORA project manager. We are here to help!

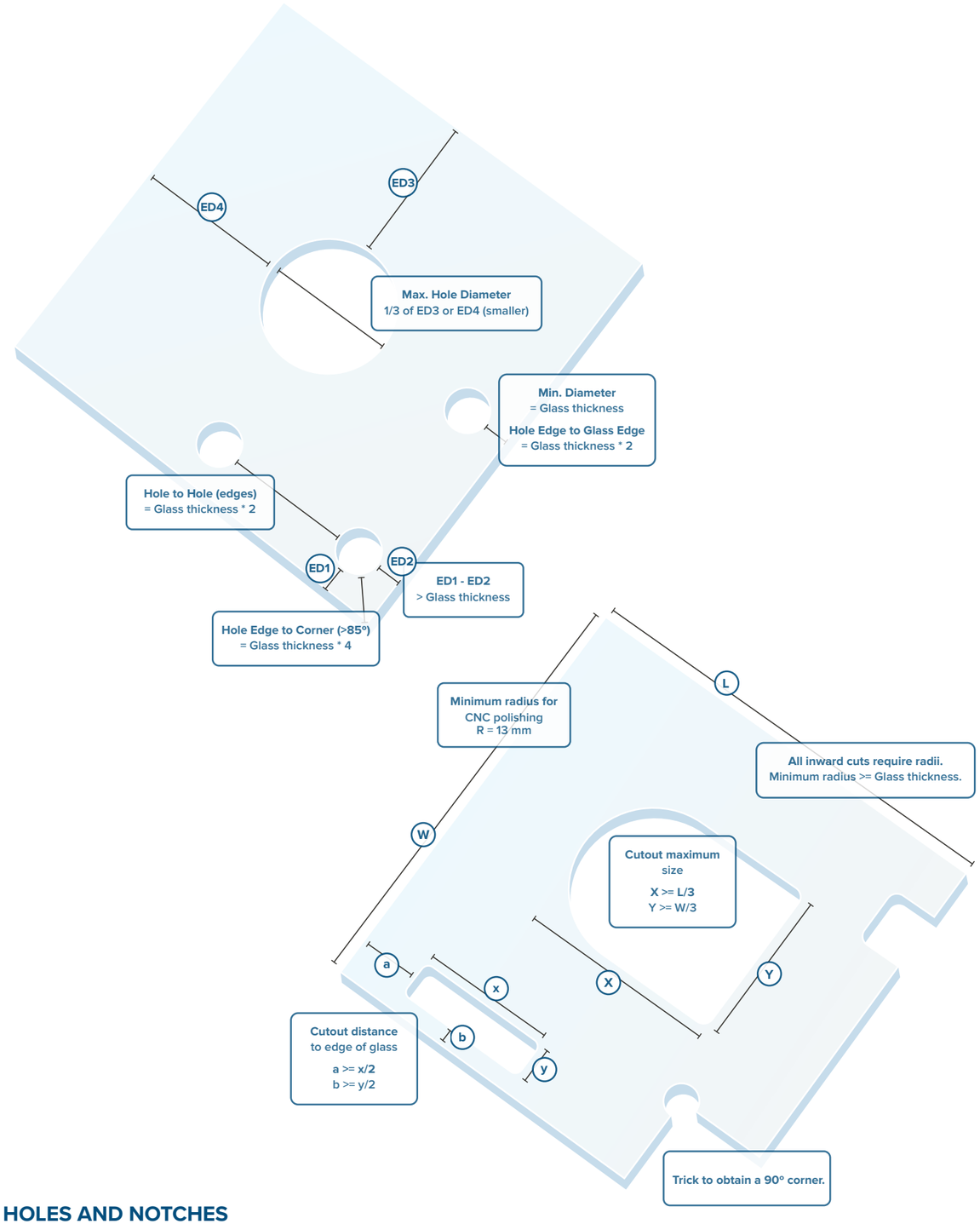
Onassis Cultural Center, NYC

FABRICATION

With the most sophisticated and precise machines on the market, AGNORA provides CNC fabrication, polishing and edging capabilities across a wide range of applications. AGNORA has the largest CNC Intermac machines in North America and the largest single-edger machine in the world. Our craftsmen are able to apply custom shapes and angles that were once considered impossible in the glass industry. This capability is useful for projects calling for high precision and hole alignment on glass fins and balustrades. Our fabrication abilities give you new freedom to design your projects.

At AGNORA

We use our customer's CAD files for fabrication.
Our heat-treated laminates are run through CNC processes for component alignment.
We have the largest single edge polisher in the world and can polish 100 mm - 4thick.
Our special polishing compound creates the ultimate smooth edge.



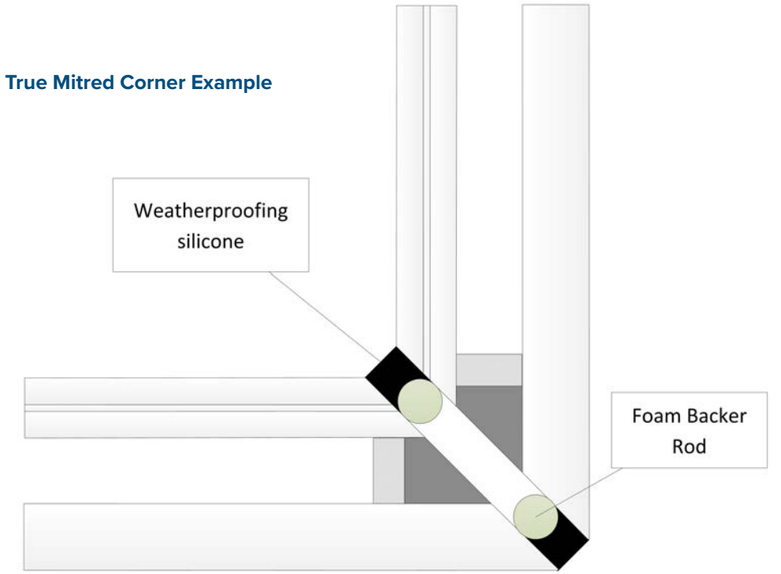
HOLES AND NOTCHES

When working with heat-treated glass, thermodynamic laws command the geometry of the holes and notches. These are described in ASTM C1048.04 paragraph 7.9. Here is a visual reminder of the basics. We can often process outside the above recommendations, therefore please contact us to discuss your drawings further.

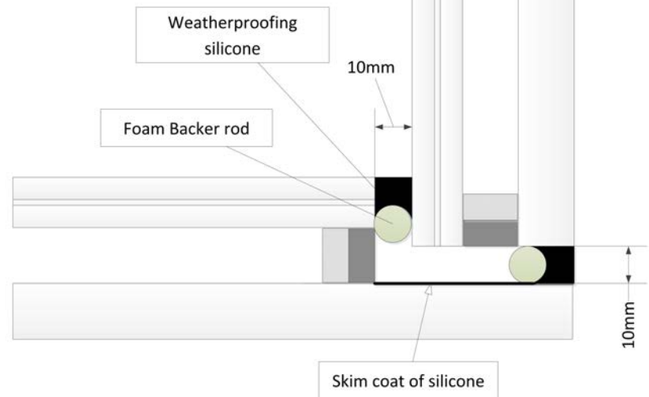
MITRED CORNER CONFIGURATIONS

We offer front and back mitres using the same finish, machines and precision.

True Mitred Corner Example

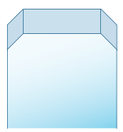


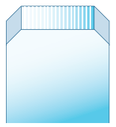
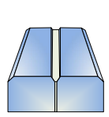
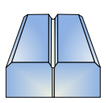
Step Side Corner Example



EDGING OPTIONS

We use the most detailed description of edge work in the market to ensure that our finishes match your expectations. You will see these names on our drawings, quotes and order acknowledgements.

	CATEGORY	NAME	DESCRIPTION	MACHINE	PRECISION	USAGE
	Minimum Edge	Belt Edge Arrissed	Diamond belt arrissed	KSR	± 0.5 mm	• All large (>6 m^2) glass, non-exposed tempered edge • Good dimensional tolerance
	Minimum Edge	Belt Flat Ground	Diamond Belt flat ground. Some spots remain “as cut”	KSR	± 0.5 mm	• Non-exposed tempered edge • Used often on 10 mm and coated glass • Good dimensional tolerance
	Diamond Tool	Diamond Tool Flat Ground	Dull edge with a chamfer on each side	Single Edger	± 1.5 mm	• Normal dimensional precision for thick (>=12 mm) tempered glass • Can only be used on straight edge
	Diamond Tool	Diamond High Polish	Shiny edge with a chamfer on each side	Single Edger	± 1.5 mm	• Normal dimensional precision • Best clarity • Ideal for annealed laminate • Can only be used on straight edge

	CATEGORY	NAME	DESCRIPTION	MACHINE	PRECISION	USAGE
	CNC	CNC Flat Ground	Dull edge with a chamfer on each side	Intermac	± 0.5 mm	• High dimensional precision for thick (>=12 mm) tempered glass • Used in cutout and holes
	CNC	CNC Polish	Shiny edge with lines parallel to surfaces and chamfers on each side	Intermac	± 0.5 mm	• High dimensional precision for thick (>=12 mm) tempered glass • Shiny but not perfect
	CNC	CNC High Polish	Shiny edge and chamfers on each side.	Intermac	± 0.5 mm	• High dimensional precision for thick (>=12 mm) tempered glass • Best polish and precision
	CNC	Perfect_ Align®	Shiny edge used for heat-treated laminates using PVB	Intermac	± 0.5 mm	• High Quality edge for tempered laminates to obtain a good interlayer trim
	CNC	Ultimate SG Finish®	Shiny edge used for heat-treated laminates (SentryGlas®)	Intermac	± 0.5 mm	• Perfect Align edgework PLUS proprietary process for smooth and uniform SG interlayer edge

Lake Huron Beach House

Heat Treatment

In order to provide greater resistance to thermal, mechanical stresses, and achieve specific break patterns for safety glazing applications, annealed float glass can be subjected to a heat-treating process.

FULLY TEMPERED (FT)

Tempered or toughened [UK] glass is a type of safety glass processed by controlled thermal treatments. It is four times stronger than annealed glass. Tempering shrinks the faces of the glass thus putting the outer surfaces into compression and the inner surfaces into tension. This imprisoned energy causes the glass, when broken, to shatter into small, granular chunks instead of splintering into jagged shards. The granular chunks are less likely to cause injury.

HEAT STRENGTHENED GLASS (HS)

Heat Strengthened Glass is produced with surface compression levels less than fully tempered glass. These lower compression levels yield a product that is generally twice as strong as annealed glass of the same thickness, size and type. Heat Strengthened Glass will fracture into large fragments, similar to annealed glass breakage but without the star/shard pattern. With its unique furnace configuration, AGNORA can HS up to 12 mm thick uncoated glass and 10 mm coated glass. Monolithic HS glass is not a safety glass.

At AGNORA

We are certified by the Safety Glass Certification Council SGCC.
We are uniquely able to Heat Strengthen 12mm glass and to Temper 12mm coated glass.
Our full convection furnace produces ultra-flat glass with minimal roller wave.
Laser engraved safety logo; precise and unobtrusive.
We are able to heat treat up to 50 L/W ratio

AGNORA FT glass meets the following standards:

ASTM C 1048-12 Standard Specification for Heat-Treated Flat Glass – Kind HS, Kind FT Coated and Uncoated Glass
ANSI Z97.1- 2015 – Safety Glazing Materials Used in Buildings
CAN CGSB 12.1-M90 – Canadian Standard for Tempered or Laminated Safety Glass

AGNORA HS glass meets the following standards:

ASTM C 1048-12 Standard Specification for Heat-Treated Flat Glass – Kind HS, Kind FT Coated and Uncoated Glass

LARGEST PRINTER IN NORTH & SOUTH AMERICA.

Digital Ceramic Printing

AGNORA is home to North & South America's largest digital ceramic in-glass printer. Our highly-skilled Digital Print Technicians use the Dip-Tech AR8000W to provide digital in-glass solutions that combine the durability of ceramic inks with the versatility of digital printing.

Whether searching for functional solutions such as solar control or seeking leading-edge technology for artistically vibrant and creative visual displays, digital ceramic printing offers a field-proven solution for exterior and interior glass printing applications. AGNORA's digital printing process applies ceramic ink directly to the glass surface.

After printing, the glass goes through our tempering oven, fusing the ceramic ink permanently into the surface of the glass. This results in powerful resistance to scratching, UV, and weather; ensuring long-lasting vivid colors. The printed glass can then be laminated or insulated.

Benefits

Infuse any image, design or pattern in-glass with brilliant accuracy and sharp resolution.
Sustainability with decades of UV and weather stability.
Solar Control & Controlled Transparency
Resistance to Chemicals
Time & Cost Efficiencies / Privacy & Opacity Control

At AGNORA

The success of a printed project relies heavily on the skills & expertise of the AGNORA Digital Print Specialist to manipulate the raw supplied files to reproduce the imagery with accuracy. Extensive testing using proven traditional litho-print methodologies is performed and then translated to digital ceramic ink. AGNORA pushes the limit of the printer's resolution in concert with file modifications to achieve optimal results.

Technical Specifications

Maximum Panel Size: 3.3 x 7.5 m (130 x 300in) (heat treatment limit)
Glass Thickness: 5 to 19mm
Recommended Substrate: Extra-clear (low iron),
Glass Ceramic ink is fused into glass during the tempering process

Printing Options

Photo-realistic
Spandrel Masking
Double Vision
Etch Like Ink
Traction Enhancement Ink

Opacicoat Applications

AGNORA uses roller coater technology to apply Opacicoat and Ceramic Paint.

Wall Cladding/Backsplash

Decorative

Solid color
Translucent whites
Simulated acid etch
Sandblasted glass imitation

Spandrel

Single Pane
Clear or Colored glass,
or glass with a “hard coat” Low E

Insulated Glazing

Allows for consistency
Most often made of the same composition
as the vision glass
Application of the ceramic paint or
Opacicoat paint on the interior lite (surface

At AGNORA

Strict process control allows us to create very even coatings so we can make beautiful etch or sandblast imitation.
Working with Opacicoat, we can match any color, including flashy reds and purples.
We stock numerous colors that may be required on short notice.

We are certified by ICD.

INSULATED GLASS

An Insulated Glass Unit (IGU) is two or three plies of glass enclosing a hermetically sealed air space. Insulating glass is the most effective way to increase a window's thermal performance by reducing the heat gain or loss.

To create this hermetically sealed and dehydrated space, the glass panes are separated by a spacer bar filled with a desiccant to absorb internal moisture.

All our insulated glass units are double sealed with a primary seal of polyisobutylene and a secondary seal of silicone. We prefer to use stainless steel bars for their superior thermal and mechanical performances but we can provide aluminum spacers to match existing conditions. We bend our spacer bars to limit the number of junctions therefore improving the gas retention.

Using high performance coatings, argon gas and stainless steel spacers, we can improve the insulation quality. The result is a significant reduction in both heating and air conditioning costs in a facility.

We own one of the world's largest automated IGU assembly lines.

Although an IGU might look simple and low tech, its design, components and craftsmanship will determine its longevity. At AGNORA, we want our product to have a useful life that matches your façade life. This is why we insist on a Center of Glass Deflection of 19 mm – ¾" (or L/175) as calculated using the ASTM E1300-12a. We have prepared a table giving you a basic idea of glass composition vs. glass size (see Wind Load Calculation Guidelines).

By combining different glass into an IGU, we control and enhance:

Light Level
External & Internal
Color & Reflection
Solar Energy Control
Thermal Insulation
Safety & Security
Acoustic Insulation
Fading Factors

At AGNORA

Vertical and automatic assembly for jumbo size units;
Guaranteed flat units and no pressure equalization required.
Automated four-step sides with argon.
Argon atmosphere press for over 95% fill rate.
Precise spacer shape bending, no corner keys, less junctions.

WIND LOAD CALCULATION GUIDELINES

AGNORA fabricates the highest quality and largest insulated glass units. We will offer an IGU warranty if the Center of Glass Deflection is smaller than ¾” using ASTM E1300-12a standard. The chart below provide a guideline glass configuration based on its overall dimensions.

300"	7500 mm	A	B	C	E	F	G	I	J
288"	7200 mm	A	B	C	E	F	G	I	J
276"	6900 mm	A	B	C	E	F	G	I	J
264"	6600 mm	A	B	C	E	F	G	I	J
252"	6300 mm	A	B	C	E	F	G	I	J
240"	6000 mm	A	B	C	E	F	G	H	I
228"	5700 mm	A	B	C	E	F	G	H	I
216"	5400 mm	A	B	C	E	F	G	H	I
204"	5100 mm	A	B	C	D	E	G	H	I
192"	4800 mm	A	B	C	D	E	G	G	I
180"	4500 mm	A	B	C	D	E	G	G	H
168"	4200 mm	A	B	C	D	E	G	G	H
156"	3900 mm	A	B	C	D	E	F	G	G
144"	3600 mm	A	B	C	D	E	E	G	G
132"	3300 mm	A	B	B	C	E	E	F	G
120"	3000 mm	A	B	B	C	D	E	E	F
108"	2700 mm	A	B	B	C	D	D	E	E
96"	2400 mm	A	B	B	C	C	D	D	E
84"	2100 mm	A	A	B	B	C	C	C	C
72"	1800 mm	A	A	B	B	B	B	B	B
60"	1500 mm	A	A	A	A	B	B	B	B
48"	1200 mm	A	A	A	A	A	A	A	A
		1200 mm	1500 mm	1800 mm	2100 mm	2400 mm	2700 mm	3000 mm	3300 mm
		48"	60"	72"	84"	96"	108"	120"	130"

TO NOTE

This chart is a guideline using a short duration load (3 sec.) = 1.4 Kpa - 29 PSF & long duration (30 days) 730 Pa -15 PSF.

RECOMMENDED GLASS THICKNESS

Chart is based solely on deflection values.
Glass can be annealed or tempered.

		COMPOSITION	OVERALL THICKNESS	WEIGHT per m^2	WEIGHT per ft^2
A		6 mm (1/4”) 12 mm (1/2”) spacer 6 mm (1/4”)	24 mm (1”)	30 Kg	6.1 Lbs
B		6 mm (1/4”) 12 mm (1/2”) spacer 10 mm (3/8”)	28 mm (1 1/8”)	40 Kg	8.2 Lbs
C		10 mm (3/8”) 12 mm (1/2”) spacer 10 mm (3/8”)	32 mm (1 1/4”)	50 Kg	10.2 Lbs
D		10 mm (3/8”) 15 mm (5/8”) spacer 12 mm (1/2”)	37 mm (1 1/2”)	55 Kg	11.3 Lbs
E		10 mm (3/8”) 15 mm (5/8”) spacer 15 mm (5/8”)	40 mm (1 9/16”)	63 Kg	12.8 Lbs
F		12 mm (1/2”) 15 mm (5/8”) spacer 15 mm (5/8”)	42 mm (1 5/8”)	68 Kg	13.8 Lbs
G		12 mm (1/2”) 15 mm (5/8”) spacer 19 mm (3/4”)	46 mm (1 13/16”)	78 Kg	15.9 Lbs
H		15 mm (5/8”) 15 mm (5/8”) spacer 19 mm (3/4”)	50 mm (1 15/16”)	85 Kg	17.4 Lbs
I		19 mm (3/4”) 15 mm (5/8”) spacer 19 mm (3/4”)	53 mm (2 1/16”)	95 kg	19.5 Lbs
J		19 mm (3/4”) 15 mm (5/8”) spacer 25 mm (1”)	59 mm (2 5/16”)	110 Kg	22.5 Lbs

COATED GLASS COMPARISON

*Products are sorted by Light Transmission

MANUFACTURER	PRODUCT	LBNL ID	STOCK	VTc	Rf	SHGC	Winter U BTU/h ft² °F	Winter U W/m² °C	Max H X L
Saint-Gobain	Planitherm XN II	21424	**6, 10 mm**	80%	13%	0.58	0.25	1.4	126" x 236"
Guardian	Climaguard 80/70	3248		78%	13%	0.62	0.27	1.5	100" x 144"
Saint-Gobain	Planitherm Ultra N II	11040		78%	11%	0.53	0.25	1.4	126" x 236"
AGC	Energy Select 63	1040		77%	12%	0.54	0.26	1.5	96" x 144"
Cardinal	LoE 180	2194	**6 mm**	76%	15%	0.60	0.26	1.5	96" x 144"
Viracon	VRE1-85	6050		76%	13%	0.54	0.27	1.5	84" x 165"
Pilkington	Energy Advantage on Optiwhite	**Note 1**	**6, 10 mm**	76%	17%	0.70	0.29	1.6	130" x 240"
Guardian	Climaguard Premium 2	11556		75%	15%	0.50	0.24	1.4	100" x 144"
AGC	Energy Select 73	1035		74%	16%	0.63	0.29	1.6	96" x 144"
AGC	Comfort E²	910		73%	14%	0.62	0.31	1.7	130" x 204"
Pilkington	Energy Advantage	9924	**6, 10 mm**	73%	16%	0.62	0.29	1.6	130" x 240"
PPG	Solarban 60 on Starphire	5349		72%	11%	0.41	0.24	1.4	130" x 204"
Viracon	VE1-2M	6046		70%	11%	0.37	0.25	1.4	84" x 165"
PPG	Solarban 60	5284		70%	11%	0.39	0.24	1.4	130" x 204"
Saint-Gobain	Cool-Lite XTREME 70-33 II on low iron	**Note 2**	**6, 10 mm**	70%	11%	0.30	0.24	1.3	126" x 236"
AGC	Energy Select 40	1050		70%	12%	0.38	0.24	1.4	96" x 144"
Cardinal	LoE² 272	2014	**6, 8 mm**	69%	11%	0.40	0.25	1.4	96" x 144"
Saint-Gobain	Cool-Lite SKN 076 II on low iron	21104	**6, 10 mm**	69%	13%	0.33	0.24	1.3	126" x 236"
PPG	Solarban 72 on Starphire	5435		69%	13%	0.29	0.24	1.4	100" x 144"
Guardian	SN68 on Ultra Clear	3112	**6, 10 mm**	69%	11%	0.38	0.25	1.4	130" x 240"
Guardian	SN 68	3110	**6, 10 mm**	67%	11%	0.37	0.25	1.4	130" x 240"
AGC	Energy Select 36	1055		65%	15%	0.35	0.24	1.4	96" x 144"
PPG	Solarban 70XL on Starphire	5439		64%	12%	0.27	0.24	1.4	100" x 144"
AGC	Energy Select 31	1080		63%	22%	0.30	0.24	1.4	96" x 144"

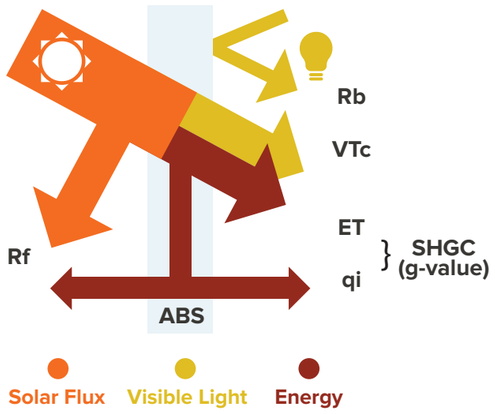
*Products are sorted by Light Transmission

MANUFACTURER	PRODUCT	LBNL ID	STOCK	VTc	Rf	SHGC	Winter U BTU/h ft² °F	Winter U W/m² °C	Max H X L
Cardinal	LoE³ 366	2157	**6, 8 mm**	63%	11%	0.27	0.24	1.4	96" x 144"
Viracon	VNE1-63	6261		62%	10%	0.28	0.24	1.4	84" x 165"
AGC	Energy Select R42	1045		62%	26%	0.42	0.25	1.4	96" x 144"
AGC	Energy Select 28	1070		62%	13%	0.28	0.24	1.4	96" x 144"
Guardian	SNX 62/27	3413	**6 mm**	61%	11%	0.26	0.24	1.4	130" x 240"
Pilkington	Eclipse Advantage	9909		60%	29%	0.55	0.31	1.7	130" x 240"
Saint-Gobain	Cool-Lite SKN 165 II	21112		60%	17%	0.31	0.24	1.4	126" x 236"
Saint-Gobain	Cool-Lite XTREME 60/28 II	11403	**6 mm**	60%	14%	0.24	0.24	1.3	126" x 236"
PPG	Solarban 67	5476		54%	19%	0.29	0.24	1.4	100" x 144"
Guardian	SN 54	3114		53%	13%	0.27	0.24	1.4	100" x 144"
Viracon	VRE1-59	6173		53%	31%	0.33	0.25	1.4	100" x 144"
PPG	Solarban 90	5447		51%	12%	0.23	0.24	1.4	100" x 144"
Saint-Gobain	Cool-Lite SKN 154 II	21136		51%	18%	0.25	0.24	1.3	126" x 236"
Guardian	SNX 51/23	26143		51%	14%	0.23	0.24	1.4	100" x 144"
Viracon	VUE1-50	6298		49%	11%	0.25	0.24	1.4	84" x 165"
Viracon	VRE1-54	6206		47%	32%	0.30	0.25	1.4	84" x 165"
Saint-Gobain	Cool-Lite KS 150 II	11165		45%	29%	0.33	0.26	1.5	126" x 236"
Viracon	VRE1-46	6172		43%	34%	0.28	0.25	1.4	84" x 165"
Guardian	SNR 43	3425		43%	27%	0.22	0.24	1.4	100" x 144"
PPG	Solarban R100	5404		42%	32%	0.23	0.25	1.4	100" x 144"
Viracon	VE1-42	6163		37%	19%	0.31	0.27	1.5	84" x 165"
Viracon	VRE1-38	6171		36%	44%	0.23	0.25	1.4	84" x 165"
Saint-Gobain	Cool-Lite ST120	21280	**Note 3**	19%	26%	0.24	0.45	2.5	126" x 201"

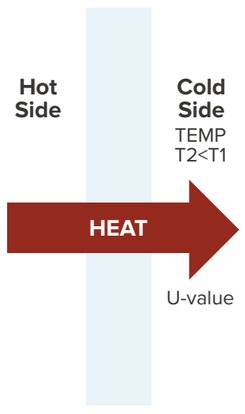
NOTE 1 Calculated in Optics6 using 9924 & 9814
NOTE 2 Calculated using Saint-Gobain Calumen II
NOTE 3 Stock in 10 mm
All calculations performed using Windows 7.4 IGDB 44.0
Items bolded YES are stocked inventory items

IGU GLOSSARY: KEY PERFORMANCE INDICATORS

Daylight and Solar Energy Factors



Thermal Insulation Factor



VTC	**Visible Light Transmission** The percentage of visible light that is transmitted through the glass. The higher the percentage the more daylight.
Rf/VLR	**Reflection front - Visible Light Reflection** The percentage of visible light that is reflected by the glass surface. The higher the percentage the more reflection.
SHGCc	**Solar Heat Gain Coefficient or Solar Factor** The measure of the total solar energy transmittance entering a building through the glazing as heat gain. The lower the SHGC the better the glass restricts heat energy transmission.
SCc	**Shading Coefficient** SC = SHGC/0.87
U value	**U Value or U Factor** A measure of the heat gain or loss through glass due to the difference between indoor and outdoor temperatures. The lower the number, the better the performance at reducing heat gain and heat loss. The imperial number is the reciprocal of the R-Value.
Tdw-ISO	**Damage weighted Transmittance** Quantifies the ability of glass to reduce fading by measuring the effects of both transmitted UV and visible light.

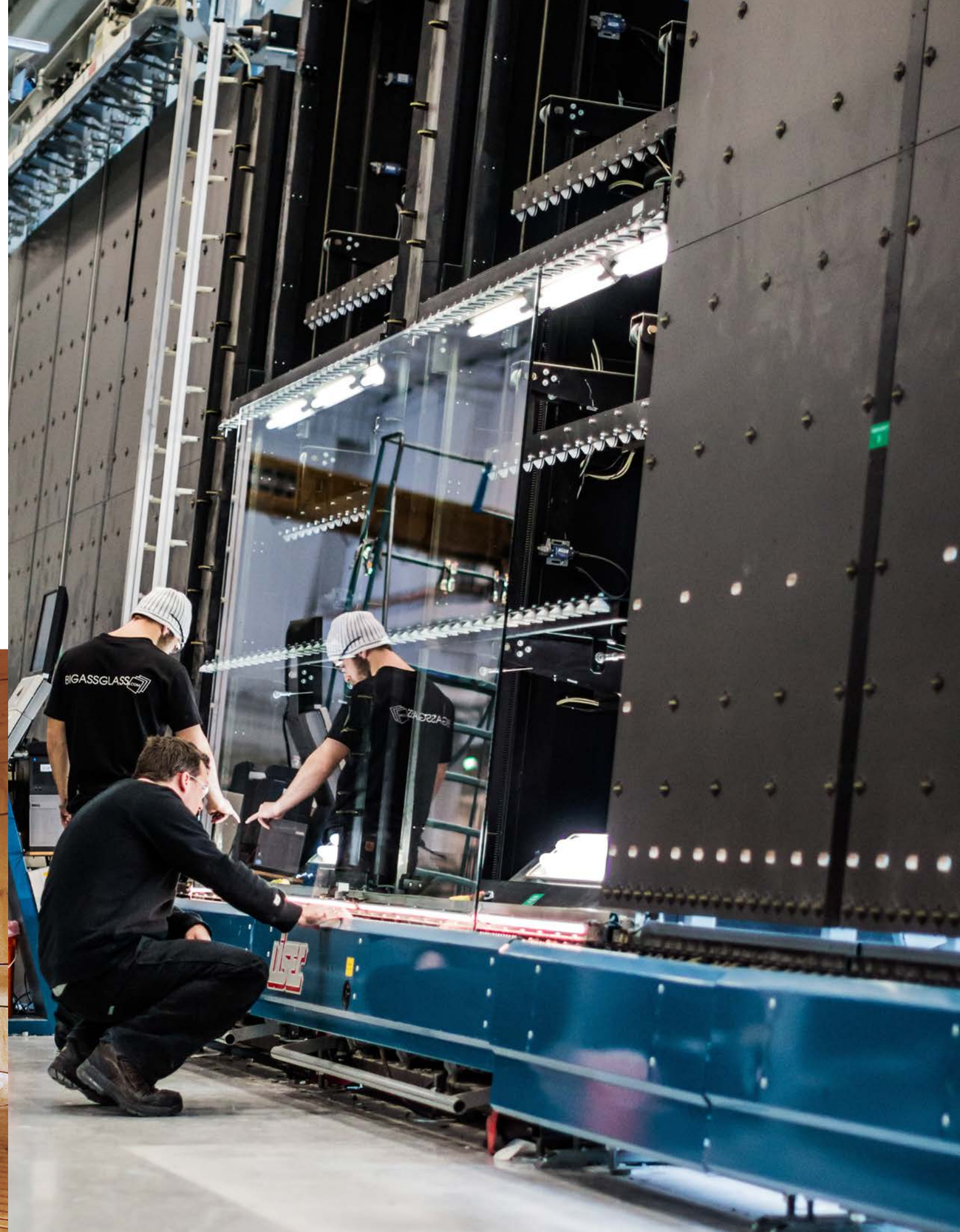
SPACER BARS

We maintain inventory of the following:

	ALUMINUM MILL FINISH	ALUMINUM BLACK (DARK BRONZE)	STAINLESS STEEL MILL FINISH	STAINLESS STEEL BLACK
10 mm - 3/8"	■	■	■	■
12 mm - 1/2"			■	■
13 mm - 1/2"	■	■		
16 mm - 5/8”	■	■	■	■
18 mm - 11/16'			■	■
19 mm - 3/4"	■	■		

SEALANT - SILICON

We use two part DOW 982FS silicone in Black and two part Momentive IGS 3723 in Grey.



WMS Boat House at Clark Park, Chicago

Laminated Glass

Laminated glass is a safety glazing material that holds together when shattered. Laminated glass may crack upon impact, but the glass fragments adhere to the protective interlayer rather than falling free and potentially causing injury. Typically laminated glass is constructed with two plies of glass permanently bonded together with polyvinyl butyral (PVB). Those plies can be annealed, heat strengthened or tempered. AGNORA can laminate up to 8 layers of glass and 100 mm – 4” thickness.

Laminated glass has been used since 1939 in automobile windshields. Its use in architectural projects started in the 1960s in applications where there is a possibility of human impact or where the glass could fall if shattered. Skylight glazing typically uses laminated glass. This is the best technology in hurricane-resistant construction; laminated glass is often used in exterior storefronts, curtain walls and windows. The use of ionoplast interlayer (SentryGlass® IG) opens up a new era in structural glass design. Advanced interlayers offer design flexibility with options for translucency, color, printed designs, etc.

Advantages of Laminated Glass

Safest glass available – retains fragments
Remains intact, transparent and functional even if broken – perfect for storefront
Provides safety with annealed glass – no roller wave distortion
Design freedom: color, translucency, opaque, solar control
Burglar retardant & Bullet resistant when multi-layers of glass are used
Protection from flying debris in hurricane & bomb blast
Cuts 99% of Ultra-Violet light
Improves acoustic properties

At AGNORA

AGNORA operates the largest automated line in North America.

Our process includes both the traditional NIP method and complex vacuum bagging techniques.

Industry-leader for precise layer alignment.

We are certified by the Safety Glass Certification Council SGCC.

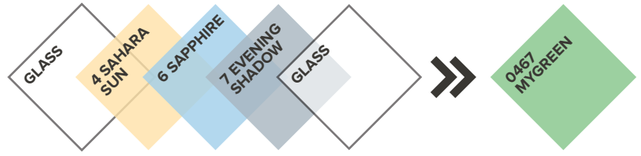
INTERLAYERS IN STOCK

Kuraray/ Trosifol	PRODUCT	SIZE	
PVB - BG R20	UltraClear 0.38 mm – 0.015” UltraClear 0.76 mm – 0.030” UltraClear 1.52 mm – 0.060”	3300 mm	130”
Trosifol Acoustic	Clear 0.76mm - 0.030"	2460 mm	96"
Kuraray	**PRODUCT**	**SIZE**	
SentryGlas®	Clear 1.52mm - 0.060” (Sheet) Clear 0.76 mm - 0.030" White 0.76 mm - 0.030"	2510 mm x 5890 mm 3300 mm 1828 mm	99” x 232” 130" 72"
Eastman	**PRODUCT**	**SIZE**	
Saflex Standard	Clear 0.38 mm - 0.015” Clear 0.76 mm - 0.030” Grey 0.38 mm - 0.015” Bronze 0.38 mm - 0.015”	2460 mm	96”
Vanceva Foundation & Speciality Color	Available upon request	2460 mm	96”
Vanceva Transluscent White	Arctic Snow (TL 65%) - 9 Cool White (TL 81%) - A	2460 mm	96”
Vanceva Opaque z	Polar White (TL 8%) - F Absolute Black - G	3210 mm	126”

VANCEVA COLOR SYSTEM

How the System Works
The Vanceva color system is based on a foundational palette of 4 key colors (pink, blue, grey and yellow) in two light transmission levels to create a base palette of 8 colors. Similar to the CMYK color system most often used in printing, the Vanceva color system allows architects, designers and glass fabricators the ability to layer several different color interlayers together, in different intensity levels, to create thousands of color possibilities.

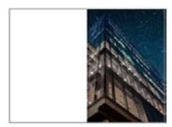
Vanceva Color Formulation Codes
One to four sheets of interlayer can be used to construct custom colored laminated glass. Since the maximum number of interlayers is four, each Vanceva color has been assigned a four-digit number. Each number or letter represents a layer from the foundational palette used to create all Vanceva color interlayer combinations.
The illustration below details an example of a three layers Vanceva color code, and each corresponding color associated with the final glass make up. An example of a one layer combination would be Vanceva 0006, while an example of a two layer color combination would be Vanceva 0026, etc.



Vanceva Translucent White
In both interior and exterior applications, Vanceva white interlayers offer a full range from total opacity for private settings to translucent designs to let the light shine in. They provide superior, uniform color, which results in a unique white safety glass. The interlayer is layered between two pieces of glass, so they are easy to maintain and clean. Vanceva interlayers are available worldwide with easy access to replacement glass. Laminated glass made with Vanceva white interlayers delivers effective protection from harmful UV radiation, glare, solar energy transmittance and heat build-up. The interlayers screen out up to 99 percent of damaging UV light to help retard color fading and the deterioration of fabrics and furnishings.

Vanceva Cool White
If a project requires a frosted look for design or privacy, a translucent effect can be created with Vanceva Cool White. Cool White has an 81% light transmission level – allowing for light to enter the space while maintaining privacy.

Vanceva Arctic Snow
For a more private feel without complete opacity, a more translucent effect can be created by using Vanceva Arctic Snow. Arctic Snow has a 68% light transmission level. Multiple layers of Arctic Snow can be used to reduce light transmittance even further--down to 29%.



Vanceva Polar White
Vanceva Polar White has superior opacity and uniformed colored surface. Polar White is also ideal when designers want to achieve two different colors of glass in a single unit (i.e. white on one side and opaque True Blue on the other) which allows for even greater design flexibility. Polar White has a light transmittance level of 8%.

Vanceva Absolute Black
Absolute Black has excellent opacity and a deep, neutral uniform colored surface compared to any black glass product on the market. Compared to back painted black glass, Absolute Black provides superior aesthetics and visual quality (no pinholes) plus the additional benefits only laminated glass offers. Absolute Black has a light transmittance level of 0%.

AGNORA recommends the Vanceva Color Selector Tool to design your own color.

EMBEDDED COATING COMPARISON

LAYER 1	INTERLAYER	LAYER 2	VTc Visible Light transmission	SHGc Solar Heat Gain Coeff.	Rf Reflection Front	Rb Reflec-tion back	U value BTU/ $h*ft^2*°F$
10 mm Optiwhite	Trosifol BG 1.52 mm	10 mm Optiwhite	88%	0.81	8%	8%	0.91
10 mm Clear	Trosifol BG 1.52 mm	10 mm Clear	81%	0.65	8%	8%	0.91
Energy Advantage 10 mm #2	Trosifol BG 1.52 mm	10 mm Clear	77%	0.61	9%	9%	0.91
Energy Advantage 10 mm #2	Trosifol BG 1.52 mm	10 mm Optiwhite	80%	0.66	9%	9%	0.91
10 mm Optiwhite	Trosifol BG 1.52 mm	10 mm Energy Advantage #4	78%	0.61	10%	10%	0.59
Planitherm XN II 6 mm PlaniClear	PVB 1.52 mm	6 mm Clear	80%	0.69	11%	10%	0.91
SKN076 6 mm low iron	PVB 1.52 mm	6 mm Clear	69%	0.44	13%	13%	0.91
XTREME 60-28 II 6mm PlaniClear	PVB 1.52 mm	6 mm Clear	57%	0.35	12%	12%	0.91

Introducing Jumbo Anti-Reflective Glass 236"x 126"

Ideal for any application where excessive glare of reflection creates an obstruction.

Excellent Optical Properties
Reflection <1%
Typical 0.7%

Museum quality - best anti-reflective available
Enhances light transmission - greater contrast & color-neutrality.
Soft neutral blue reflection - no haze

Available in jumbo sizes: 236" x 126"
6 & 10 mm extra-clear single sided in stock
Double sided monolithic available on request

LAMI PHOTOMETRIC

6mm-1/4"/0.76 mm/0.030"PVB/6mm-1/4"
VLt 95%
Rf 0.7%
U 5.5 W/(m^2 °C) – 1.0 BTU/(h ft^2 °F)
SHGc 0.74

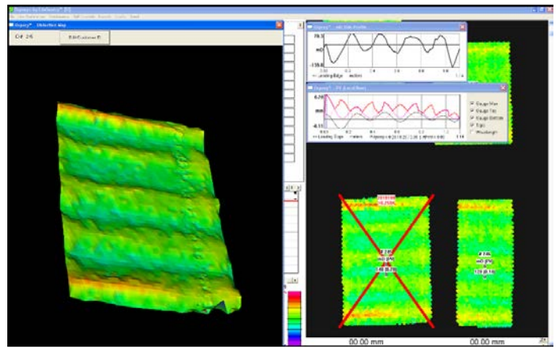
COMMON APPLICATIONS

Museum vitrines
Display cases
Retail Storefronts
Car Showrooms
Restaurants
Control Towers
Sporting Facilities

QUALITY CONTROL

OPTIMIZING QUALITY – SCANNING FOR DEFECTS
Through high-resolution images, we can categorize defects as dust, scratches, dirt, inclusions, and fingerprints on glass. By scanning the product before final assembly, we ensure that we meet the desired quality that our customers are seeking.

OPTICAL QUALITY CONTROL – DISTORTION ANALYSIS
All of our heat treated glass is analysed for localised distortion. We are able to measure the distortion, or curvature of the glass. This measurement is made in (milli) diopters and can calculate the traditional peak to valley and edge curl values. The distortion measurements are displayed as a color map of the entire sheet that can then be manipulated for better viewing or further analysis. We set up pass/fail optical power values that are applied to individual glass lites.



HEAT SOAK TESTING

Fully tempered glass may break without warning due to the expansion of nickel sulfide inclusions (NiS) present within float glass. The best way to avoid this risk is to use annealed glass. However, sometimes tempered glass is required for its added strength. Although the incidence of tempered glass breakage due to these inclusions is rare, greater publicity of their occurrence has resulted in an increased awareness of this phenomenon.

In all cases where falling glass debris is dangerous or when the value of the glass or its replacement are significant, AGNORA recommends performing a heat soak test to provide the added assurance that significant spontaneous breakage will not occur. Heat Soaking remains the only practical way to uncover NiS inclusions.

AGNORA acquired an oversized Heat Soak Oven to test its tempered glass. After tempering, we reheat the glass to 290°C - 555°F for two hours. Most glass containing NiS will shatter during this stressful procedure, this is why it is called **destructive testing**.

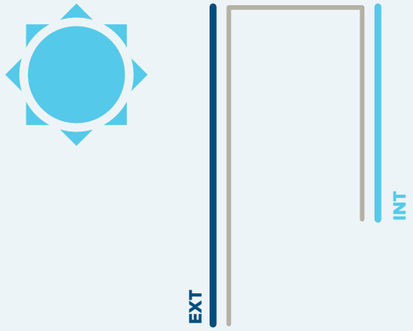
Because there is no North American standard for this procedure, we use the most credible testing method: the European standard EN14179-2. Our oven is regularly calibrated by a European certified company.

RESOURCES

LAYERS & COATING DIRECTION CHART

For all of our customer quotes and order confirmations, we list glass, as viewed in order, from EXT to INT surfaces. AGNORA supports industry-standard drawings, views are assumed to be EXT.

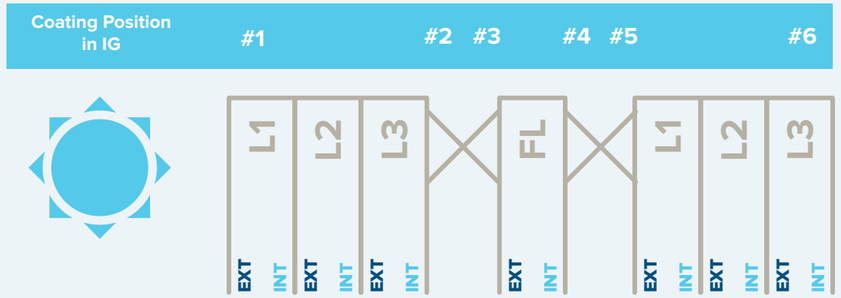
MONOLITHIC GLASS



EXT
(outside, against the elements, looking towards the house from the street)

INT
(inside/indoors, warm side, looking to the outside from within the house)

INSULATED GLASS



LAMINATED GLASS

OUR PARTNERS AND SUPPLIERS

Optiwhite Low Iron
Energy Advantage Low-e
Optiview Anti-reflective
Colored

High Performance Coatings
Diamant Extra-clear
Satinovo Acid Etch
Miralite Ecological Mirrors

Clarity Anti-Reflective
High Performance coatings

High Performance Coatings

Traction Glass

Digital Ceramic Printing

Extra-clear PVB
SentryGlas

Ceramic Enamel Paints & Etch

Vanceva Color System
Vanceva White Collection
Saflex Acoustic

Opacicoat, Silicone
Based Paint

Structural Silicone

INDUSTRY STANDARDS

Insulated Glass Certification Council (IGCC) / Insulated Glass Manufacturer Alliance (IGMA)
ASTM E2190-10 - Insulating Glass Unit Performance

Product Certification #3329
Triple glazed/Coated Glass/Stainless Steel Spacer/Argon/Silicone

Safety Glazing Certification Council (SGCC)
ANSI Z97.1-2015 - Safety glazing materials used in buildings

Products	Class	Certification #
Tempered 6 mm	UA	4883
Tempered 10 mm	UA	4885
Tempered 12 mmw	UA	4884
Laminated 66.2	UA	4886

Gesellschaft für Material- und Bauteilprüfung mbH (German Certifier)
EN 14179-2:2005 Heat Soaked Thermally Toughened Soda Lime Silicate Safety Glass

PRODUCT & PROCESS CERTIFICATIONS

Saint-Gobain
Coated Glass Fabricator
(Expro Club Member, Silver Level)

Saflex and Kuraray
Dade County NOA Qualified Laminator

ICD

GLASS LOGO STANDARD DESIGNATIONS

100 Monolithic Tempered
AGNORA
Tempered
ANSI Z97.1-2015
CAN/CGSB-12.1-2017
MMM YY

106 Monolithic Tempered 6 mm
AGNORA
Tempered
ANSI Z97.1-2015
CAN/CGSB-12.1-2017
6mm UA SGCC 4883
MMM YY

110 Monolithic Tempered 10 mm
AGNORA
Tempered
ANSI Z97.1-2015
CAN/CGSB-12.1-2017
10mm UA SGCC 4885
MMM YY

112 Monolithic Tempered 12 mm
AGNORA
Tempered
ANSI Z97.1-2015
CAN/CGSB-12.1-2017
12mm UA SGCC 4884
MMM YY

200 Monolithic Tempered HST
AGNORA
Tempered HST
ANSI Z97.1-2015
CAN/CGSB-12.1-2017
EN14179-2
MMM YY

206 Monolithic Tempered 6 mm HST
AGNORA
Tempered HST
ANSI Z97.1-2015
CAN/CGSB-12.1-2017
EN14179-2
6mm UA SGCC 4883
MMM YY

210 Monolithic Tempered 10 mm HST
AGNORA
Tempered HST
ANSI Z97.1-2015
CAN/CGSB-12.1-2017
EN14179-2
10mm UA SGCC 4885
MMM YY

212 Monolithic Tempered 12 mm HST
AGNORA
Tempered HST
ANSI Z97.1-2015
CAN/CGSB-12.1-2017
EN14179-2
12mm UA SGCC 4884
MMM YY

400 Laminated Annealed
AGNORA
Laminated
ANSI Z97.1-2015
CAN/CGSB-12.1-2017
(H) UA SGCC 4886
MMM YY

401 Laminated Tempered
AGNORA
Laminated Tempered
ANSI Z97.1-2015
CAN/CGSB-12.1-2017
(H) UA SGCC 4886
Feb-17

402 Laminated Tempered HST
AGNORA
Laminated FT HST
ANSI Z97.1-2015
CAN/CGSB-12.1-2017
EN14179-2
(H) UA SGCC 4886
MMM YY

403 Laminated Heat Strengthened
AGNORA
Laminated HS
ANSI Z97.1-2015
CAN/CGSB-12.1-2017
(H) UA SGCC 4886
MMM YY

300 Monolithic Heat Strengthened
AGNORA
Heat Strengthened
ASTM C 1048-04
MMM YY

500 Dade County
AGNORA
Laminated
ANSI Z97.1-2015
MDCA
Storm / VS02
(H) UA SGCC 4886
MMM YY

600 Sample
AGNORA
Ref OOOO-LL
MMM YY

All glass that meets the ASTM and Canadian standards can have our official permanent identification marking laser-etched into the glass. The table to the left shows how the marking is used for each product.

An example of the engraved logo.

CRATE CONSTRUCTION

AGNORA takes great care to package and crate all glass to help ensure it reaches its destination safely. Should you have any specific questions regarding glass sequencing or loading, contact your AGNORA Project Manager. Our logistics team will assist you with delivery-specific details prior to your glass departing AGNORA.

LOGISTICS@AGNORA.COM

CLEANING ARCHITECTURAL GLASS PRODUCTS

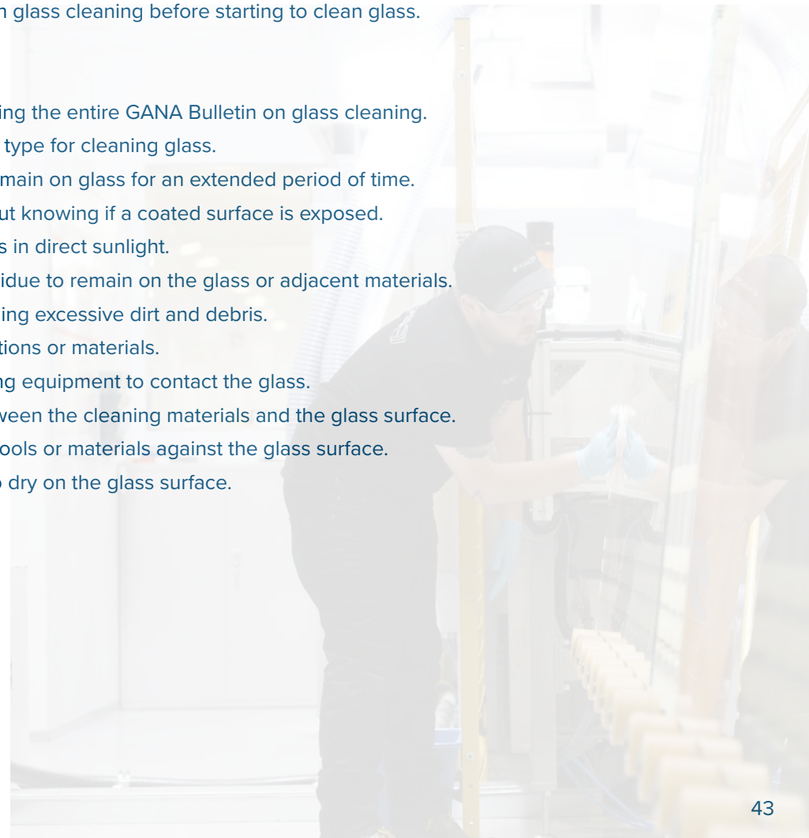
The following “Dos” and “Do Nots” are offered as a supplement to the Glass Association of North America (GANA) Glass Informational Bulletin– Proper Procedures for Cleaning Architectural Glass Products.

TO DO:

DO clean glass as soon as dirt and residue appear visibly.
DO determine if coated glass surfaces are exposed.
DO exercise special care when cleaning coated glass surfaces.
DO avoid cleaning tinted and coated glass surfaces in direct sunlight.
DO start cleaning at the top of the building and continue to lower levels.
DO soak the glass surface with a clean water and soap solution to loosen dirt and debris.
DO use a mild, nonabrasive commercial window cleaning solution.
DO use a squeegee to remove all of the cleaning solution.
DO dry all cleaning solution from window gaskets, sealants and frames.
DO clean one small window area and check to see if procedures have caused any damage.
DO be aware of and follow the glass supplier’s specific cleaning recommendations.
DO caution other trades against allowing other materials to contact the glass.
DO watch for and prevent conditions that can damage the glass.
DO read the entire GANA Bulletin on glass cleaning before starting to clean glass.

TO NOT DO:

DO NOT start cleaning without reading the entire GANA Bulletin on glass cleaning.
DO NOT use scrapers of any size or type for cleaning glass.
DO NOT allow dirt and residue to remain on glass for an extended period of time.
DO NOT begin cleaning glass without knowing if a coated surface is exposed.
DO NOT clean tinted or coated glass in direct sunlight.
DO NOT allow water or cleaning residue to remain on the glass or adjacent materials.
DO NOT begin cleaning without rinsing excessive dirt and debris.
DO NOT use abrasive cleaning solutions or materials.
DO NOT allow metal parts of cleaning equipment to contact the glass.
DO NOT trap abrasive particles between the cleaning materials and the glass surface.
DO NOT allow other trades to lean tools or materials against the glass surface.
DO NOT allow splashed materials to dry on the glass surface.



AT A GLANCE

in	2	4	8	16	32	64	mm
0.016						1/64	0.4
0.031					1/32		0.8
0.047						3/64	1.2
0.063				1/16			1.6
0.078						5/64	2.0
0.094					3/32		2.4
0.109						7/64	2.8
0.125			1/8				3.2
0.141						9/64	3.6
0.156					5/32		4.0
0.172						11/64	4.4
0.188				3/16			4.8
0.203						13/64	5.2
0.219					7/32		5.6
0.234						15/64	6.0
0.250		1/4					6.4
0.266						17/64	6.7
0.281					9/32		7.1
0.297						19/64	7.5
0.313				5/16			7.9
0.328						21/64	8.3
0.344					11/32		8.7
0.359						23/64	9.1
0.375			3/8				9.5
0.391						25/64	9.9
0.406					13/32		10.3
0.422						27/64	10.7
0.438				7/16			11.1
0.453						29/64	11.5
0.469					15/32		11.9
0.484						31/64	12.3
0.500	1/2						12.7
0.516						33/64	13.1
0.531					17/32		13.5
0.547						35/64	13.9
0.563				9/16			14.3
0.578						37/64	14.7
0.594					19/32		15.1
0.609						39/64	15.5
0.625			5/8				15.9
0.641						41/64	16.3
0.656					21/32		16.7
0.672						43/64	17.1
0.688				11/16			17.5
0.703						45/64	17.9
0.719					23/32		18.3
0.734						47/64	18.7
0.750		3/4					19.1
0.766						49/64	19.4
0.781					25/32		19.8
0.797						51/64	20.2
0.813				13/16			20.6
0.828						53/64	21.0
0.844					27/32		21.4
0.859						55/64	21.8
0.875			7/8				22.2
0.891						57/64	22.6
0.906					29/32		23.0
0.922						59/64	23.4
0.938				15/16			23.8
0.953						61/64	24.2
0.969					31/32		24.6

AREA CONVERSION

1 m²	=	10.764 ft²
1 ft²		0.0929 m²

MASS CONVERSION

1 Kg	=	2.205 Lbs		
1 Lb		0.4536 Kg		
1 ton		907 Kg	=	2000 Lbs
1 Tonne		1000 Kg		2205 Lbs

DISTANCE CONVERSION

1 Inch	=	25.4 mm	= 2.54 cm	0.0254 m
1 Foot		12 inches	30.48 cm	0.3048 m
1 m		39.37 inches	100 cm	1000 mm

DENSITY/WEIGHT

Water	=	1.0				
Glass		2.5				
1 Liter	or	1000 cm³	of Water	weighs		1.0 Kg
1 Liter		1000 cm³	of Glass			2.5 Kg

FOR GLASS

1000 mm	X	1000 mm	X	1 mm	=	1 litre	or 2.5 Kg
1000 mm		1000 mm		6 mm		6000 cm³	15 Kg

GLASS WEIGHTS

1.0 m²	=	10.764 ft²
1.0 ft²	=	0.093 m²

THICKNESS

1 mm	1/32"	2.5 Kg	5.5 Lbs
5 mm	3/16"	12.5 Kg	27.6 Lbs
6 mm	1/4"	15.0 Kg	33.1 Lbs
8 mm	5/16"	20.0 Kg	44.1 Lbs
10 mm	3/8"	25.0 Kg	55.1 Lbs
12 mm	1/2"	30.0 Kg	66.2 Lbs
15 mm	5/8"	37.5 Kg	82.7 Lbs
19 mm	3/4"	47.5 Kg	104.7 Lbs
1 mm	1/32"	0.23 Kg	0.51 Lbs
5 mm	3/16"	1.18 Kg	2.60 Lbs
6 mm	1/4"	1.39 Kg	3.07 Lbs
8 mm	5/16"	1.86 Kg	4.10 Lbs
10 mm	3/8"	2.32 Kg	5.12 Lbs
12 mm	1/2"	2.79 Kg	6.15 Lbs
15 mm	5/8"	3.48 Kg	7.68 Lbs
19 mm	3/4"	4.41 Kg	9.73 Lbs

TAKE A NOTE

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AGNORA is the official, sole supplier of fabricated glass to the Federal Aviation Administration (FAA). From coast to coast, we have provided glass to over 50 airports including O'Hare, Sarasota Bradenton (pictured), and Detroit Metro Airport.

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