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On the cover: Visitors to Caymus Winery's new Visitor Experience Centre will experience beautiful views of the surrounding vineyards thanks to the floor-to-ceiling glass façade, supplied by 2023 Top Glass Fabricator AGNORA. AGNORA worked with the design team to deliver glass with a high degree of visual performance, significantly limiting both anisotropy and distortion. Photo by Matthew Millman.



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ANNUAL REPORT

The 2022 NGA Annual Report showcases the association's top achievements

LEGISLATIVE UPDATES

On-demand webinar with ASA's Mike Oscar about legislation for glaziers

ADVOCACY DAYS

NGA's Glass & Glazing Advocacy Days gains federal and congressional attention

GLASSBLOG



IMPROVEMENT

Going Where We've Never Been

By David Vermeulen, TGP



TRENDS

Colors Go Simple for 2023

By Tammy Schroeder, Lintec



INDUSTRY

Glass Events & New Data

By Max Perilstein, Sole Source Consultants



PROJECT SHOWCASE

Featured in Glass Magazine Weekly and on [GlassMagazine.com](https://www.glassmagazine.com). To submit projects or case studies, write [Norah Dick, ndick@glass.org](mailto:norah.dick@glass.org). Pictured: Bendheim supplied its TurnKey Glass Wall Cladding system for the anchor building in a larger \$157-million downtown redevelopment project in Fishers, Indiana. Housing the new corporate headquarters for First Internet Bank, Bendheim's system frames the elevators of the six-story structure. Architectural Glass & Metal of Indianapolis was the glazing contractor.

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Five Ways to Address Generational and Mentorship Gaps



KATY DEVLIN
Content Director,
Editor-in-Chief
kdevlin@glass.org

How do you make time to train and mentor new employees? How do you incentivize workers to stay? Is the next generation ready to take the reins?

These were several key questions addressed by panelists during the panel “Five Ways to Address Generational & Mentorship Gaps” at the recent 25th anniversary BEC Conference in Las Vegas, which drew more than 680 industry participants for two days of industry education. The event was hosted by the National Glass Association and was held March 5-7 at Caesar’s Palace Las Vegas.

During the panel, leaders from three family glazing businesses—Joey Aragon, director of operations at Aragon Construction; Taylor Anderson, director of marketing for Anderson Aluminum; and Jeff Haber, managing partner at W&W Glass—offered strategies on a range of labor issues, including mentorship, worker retention and ownership transition. Five takeaways from the panel:

Take time for a big-picture approach. “Make the time to work on the business, not just in the business,” says Anderson. “Focus your efforts on the company’s most important initiatives, set

timelines, execute, and follow-up. And determine short-term and long-term goals regarding ownership, transitions, and department initiatives.”

Prioritize mentorship. Aragon recommended formalizing mentor-mentee partnerships at the company. “This adds excitement for those people and the people around them,” he says. Additionally, Aragon also emphasized that mentorship programs can start small. “Don’t let trying to make something big and in-depth be a barrier to creating a mentorship program. You can do this tomorrow,” he says.

Develop processes to capture institutional knowledge. Anderson recommends that companies create development programs that can help fill the knowledge and experience gaps between more experienced and newer employees. “Develop opportunities for your more experienced employees to step out of their day-to-day and focus on sharing their knowledge with the next generation,” she says.

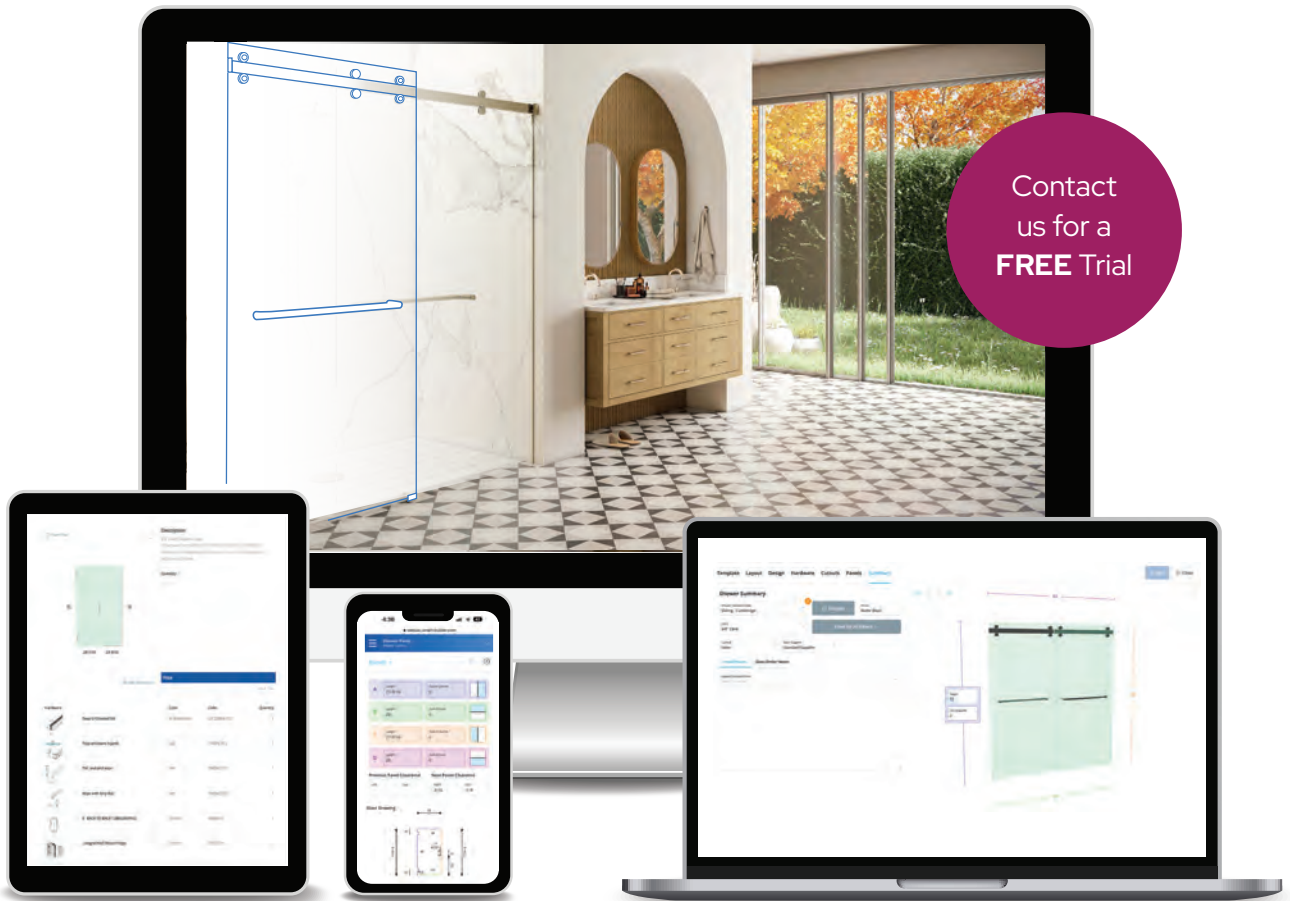
Systemize the feedback process. “When we got on a regimented program for feedback, lightbulbs went off,” says Aragon. The company instituted quarterly conversations. “What’s good about that is it creates a predictable rhythm. Mentors and mentees know it’s coming up ... and everybody has chance to hear feedback.”

Identify goals for business exit and succession. All company owners should begin to make plans for ownership transition and management succession. “At a certain point you have to decide, what are you going to do,” according to Haber, who discussed his company’s recent transition to an employee stock ownership plan. “Our goal was to seamlessly find a way to not damage the brand equity built up over decades while protecting all the stakeholders—i.e., employees, selling shareholders, customers and the next generation while transferring ownership,” he says.

For more coverage from BEC, visit GlassMagazine.com. ■



From left to right, panelists Jeff Haber of W&W Glass, Joey Aragon of Aragon Construction, Taylor Anderson of Anderson Aluminum, and moderator Sara Neiswanger, NGA.



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NEED-TO-KNOW INFORMATION
FROM THE NGA

NGA WITH GANA: FIVE YEARS ONE VOICE

Five years ago, the Glass Association of North America combined with the National Glass Association in order to harness the resources each association provided into one organization. The combined association has delivered on its promises to the industry with expanded education and training programs, advocacy efforts, 105 technical publications, two magazines, and a robust schedule of 27 conferences and events with a total of 34,846 attendees, all while reducing member costs and effort.

The NGA-GANA combination facilitated more robust events for the industry to educate, idea-share and network. Since the combination, NGA expanded to host five new events—Glass Processing Automation Days and the NGA Fall Conference in Toledo and Old Guard Reunion in 2019, the first BEC Conference in Nashville in 2020, Bridging the Supply Chain in 2022, and the 2022 NGA Blueprint for Collaboration in conjunction with A'22 Conference on Architecture to discuss challenges and solutions of the future of glass in design.

NGA also doubled down on providing education and events about glass specifically for architects—issuing 111 AIA learning units to licensed architects and hosting the Glass & Glazing Design Academy with Architectural Record for almost five years.

The organization also further strengthened NGA's industry advocacy and technical resources. NGA's expanded global alliance and advocacy

NGA MILESTONES

Since the merger, NGA with GANA has hosted:

- 27 conference and events
- 34,846 event attendees
- 5 new events

NGA with GANA has organized:

- Over 200 committee volunteers
- 44 active task groups
- 82 new task groups

reach includes 82 task groups since the combination, 200-plus committee volunteers and 44 currently active task groups. Glass & Glazing Advocacy Days is one of the newest member benefits made possible by the combined strength of the associations and last year NGA sponsored and facilitated the United Nations' International Year of Glass, representing the glass and glazing industry on four continents.

View more event milestones at glass.org/news/2023/nga-gana-five-years-one-voice. ■

NGA RESPONDS TO GSA LEC STANDARD

The U.S. General Services Administration is working quickly to establish a standard for materials that qualify for funds allocated by the Inflation Reduction Act. NGA submitted a response to the GSA Inflation

Reduction Act Low Embodied Carbon Material Standards (GSA LEC Standard), which included points on categories of processed glass, facility-specific EPD requirements, ENERGY STAR plant scores, a tiered approach for flat glass, the EC3 calculator, and the addition of operational carbon to embodied carbon in the procurement process. Read the full response at glass.org/advocacy/initiatives/priority-issues.

"GSA's P100 Facilities Standard for the Public Buildings Service needs glass to not only have a low carbon footprint or low GWP (embodied carbon), but to also provide many functions..." says Urmilla Sowell, NGA technical and advocacy director, in a February letter to the GSA. "With the proposed GSA LEC Standard focusing on GWP from the EC3 calculator, there is a risk that GSA will inadvertently choose the wrong glass for its buildings."

During a February webinar, the GSA communicated that by partnering



with the industry it hopes for two key outcomes: fewer and higher-quality buildings that foster a healthier workplace experience, and the achievement of net-zero emissions across their portfolio by 2045.

GSA plans to achieve both goals using the \$3.4 billion allocated by the IRA, which is organized into three pots: \$2.1 billion allocated to low embodied carbon materials production; \$975 million for emerging and sustainable technologies; and \$250 million for the conversion of agency buildings to high-performance green buildings. Additionally, GSA acknowledged the comments put forth by industry partners and are in the process of addressing NGA's main response points. ■

WEBINAR OFFERS CLOSER LOOK AT LEGISLATION FOR GLAZIERS

In February, the National Glass Association hosted the webinar, "Legislative / Regulatory and Political Update for Glazing Contractors," presented as part of NGA's alliance with the American Subcontractors Association. The webinar featured ASA Director of Government Relations Mike Oscar, who walked participants through an informative webinar presenting top legislative and regulatory takeaways for glazing contractors.

"We work very hard within the ASA to address those issues [workforce development, federal tax reforms, construction project contracts] from a legislative perspective, and one of the ways we do that is to look at legislation

coming down the pike," says Oscar. "What matters is that we're creating precedent and that's important for you because whether you're doing a public or private project, if you have a federal-level precedent it can trickle down to the state or local level and you can take advantage of that as a win across the board."

Oscar touched on the renewable energy tax credit for construction before January 2025, the deduction for energy-efficient commercial buildings that started last year, the \$330 million in grants to states adopting residential and commercial building energy codes that meet or exceed the 2021 IECC, the Inflation Reduction Act opportunities, the CHIPS and Science Act and the Ocean Shipping Reform Act.

"The [CHIPS and Science Act], in my opinion, will have a big impact for

the glazing industry and how buildings are constructed," says Oscar. "And the [Ocean Shipping Reform Act] dealing with supply chain issues ... all these pieces of legislation should be, and will be, impacting you, and they'll be impacting NGA and ASA for many years to come. The construction industry should be aware of it and be prepared to act upon it accordingly."

According to Oscar, the "bottom line is that from ASA's and NGA's perspective, we work to educate, to advocate and to ensure collaboration. We have to build the relationships and determine common ground and establish a pathway forward. And then work to either voice our support or our opposition to policies that might impact the subcontractor community."

The webinar is available on demand for NGA members at glass.org/ondemand-webinars. ■

DID YOU KNOW?

How to Maximize NGA Resources

With nearly 120 resources available, members might need some help in finding resources on a particular topic or someone to help answer your questions.

Steps to Maximize Your NGA Resources: A How-to Webinar was recently added to NGA's on-demand webinars and is available to walk you through the steps to maximize NGA's benefits and resources to help your business.

"NGA offers a wide variety of tools for free to the entire industry," says Sara Neiswanger, NGA associate director of industry engagement, who presented the webinar. "This walkthrough of the resource hub was born from comments by members who are seeking a more holistic view of NGA resources. We want to equip you to find what you're looking for on the website, and to share these resources with your colleagues."

Watch the webinar at glass.org/ondemand-webinars.



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GLASS INFORMATIONAL BULLETIN

Design Considerations for Laminated Glazing

Architectural designs often require glazing materials that provide enhanced levels of security and safety performance properties. These properties can include resistance to ballistics, blast, hurricane/cyclic wind pressures and physical attack. Applications may also require sound reduction, fade resistance, and solar and thermal control. Laminated glazing may consist of multiple lites of glass, interlayers, resins, and/or plastic glazing materials such as polycarbonate sheet or acrylic, which are often complex in nature. They are designed to provide specified levels of performance.

Design professionals and building owners should be aware of the following considerations when selecting and specifying laminated glazing.

Aesthetic color

Float glass is nearly colorless. However, a green or blue-green tint, which is faint in thin glass may become noticeable in applications where the glass thickness exceeds $\frac{3}{8}$ inches (10 millimeters). In certain laminated glazing applications, the green tint may be regarded as aesthetically displeasing. For those projects that require the highest level of color clarity, low-iron float glass should be considered. Low-iron float glass may also assist the designer in providing a closer color match to thinner glass in proximity to the thicker laminated glazing.

Laminated glazing that is designed to block ultraviolet light (energy wavelengths from 280 nm – 380 nm)



Example of laminated glass curtain wall at Salt Lake City Public Safety Building. GSBS Architects, Photo by Wayne Gillman

may also block a portion of the visible light spectrum (wavelengths from 380 nm – 420 nm) resulting in a slight yellow appearance. This yellow appearance may become noticeable when these materials are used in thicker or multiple layers. Yellowness can vary by interlayer type and manufacturer.

When a low-e or reflective coating is

used in the construction of a laminate and placed in contact with the interlayer, the refractive index of the coating is changed and may result in a perceived color shift. This means that a coating in an insulating glazing unit may appear different from the same coating in a laminate.

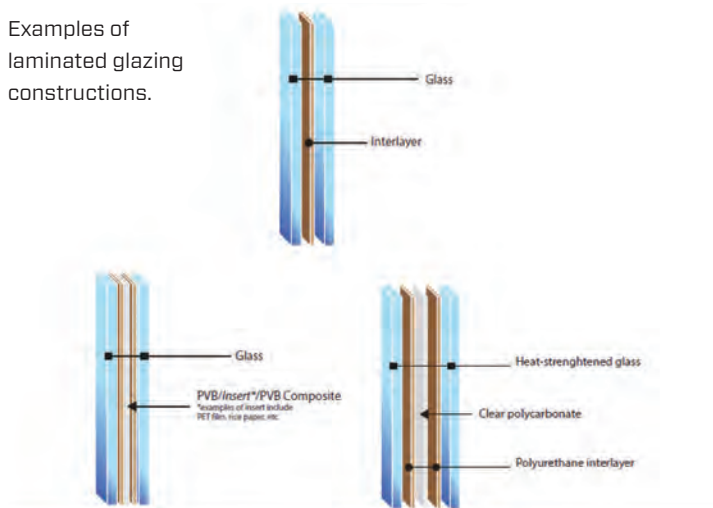


This Glass Informational Bulletin is excerpted from the NGA Glass Technical Paper “Design Considerations for Laminated Glazing Applications” (FB04-03). Download at glass.org/store.



GLASS INFORMATIONAL BULLETIN—DESIGN CONSIDERATIONS FOR LAMINATED GLAZING

Examples of laminated glazing constructions.



- Thermal expansion/contraction properties and changes in humidity may cause the plastic glazing material or the interlayer to bow and/or warp.
- Providing adequate space within framing systems will reduce perimeter issues due to edge pinch.
- Localized areas of distortion may result from small particulate inclusions (fish-eyes) on coated plastic sheet materials.
- As more individual plastic layers are utilized in the laminate, distortion may become more pronounced.

Optical distortion in heat-treated glass

Bow (warp), roll wave distortion and picture frame distortion are inherent characteristics of heat-treated glass. Laminated glazing materials may incorporate multiple lites of heat-strengthened or tempered glass to achieve high levels of resistance to thermal and mechanical loads. While fabricators take steps to minimize these conditions, they cannot be eliminated.

The visibility of reflective distortion is greatly affected by surrounding conditions and glazing orientation. To decrease the visibility of roll wave distortion in heat-treated laminates, fabricators commonly recommend, and design professionals specify, that the wave direction (wave's peak) be glazed parallel to the sill of a window or door whenever possible.

A strain pattern may become evident by reflectance and in transmittance when viewing the glazing material at severe angles or under polarized light conditions. The potential for

visible iridescence is enhanced as the thickness of the laminated glazing material increases. The strain pattern is inherent in heat-treated components and is not a result of discoloration or non-uniformity.

Multiple-ply laminates

Non-glass components such as interlayer films and/or plastic sheet products such as polycarbonate, acrylic sheet or polyethylene terephthalate (PET) may have thickness or flatness variability, which may cause distortion of images when viewed through the glazing material.

The magnitude and spacing of this variability are both important factors when trying to assess the suitability of a multiple-ply laminate for a given application, as precise alignment of the components containing this variability is not possible. This distortion is greatly affected by viewing angle, and vertical lens lines are generally more objectionable. Other design considerations include:

Temperature performance

Laminated glass may be used in applications where the laminate could be exposed to high and low temperatures. Examples are spandrel, tinted, southern-facing elevations, coatings and non-conditioned space behind the glass. The performance of the interlayers at different temperatures varies by interlayer type. Consult the interlayer manufacturer for specific interlayer temperature limits.

Product awareness

Awareness of the laminated glazing product construction and inherent characteristics of the laminated glazing can dramatically affect the design application. Design professionals and building owners are strongly encouraged to utilize full-size mockups for evaluating the appearance of the glazing system under the specific project conditions, lighting conditions and surrounding landscape.

Refer to the NGA Laminated Glazing Reference Manual for industry specifications. [Download at glass.org/store](https://glass.org/store). ■



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AGC Considering Transfer of its Business in Russia

AGC Inc. announced in February it has started considering transfer of AGC Group's business in Russia. AGC Group is mainly engaged in the architectural and automotive glass business in Russia.

Amidst the uncertain situation in Russia, the group had suspended investments in the country, including the periodic repair of its glass manufacturing furnace, since March of last year. AGC has since been carefully monitoring the situation, keeping in mind its employees' and customers' best interests. It is the company's policy to select a party that will continue to operate the business, say officials.

As announced in the release, an impairment loss of \$103 million to the fixed assets of this business has been recorded in the consolidated financial results for the fourth quarter of the fiscal year ending Dec. 31, 2022. The financial impact in case of the transfer has been incorporated into the full-year consolidated financial forecast for the fiscal year 2023.

Eastman Acquires Dalian Ai-Red Technology

Eastman Chemical Co. announced it acquired Ai-Red Technology (Dalian) Co., a manufacturer and supplier of paint protection and window film for auto and architectural markets in the Asia-Pacific region. Terms of the agreement were not disclosed.

"This acquisition provides additional capacity to serve the growing demand for our paint protection and window film products and creates additional

capacity for innovation and product scale-up from our existing operations," says Erin Bernhardt, vice president and general manager of the Performance Films business of Eastman's Advanced Materials segment. "By adding this capacity and team to Eastman's industry-leading team, technologies and brands, we expect to accelerate an already aggressive growth trajectory in automotive and architectural aftermarket films."

AGC and Saint-Gobain Partner on Decarbonization

AGC and Saint-Gobain will collaborate on the design of a pilot flat glass line that is expected to reduce direct CO₂ emissions.

As part of this project, AGC's patterned glass production line in Bavevka, Czech Republic, will be entirely refurbished into a line that is aiming to be 50 percent electrified and 50 percent fired by a combination of oxygen and gas. Current technology used in flat glass furnaces are fired by natural gas. This sustainable flat glass line design will contribute to both companies' paths toward carbon neutrality and to the acceleration of the flat glass industry's decarbonization.

The new technology is expected to be implemented on the patterned glass line for operation by the second half of 2024.

FHC Partners with Residential Supplier Prime-Line Products

The Frameless Hardware Co. entered into a strategic partnership with Prime-Line Products. The agreement allows FHC to expand its offering to its customers in the residential hardware

and home-improvement sectors while providing better service to Prime-Line's wholesale customer base.

As part of the new partnership, targeted segments of Prime-Line's existing wholesale customers will now be served by FHC, which offers complementary products and occupies manufacturing and distribution supercenters on both coasts servicing all of the United States. Prime-Line's product offerings include window and screen repair, interior hardware, repair springs, and exterior window and door hardware. This arrangement bolsters FHC's product selection as a supplier to trades working in glass, glazing, windows and doors in any project category, say company officials.

Tristar Glass Expands into Texas

Tristar Glass, headquartered in Catoosa, Oklahoma, will expand its Texas operations with a new 180,000-square-foot facility in Dallas. The company's existing Texas location is in Houston.

The company expects its new Dallas facility to be fully operational by the end of the summer. Equipment was slated to begin in March, centering around new technologies.

"It's both a reactive and proactive move for Tristar," says Tim Kelley, president, Tristar Glass. "While this expansion is going to help better serve our existing customers in the immediacy, these new capacities and capabilities are going to reinforce our leadership position in the local market and enable us to further expand our customer base and reach." Tristar has more expansion plans in the works, say company officials.



THE ULTIMATE IN SPACE FLEXIBILITY

The Glass Guru Adds New Colorado Location

The Glass Guru recently added to the brand's growing footprint of service locations in Colorado. James Child, franchise owner of the existing Colorado Springs and Arvada locations in Colorado, has opened an additional location, The Glass Guru of Denver South in Highlands Ranch.

The Denver South location is one of

several new locations opening for The Glass Guru in 2023. Child acquired The Glass Guru of Colorado Springs in 2020 before purchasing the Arvada location in 2022. Based on the rapid growth of his other two locations, the leadership team at The Glass Guru is pleased with Child's expansion into his third location for the brand, say officials. The Glass Guru Denver South is the seventh location of the franchise in Colorado.

Aldora Opens Facility in Virginia

Aldora opened a new 72,000-square-foot glass fabrication and distribution facility, hoping to enhance service for regional customers. The facility provides tempered, fabricated and insulating glass products to customers within a 150-mile radius and is located at 280 Enterprise Dr., Newport News, Virginia.

This new building will be Aldora's seventh location for mid-Atlantic and Southeastern customers. Its services will reach fabricators in Richmond; Baltimore; Washington, D.C.; Norfolk; Raleigh-Durham; Roanoke and other nearby regions.

The facility includes a convection oven for tempering needs. Precision glass equipment will produce glass, mirrors and shower doors, and an automated vertical IG line will make durable insulating glass products.

sedak Extends Photovoltaic Installation at Facility

sedak extended its photovoltaic installation to now provide around 1.7 million kilowatt hours. Since 2021, sedak's photovoltaic system has been supplying the company's location in Gersthofen, Germany, with almost 260,000 kWh annually.

The company's new installation will provide an additional 1,400,000 kWh per year of solar power. In total, there are more than 4,000 modules with an area of roughly 86,000 square feet. With the extension of the PV system sedak is now able to cover around 80 percent of the electricity requirement using regenerative energies.

Brin Glass Co. Becomes Certified Contractor of the NACC

Brin Glass Co. became certified as a contractor of the North American Contractor Certification Program for Architectural Glass and Metal Contractors. This certification recognizes Brin as a provider of quality, reliable services that comply with industry-accepted guidelines, say officials.

Contractors must meet stringent requirements to receive the certification,





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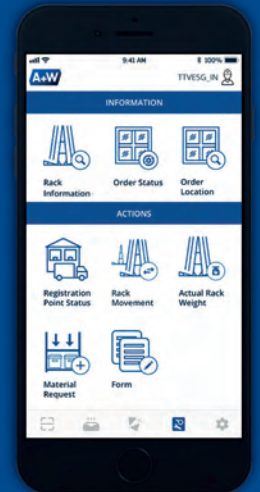
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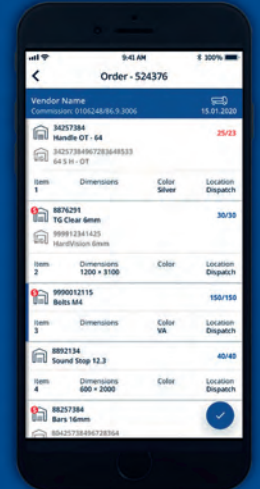
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including a comprehensive review of their past performance, safety record and quality of work.

“We are proud to be a part of the NACC program,” says Bill Sullivan, president and CEO, Brin Glass. “Our commitment to providing quality service and workmanship has been a priority since we opened our doors in 1912. The NACC certification is a great way to demonstrate to our clients that

we are dedicated to delivering the highest standards of excellence.”

SAF Introduces New Column Cover Rollers

SAF continues to add new machinery to facilities across its organization with new column cover rollers at SAF West in Redding, California. The rollers presently at the Redding plant are being relocated to SAF’s newest

location in Temple, Texas, allowing for column cover fabrication from the organization in more regions across the United States.

The double-pinch hydraulic four-roll 16-foot plate bending machine, MG Model M 5006 B-RR, allows SAF to create longer and taller column covers up to 16 feet in length and in a range of circumferences. The MG roller offers easy operation due to its ability to pinch the plate between two central rolls, pre-bending the leading edge, and then rolling the metal material along with the trailing edge all in one direction and in one pass.

For customers and installers, these larger column covers translate to fewer horizontal reveals needed when stacking sections, enhancing the aesthetic appeal of a column once installed. In addition, taller column covers reduce installation time because they cover more area.

PEOPLE NEWS



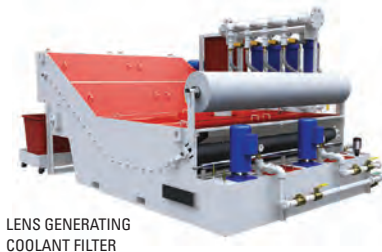
Jayson

Bendheim named *Donald Jayson* as its new president. A co-owner of the firm, Jayson most recently served as senior vice president at Bendheim. Jayson’s new role comes as Ben Jayson, former president and the family’s fourth generation, will seek to further advance glass innovation on an independent basis. Jayson represents the third generation of family leadership for Bendheim. Nearing its centennial mark, the firm was founded in 1927 by Jayson’s maternal grandparents, Sem and Margaret Bendheim.

“I am extremely proud of Bendheim’s heritage and of our contributions to award-winning architecture throughout the world,” says Donald Jayson. “We look forward to developing glass solutions for designers and enhancing the beauty of built environments for many years to come.”



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Mori

Nippon Sheet Glass announced that *Shigeki Mori* will be stepping down from his position as president and CEO of the company, effective

April 1, and Munehiro Hosonuma will take his place. Hosonuma currently serves as vice president and chief operating officer of the company.

Mori will retire from the board of directors and as representative executive officer and will be appointed as executive officer, chairperson of the company at the Ordinary General Meeting of Shareholders to be held in late June.



Haynesworth

The Board of Directors of **Eastman Chemical Co.** elected *Linnie M. Haynesworth* as a director. Haynesworth was most recently

the sector vice president and general manager of the Cyber and Intelligence

Mission Solutions Division for Northrop Grumman Corporation's Mission Systems Sector, where she was responsible for multiple \$1 billion-plus divisions.

Haynesworth has more than 30 years of industry experience in technology, including aerospace, intelligence and cybersecurity systems. In addition to her position on Eastman's board of directors, Haynesworth currently serves on the boards of Micron Technology Inc., Truist Financial Corp. and Automatic Data Processing Inc.



Berrios

Ryan Berrios joined **Vitro Architectural Glass** as a commercial account manager for Northern California, Northern Nevada,

Utah and Colorado. Serving as lead for commercial fabrication accounts in these areas, Berrios will offer consultation to fabricators, glaziers and other stakeholders by identifying the

best-performing glass products for their projects.

Prior to joining Vitro, Berrios worked in multiple roles over a 30-year career at B-K Lighting Inc., an architectural and landscape lighting manufacturer, including his most recent position as national sales manager.



La-Borde

Guardian Glass North America welcomed *Kris La-Borde* as a regional technical advisor.

La-Borde will provide glazing performance technical support

for fabricators, glaziers, architects, consultants, developers and specification writers with a focus on the commercial sector. He will support the West region sales team and Guardian's Kingsburg, California, manufacturing facility

La-Borde has more than 16 years of experience in engineering across the globe with the past 12 years specific to the façade and building enclosure industry. He previously was a façade engineer for Thornton Tomasetti in Los Angeles and London, spending eight years focusing on North American façades and enclosures.



Fochs

Jeff Fochs has been named **Tubelite's** regional sales manager serving the Northwest and Southwest. He succeeds Terry Robinholt

who retires after a long career with Tubelite.

Together with his team of client development managers, Fochs works with commercial architects, glazing contractors and building project teams to provide consultative support regarding Tubelite's architectural aluminum storefront, curtainwall, entrance, window and daylight control systems.

Fochs transitions into his new role at Tubelite following more than a decade of working at Linetec. ■

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EYE ON INTERIORS

HOW DESIGNERS LOOK TO GLASS FOR FLEXIBLE WORKSPACES, STYLISH HOME INTERIORS
BY SPENCER RAYMOND



Glass wall system installation.
Photo by Transwall

The pandemic left us with a greater appreciation for where we spend most of our time—our homes. The past few years have seen an increased focus on maximizing and upgrading our living space. This continues into the new year with an emphasis on luxurious bathrooms, wine rooms, closets and cellars.

Today's workplace is following suit with an increased emphasis on designing for wellness. These ideological shifts are reflected in the way both work and residential spaces are utilized.

Luxury primary baths

Home has always been important but now, more than ever, there is a greater emphasis on it as a place for relaxation, leisure or entertainment.

Take the primary bathroom, which continues to grow in size in everything from single-family homes to luxury condominiums. Now, we're seeing an

emphasis on all-inclusive wet rooms—totally waterproofed bathrooms with curb-less showers and freestanding tubs. These began as a solution for smaller spaces, but are gaining popularity as they create a more spacious aesthetic.

The heightened focus on primary bathrooms has resulted in a greater demand for large glass shower enclosures. These can be hinged, sliding, or fixed panels. Some run up to the ceiling with a vent panel for the option of a steam or shower enclosure.

Homeowners understand that a premium investment upfront will prevent the need to replace lower-quality glass down the line. The ease of cleaning and maintenance ensures the glass will look and perform optimally longer than traditional tile, ceramic, or stone. Even better, there are multiple options for single-surface, shower-protected glass or dual-surface glass protection. Contractors have the flexibility to offer what best

meets customer needs.

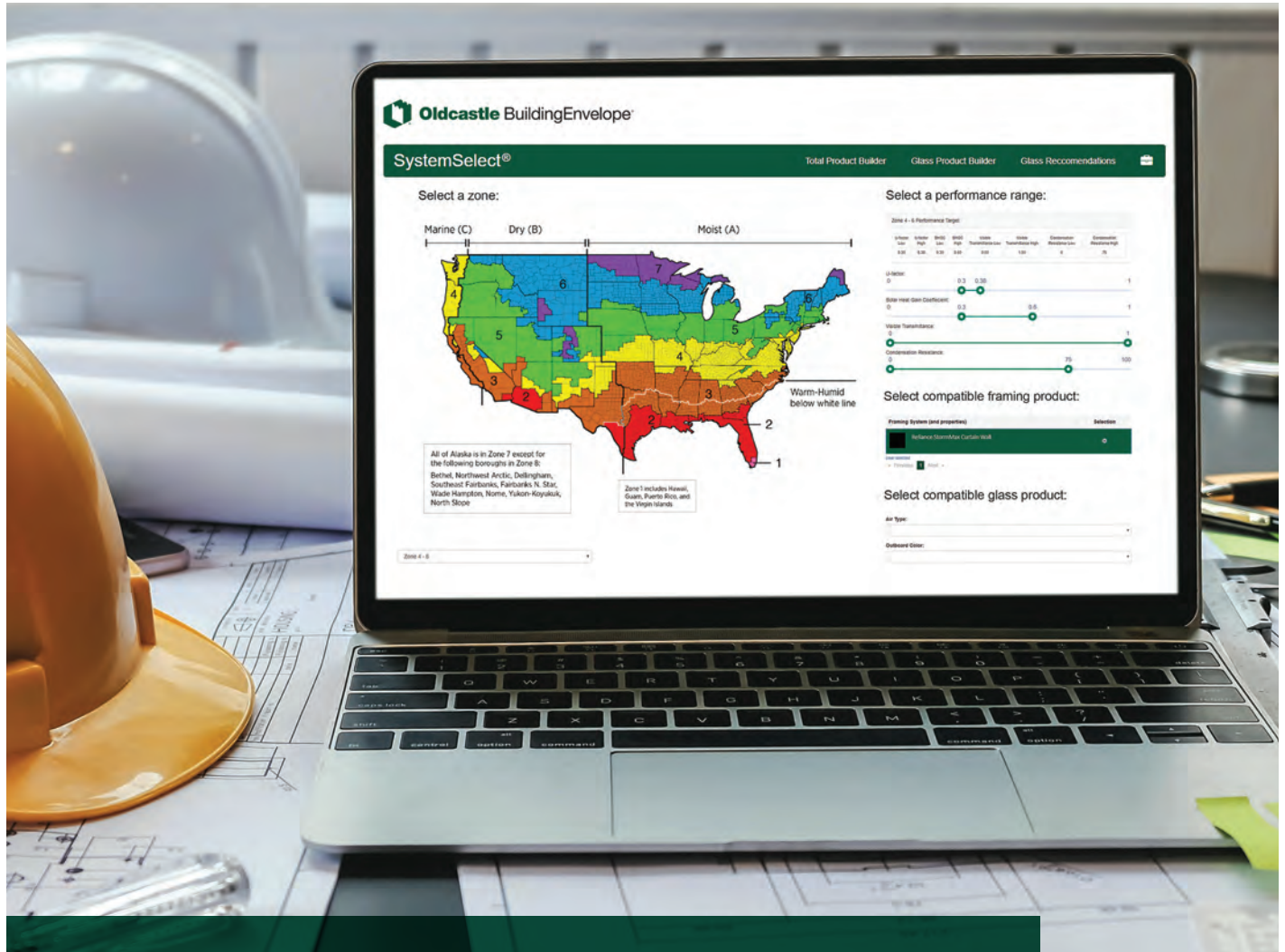
Finally, the broader use of walls and doors provide designers the opportunity to make striking visual statements with back-painted glass or custom wall cladding.

Trends we were watching at the end of last year continue to gain traction. Namely, iron grids and black matte finishes in both residential and commercial applications. You'll find direct-to-glass printed grid designs on showers, but also on interior glass walls and office partitions.

Wine cellars, glass railings

Reimagining the home interior creates the opportunity to put other existing spaces to better use. Closets under the stairs and bonus rooms are being transformed into stylish wine cellars that can be exquisitely showcased with floor to ceiling glass enclosures.

Openness is the deciding trend, one



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easily captured by creating more visual space with glass walls and glass railings. Even though the square footage remains the same, glass provides the feel of more room, and therein, more value.

In realizing these designs, glass continues to be a creative and flexible material for commercial interior designers and homeowners. It's easier to maintain and clean than traditional alternatives—and more cost effective since glass can be fabricated to mimic anything from stone and marble to wood. There are numerous possibilities for maximizing space and adding personality with back-painted and direct-to-glass back-splashes and wall cladding.

Glass railings have always been popular for commercial building designs, but now we are seeing more and more glass railing designs being used for residential applications—interior and exterior. Not unlike the trend for frameless heavy glass shower enclosures, designers want glass railings with little or no exposed hard-

ware, even to the exclusion of a top cap.

Flexible workspaces

Today's employees believe the top three primary purposes of the workplace are collaboration with teams, building social connections and camaraderie, and developing personal and professional relationships. As such, offices are being designed to accommodate flexible workspaces and meeting areas. And when it comes to daylighting—the emphasis on health and wellness isn't going anywhere.

For the glass industry, this means an increased demand for demountable partitions—movable, sliding, and folding glass walls and glass wall systems.

Designers and architects can answer this growing need with movable glass partition walls that are easily reconfigured into meeting spaces. Likewise, open areas with ample daylighting and functional areas with multipurpose use—think walls that

double as glass markerboards for idea sharing and collaboration—combine durability and flexibility with a minimal and clean design.

The workforce became accustomed to an elevated level of privacy while operating from home. Varying levels of privacy are easily achievable with satin etched, textured patterned, direct-to-glass printing and dynamic glazing—to maximize employee comfort and confidentiality. Laminated glass takes this a step further with sound-reducing interlayers and privacy fades.

A lot has shaped the way both work and home spaces are regarded and utilized over the last few years. Glass continues to prove itself versatile and uniquely equipped to fulfill a range of creative, practical and aesthetic demands. ■

Spencer Raymond is a product manager at GGI. He can be contacted at sraymond@generalglass.com.



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VIG'S FUTURE-PROOF PERFORMANCE

INTEREST IN VIG IS GROWING, BUT BARRIERS TO ADOPTION REMAIN
BY AMY ROBERTS



Above: Apartments with glass packs —insulating glass windowpanes are separated by vacuum-gas-filled space to reduce heat transfer.

Vacuum insulating glass, or VIG, offers daylighting options with enhanced thermal and acoustic performance. These attributes improve building operational performance and occupant comfort, save energy and costs, help reduce greenhouse gas emissions, and support future overall property value. Industry experts say interest in VIG is growing, but barriers to adoption remain.

Discussing these opportunities and challenges, the Fenestration and Glazing Industry Alliance hosted a panel discussion about VIG at the 2022 FGIA Hybrid Fall Conference. Panelists included:

- Dave Cooper, chief technology officer of Vacuum Glass LLC, who moderated the discussion
- Bill Davis, senior IG technical service and product manager at Vitro Architectural Glass
- Kayla Natividad, architectural

technical service engineer at Pilkington

- Cenk Kocer, senior research fellow at the University of Sydney
- Marc LaFrance, windows technology manager at the U.S. Department of Energy.

Advantages of VIG

Monolithic VIG consists of two edge-sealed lites of flat glass separated by pillars (or standoffs) within a vacuum space. Like traditional IG units, VIG can be used in nearly any fenestration product for new construction, renovation, and retrofits in commercial, residential and institutional projects. Cooper highlighted that VIG's lightweight, two-lite, thin design makes it a good fit for updating single-pane glazing, which is still in 40 percent of commercial buildings.

According to the panelists, heat-strengthened, fully tempered VIG can achieve thermal performance R-values up to 16 or center of glass U-values of 0.07 Btu/hr ft²F. "We can stop thinking about the window-to-wall ratio when we start thinking about VIG," Cooper says. "VIG supports greater window-to-wall ratio with significantly enhanced thermal performance."

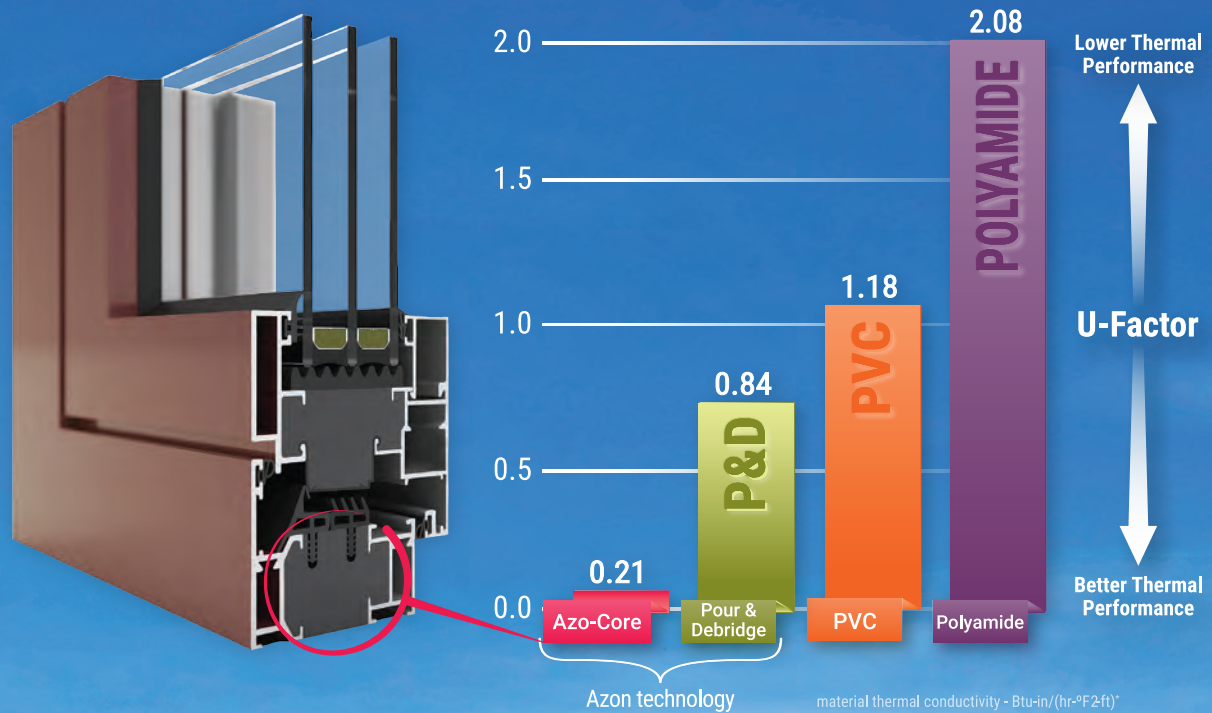
Energy-efficiency considerations

"VIG easily supports the Version 7.0 Energy Star Specification for Residential Windows, Doors and Skylights that goes into effect in October," Cooper continues. "VIG is future-proofing the step-changes that will be required by Energy Star versions 8, 9 and 10."

Cooper adds that California's Title 24 and New York City's Local Law 97 already are in effect and present immediate opportunities for VIG to contribute to energy efficiency and carbon reduction goals.

In New York City, more than 65 percent of carbon emissions can be attributed to already existing buildings, shares Natividad. "That is a big thing to tackle here," she says. "If you improve your building operation performance, you can reduce the size of your HVAC system, saving money."

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Offering a global and historical perspective, Kocer says that the University of Sydney first manufactured VIG samples in 1989. During the FGIA panel, he provided current examples from manufacturers in China, Taiwan and Europe that have been developing VIGs since 2000. VIG sizes over 3 meters are now available. "At the moment, with the science and engineering, there is a lot of knowledge out there in terms of how to design these," Kocer says.

Industry evaluation

Industry standards ensure consistency and provide assurances. FGIA's VIG panelists highlighted:

- ISO-19916 Part 1 was published in 2018, providing a specification for VIG. The Part 3 test method for evaluation of performance under temperature differences followed in 2021.
- NREL published "Guidelines and Specification for Enhance Durability

Evaluation of Insulating Glass and Vacuum Insulating Glass Units" in September 2022.

- NFRC is on track to include a revised VIG simulation module of thermal performance for certification and Energy Star through the updated LBNL Window 8 program, which is soon to be launched.
- ASTM working groups WK83379 and WK83445 were formed in September 2022 to develop VIG specification, durability and strength standards. Cooper chairs both. Initially developing the scope of work, he reported participants have joined from across the globe intending to have a standard published by 2025. In the interim, several VIG products have passed the existing ASTM E2190 standard for IG certification.

"A lot of investment in VIG is coming. But a challenge is that we do not yet have a cost-effective version today," says LaFrance.

Market opportunity and adoption

Because all VIG is imported, "tariffs, customs, duties and shipping currently account for about one-third of VIG's cost," says Cooper. He predicts U.S. VIG production will begin by 2026, and VIG product cost and market pricing will decrease further as volume increases.

To enable significant market opportunity and adoption, Cooper emphasized removing barriers to low-cost manufacturing, tempered VIGs and make-to-order supply strategies. "It's not a question of 'if' VIG can support improved building thermal performance, but 'when.' This is not a new technology; it's here," Cooper stresses. "The time is now." ■

Amy Roberts serves as the director of Canadian and Technical Glass Operations for the Fenestration and Glazing Industry Alliance. For more information, visit fgiaonline.org.

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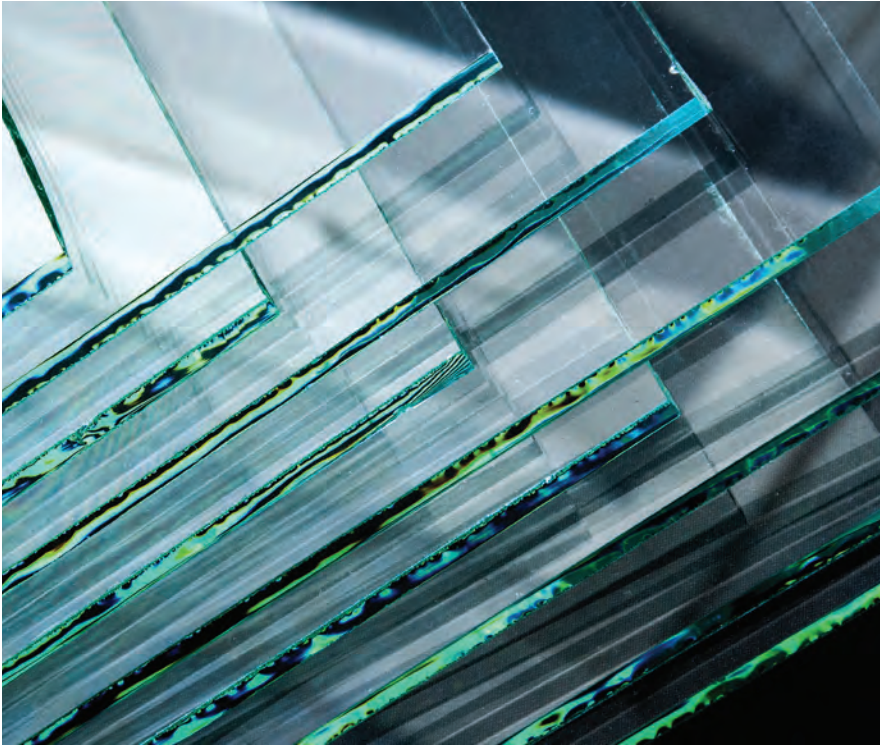
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ARE YOU FOLLOWING THESE MANUFACTURING BEST PRACTICES?

HOW TO STAY EFFICIENT AND MAINTAIN UNCOMPROMISING QUALITY **BY JOE ERB, JOHN RYBA**



Continuous improvement is essential in any manufacturing environment. It's the key to efficiency, quality and profitability.

That's why a fabricator should periodically take a step back identify areas to evaluate and potentially improve throughout the production line. Not sure where to begin? Here are a few best practices a company can leverage in some critical areas of the production process.

Optimize your line layout

An efficient commercial glass manufacturing line follows as straight a line as possible from start to finish, enabling the easy transfer of materials from one point to the next. If, for instance, you're not following a straight path in carting glass to the insulating station, you're wasting time. This may seem small, but such losses can add up, dragging down your rate of production.

Small inefficiencies can creep up on any manufacturing process. If you've experienced turnover, added new equipment or introduced a new product, one process or another may have become

inadvertently complicated without anyone even realizing.

What's more, your evaluation process might not mean changing what you're currently doing, but rather discovering that your standard processes aren't being upheld. Regular auditing can help you uncover trouble and fix it before it costs you.

Identify common problem areas

When it comes to the physical production of insulating glass units, a few particular areas stand out as common error points:

Desiccant. If your desiccant is compromised, even expertly sealed IG units will show condensation in the air space shortly after it's been assembled. Your desiccant's ability to absorb moisture is finite, and most desiccant materials have a strong affinity for ambient moisture, even at low humidity levels. In order to prevent your desiccant from wasting its capacity, keep it properly stored at all times. If you're leaving your desiccants out in the open when your line isn't in operation, it could become a problem.

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Primary seals. It's important to be sure your primary sealant is properly placed and not over- or under-filled. Avoid skips or voids in the primary sealant, as this is your main moisture barrier. Next, the joint of the spacer must be fully closed—if the spacer ends are not properly joined, this could create a path for moisture or desiccant to get into the air space. Once you've pressed the unit, verify that the primary sealant is fully pressed out and wetted to the glass and spacer. Fully wetted PIB should be a solid, flat black.

Secondary seals. Your secondary seal ensures the structural integrity of the unit. Your spacer should be consistently inset to allow for a proper secondary sealant depth. Next, be sure that your inset is properly filled. Sealants can sometimes flow up the sides of the glass first, making it look as though the inset is fully filled—but the center may in fact

be much shallower. Once the proper depth is achieved, check for and close any joints or gaps, and fix any bulges that extend past the glass edges.

Your production technicians should be well-versed on common production pain points like these. If they aren't, it may be worth investing some time in training from a knowledgeable third party.

Stay focused on maintenance

Any part of your manufacturing process—whether it's manual work or a fully automated line—is only as good as what you put into it.

For example, if your crews are loading dirty or roughly cut glass into your machine, it's likely you'll have aesthetic issues or possible seal failure no matter how sophisticated and efficient that machine is. What's more, fixing or remaking poor quality units will eat into

any efficiencies you may have gained by investing in automation.

Roughly cut or dirty glass is typically the result of a maintenance lapse. Regular inspection of your glass cutting machine blades is essential to achieve consistent, cleanly cut glass. If you're skipping this inspection, you may not realize your blades are too dull until it's too late. The same goes for your glass washing station—it's not uncommon to find that a glass washer's brushes are not even coming into contact with the glass, or that the machines are using dirty water. These are the kinds of issues that can be easily missed if you've put off maintenance tasks for too long. ■

Joe Erb is Quanex national account manager, and John Ryba is Quanex director of technical services.

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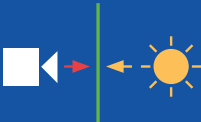
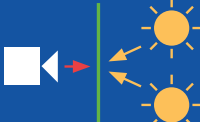







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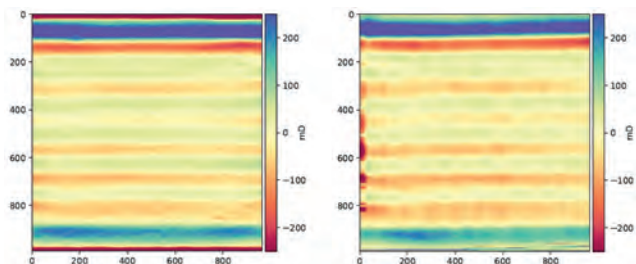
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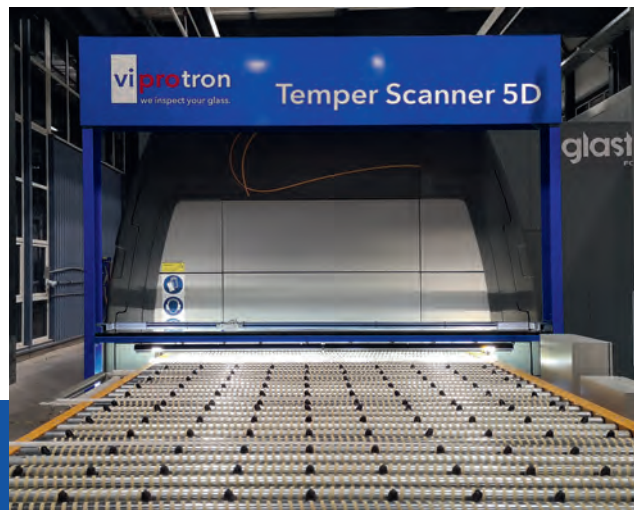
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T O P

F A B R I C A T O R S

The new Visitor Experience Centre at Caymus Winery in Napa Valley, features floor-to-ceiling glass from Top Glass Fabricator AGNORA. See the full case study on GlassMagazine.com. Photo by Matthew Millman.

GLASS

FABRICATORS
SPEED UP TO
SUPPLY AN
UNCERTAIN BUT
BUSY MARKET
BY NORAH DICK

T

This year's Top Glass Fabricators can celebrate a recovering industry. They report higher sales, increased investment and expanding companies.

This last year was also one that saw major changes unfold among leading companies. Oldcastle BuildingEnvelope was established as a standalone enterprise in May 2022 after its acquisition by KPS Capital Partners. This last fall, Truelink Capital acquired Trulite Glass & Aluminum Solutions.

And while 2022 saw plenty of demand for glass, uncertainty about future stability remains as the larger economy continues to take a bruising from inflation and continued supply chain issues. "Mid-2020 through mid-2022, we saw a demand growth of 30-40 percent," says Garrett Ames, president, Dillmeier Glass. "Late 2022, customers' demands have greatly reduced. Seems most, or all, are predicting a very soft and slow 2023, and possibly 2024."

Fabricators remain agile and innovative in the face of these ongoing obstacles. "Our overall inventory is relatively large and varied, resulting in a cushion against rapid price increases and volatile supply chains," says Adam Mitchell, marketing manager, AGNORA.

Find the industry ranking for Top Glass Fabricators on pages 42-49, which features leading fabricators that supply the North American market. To see more information on fabricator product types and locations, visit WorldofGlassMap.com. This report also features data and analysis compiled from survey responses contributed by most Top Glass Fabricators. To learn about fabricator product and design trends, see p. 50. To read about manufacturing innovation and capital investment, go to p. 52. To see how the market continues to grow regionally, and in terms of company sales, see p. 54, and learn how that capacity continues to be hampered by industry wide challenges beginning on p. 56.

Visit
WorldofGlassMap.com
for:

- Map of Top Glass Fabricator locations
- Plant production capabilities
- Downloadable list of Top Glass Fabricators

Thanks to Oldcastle BuildingEnvelope for sponsoring WorldofGlassMap.com.



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THE LIST

The 63 companies that comprise the 2023 Top Glass Fabricators represent the foremost companies in this industry. Fabricators that are part of this ranking must fabricate architectural glass, supply the North American market and have gross sales that equal or exceed \$5 million.

Do you feel your company belongs on the list? Contact Norah Dick, senior editor of Glass Magazine, at ndick@glass.org.

Over \$1b

1

Oldcastle BuildingEnvelope

obe.com
Dallas
Plants: 84
Total employees: 6,500

04

Trulite Glass & Aluminum Solutions

trulite.com
Peachtree City, GA
Plants: 32
Total employees: 2,200+

07

HMI

hmiglass.com
Louisville, KY
Plants: 3
Total employees: 600

10

Aldora

aldoraglass.com
Coral Springs, FL
Plants: 7
Total employees: 495

\$300-800 million

02

Press Glass Holding SA

pressglass.com
Konopiska, Poland
Plants: 15
Total employees: 5,000+

05

Viracon

viracon.com
Owatonna, MN
Plants: 1
Total employees: 11500

08

Hartung Glass Industries

hartung-glass.com
Tukwila, WA
Plants: 9
Total employees: 1,000

11

Vitrum Glass Group

vitrum.ca
Langley, British Columbia
Plants: 2
Total employees: 400+

02

Press Glass Holding SA

pressglass.com
Konopiska, Poland
Plants: 15
Total employees: 5,000+

\$100-300 million

06

Tvitec | Cricursa

tvitecglass.com
Cubillos del Sil, Spain
Plants: 7
Total employees: 700

09

Prelco Group

prelco.ca
Rivière-du-Loup, Québec, Canada
Plants: 6
Total employees: 675

12

Glasswerks

glasswerks.com
South Gate, CA
Plants: 7
Total employees: 600

03

Tecnoglass Inc.

tecnoglass.com
Miami
Plants: 6
Total employees: 8,600

American Insulated Glass

aiglass.com
Atlanta
Plants: 7
Total employees: 600+

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\$50-100 million

13

GlassFab Tempering Services

glassfabusa.com

Tracy, CA

Plants: 4

Total employees: 225

14

Dreamwalls by Gardner Glass Products

dreamwalls.com

North Wilkesboro, NC

Plants: 2

Total employees: 300

15

Tristar Glass

tristarglass.com

Catoosa, OK

Plants: 3

Total employees: 250

16

General Glass International

generalglass.com

Secaucus, NJ

Plants: 1

Total employees: 200+

17

sedak GmbH & Co. KG

sedak.com

Gersthofen, Germany

Plants: 3

Total employees: 350

18

Grupo Tecnovidrio

grupotecnovidrio.com

Mexico City

Plants: 5

Total employees: 800

19

Basco Shower Door

bascoshowerdoor.com

Mason, OH

Plants: 4

Total employees: 500

20

Glaz-Tech Industries

glaztech.com

Tucson, AZ

Plants: 8

Total employees: 280

21

McGrory Glass

mcgrory.com

Paulsboro, NJ

Plants: 3

Total employees: 153

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22

AGC Interpane

interpane.com
Lauenforde, Germany
Plants: 2
Total employees: 600

\$30-50 million

23

Garibaldi Glass Industries

garibaldiglass.com
Burnaby, British Columbia,
Canada
Plants: 1
Total employees: 242

24 (tied)

Custom Glass Products

customglassproductswi.com
Weston, WI
Plants: 3
Total employees: 150

24 (tied)

Insulite Glass Co.

insuliteglass.com
Olathe, KS
Plants: 2
Total employees: 180

24 (tied)

Blue Star Architectural Glass

bluestarglass.net
North Brunswick, NJ
Plants: 2
Total employees: 150

24 (tied)

Paragon Tempered Glass

paragontemperedglass.com
Antwerp, OH
Plants: 2
Total employees: 150

24 (tied)

Glass and Metal Craft

glassandmetalcraft.com
Wixom, MI
Plants: 2
Total employees: 140

29

Dillmeier Glass

dillmeierglass.com
Van Buren, AR
Plants: 1
Total employees: 152

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www.SalemFTG.com

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30**Splendor Glass Products**

splendorshowdoor.com

Holland, OH

Plants: 1

Total employees: 92

35 (tied)**AGNORA**

agnora.com

Collingwood, Ontario, Canada

Plants: 1

Total employees: 70

40 (tied)**Skyline Design**

skydesign.com

Chicago

Plants: 1

Total employees: 85

45**Maryland Glass & Mirror**

mdglass.net

Baltimore

Plants: 1

Total employees: 50

31**M3 Glass**

m3glass.com

Irving, TX

Plants: 2

Total employees: 110

35 (tied)**GlasPro Inc.**

glas-pro.com

Santa Fe Springs, CA

Plants: 1

Total employees: 100

40 (tied)**Clarity Glass Wholesalers**

clarityhouston.com

Houston

Plants: 1

Total employees: 70

46**Echols Glass & Mirror Inc.**

echolsglass.com

Buford, GA

Plants: 1

Total employees: 70

\$10-30 million

32 (tied)**Cat-i Glass Mfg**

catiglass.com

South Elgin, IL

Plants: 2

Total employees: 180

37**Flat Glass Distributors**

flatglassdistributors.com

Jacksonville, FL

Plants: 1

Total employees: 70

40 (tied)**Blackline Aluminum**

blacklinealuminum.com

Markham, Ontario, Canada

Plants: 2

Total employees: 80

47**Consolidated Glass Corp.**

cgcglass.com

New Castle, PA

Plants: 1

Total employees: 61

32 (tied)**Glenny Glass**

glennyglass.com

Milford, OH

Plants: 2

Total employees: 105

38**TBM Inc.**

tbmglass.com

Santa Ana, CA

Plants: 1

Total employees: 54

43**High Performance Glazing Inc.**

hpglazing.com

Concord, Ontario

Plants: 1

Total employees: 45

48**Goldray Glass**

goldrayglass.com

Calgary, Alberta, Canada

Plants: 1

Total employees: 70

34**Southern Wholesale Glass**

Americus, GA

Plants: 1

Total employees: 100

39**Northwestern Glass Fab**

nwglassfab.com

Fridley, MN

Plants: 1

Total employees: 55

44**Kensington Glass Arts**

kensingtonglass.com

Ijamsville, MD

Plants: 2

Total employees: 60

49**FGD Glass Solutions**

fgdglass.com

Suwanee, GA

Plants: 1

Total employees: 25

50 (tied)

**All Counties Glass
Distributor**

allcountiesglass.com
Stockton, CA
Plants: 1
Total employees: 43

50 (tied)

Tempco Glass

tempcoglass.com
Flushing, NY
Plants: 1
Total employees: 55

50 (tied)

CAN-AM Glass Products

canamautoglass.ca
Edmonton, Alberta
Plants: 1
Total employees: 50

50 (tied)

InKan Ltd.

inkan.ca
Brampton, Ontario, Canada
Plants: 2
Total employees: 70

54

**Precision Glass Bending
Corp.**

e-bentglass.com
Greenwood, AR
Plants: 1
Total employees: 75

**Less than
\$10 million**

55

D3 Glass

d3glass.com
Fort Myers, FL
Plants: 1
Total employees: 52

56 (tied)

Over the Mountain Glass

otmglass.com
Bessemer, AL
Plants: 2
Total employees: 50

56 (tied)

RGT/Glass America

glassrgt.com
Saddle Brook, NJ
Plants: 1
Total employees: 30

56 (tied)

Standard Bent Glass

standardbent.com
East Butler, PA
Plants: 2
Total employees: 75

56 (tied)

**Adriatic Glass & Mirrors
Ltd.**

adriaticglass.com
Concord, Ontario, Canada
Plants: 1
Total employees: 50

60

Imagic Glass Inc.

imagicglass.com
Toronto
Plants: 1
Total employees: 30

61

Privacy Glass Solutions

privacyglasssolutions.com
Coral Springs, FL
Plants: 1
Total employees: 43

62 (tied)

Dundy Glass & Mirror Corp.

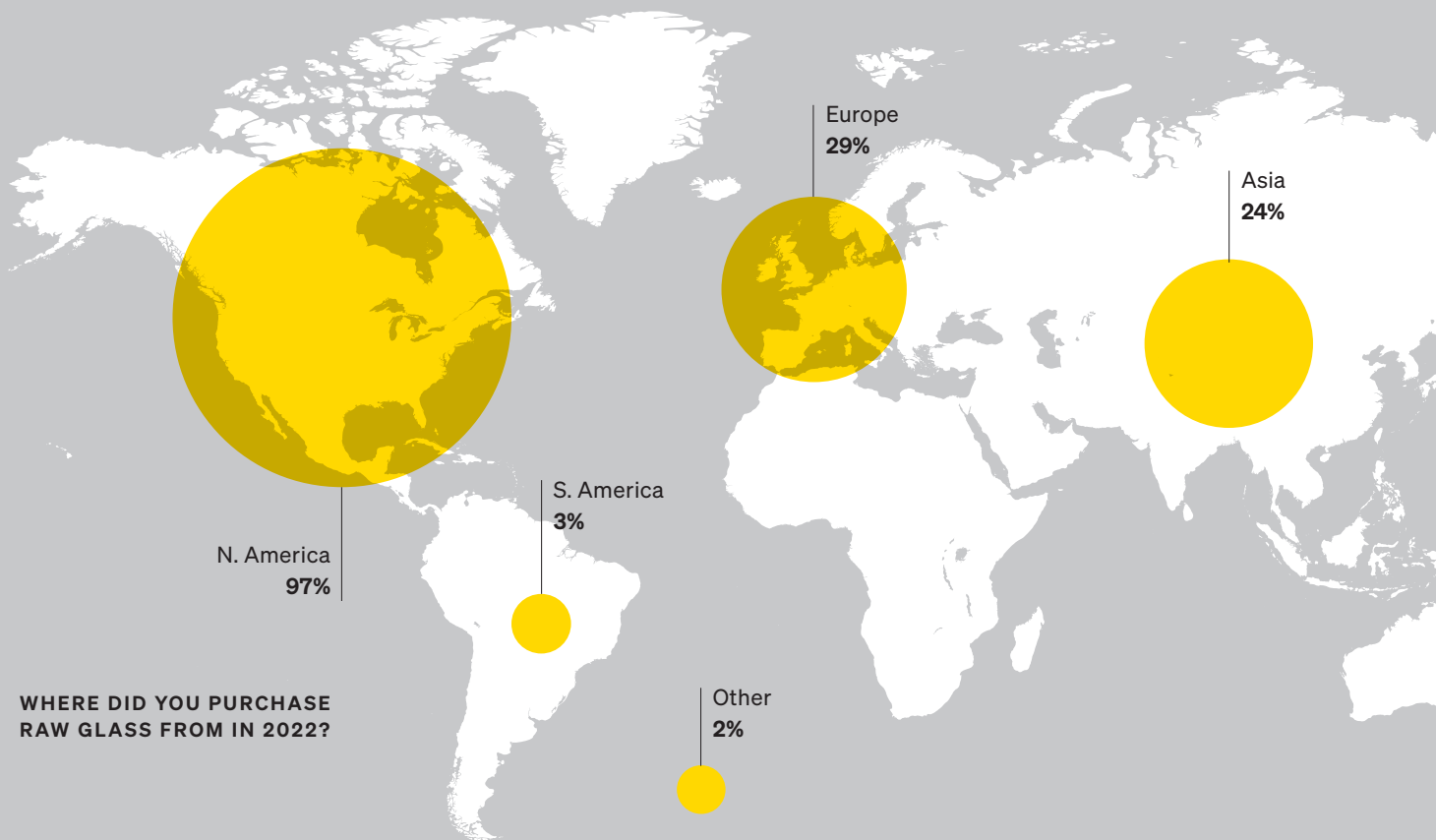
dundyglass.com
Springfield Gardens, NY
Plants: 2
Total employees: 25

62 (tied)

**William Penn Performance
Glass Inc.**

williampennglass.com
York, PA
Plants: 1
Total employees: 30

PRODUCTS



WHERE DID YOU PURCHASE
RAW GLASS FROM IN 2022?

THE TAKEAWAYS

● The four major fabricated glass types—tempered, insulating, laminated and decorative—showed little change in terms of growth, year over year. However, more fabricators report producing value-added products. Both protective and curved glass products showed a 5 percent increase from 2021 to 2022, according to survey respondents. In addition, fabricators report supplying fire-rated glass and self-cleaning glass as well as photovoltaic glass and blinds between glass systems.

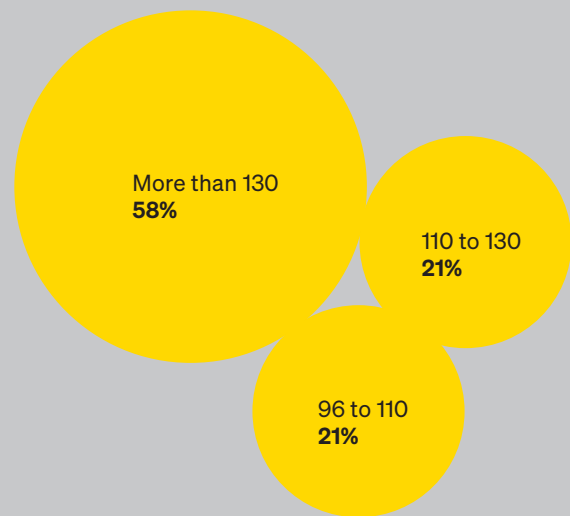
● Fabricators continue to lack consensus on jumbo glass dimensions. Fifty-eight percent elected the largest size at more than 130 inches wide. A significant majority of respondents, 79 percent, said they expect glass sizes will increase again in the coming year.

● Higher raw glass sourcing from Asia returned this last year, according to respondents, likely due to eased COVID restrictions in China. Twenty-four percent of fabricators reported sourcing raw glass from Asia compared to last year's 18 percent. Glass sourced from Europe also showed a 5 percent year-over-year increase.

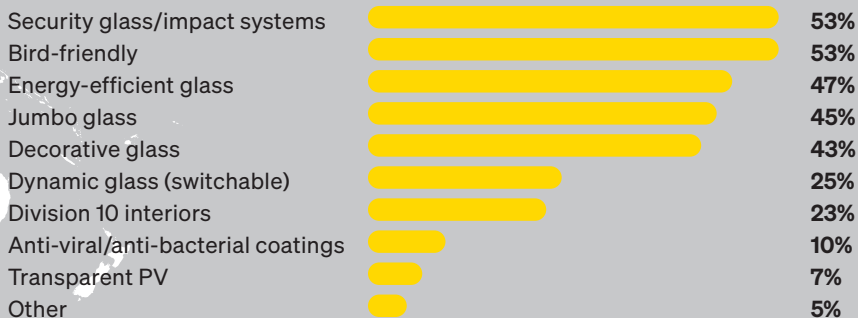
WHAT GLASS TYPES DO YOU FABRICATE?



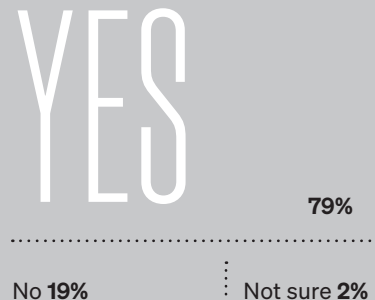
WHAT SIZE RANGE DO YOU CONSIDER JUMBO GLASS? (INCHES WIDE)



WHAT DESIGN TRENDS HAVE YOU NOTICED IN THE LAST YEAR?



DO YOU PREDICT GLASS SIZES WILL EXPAND IN 2023?



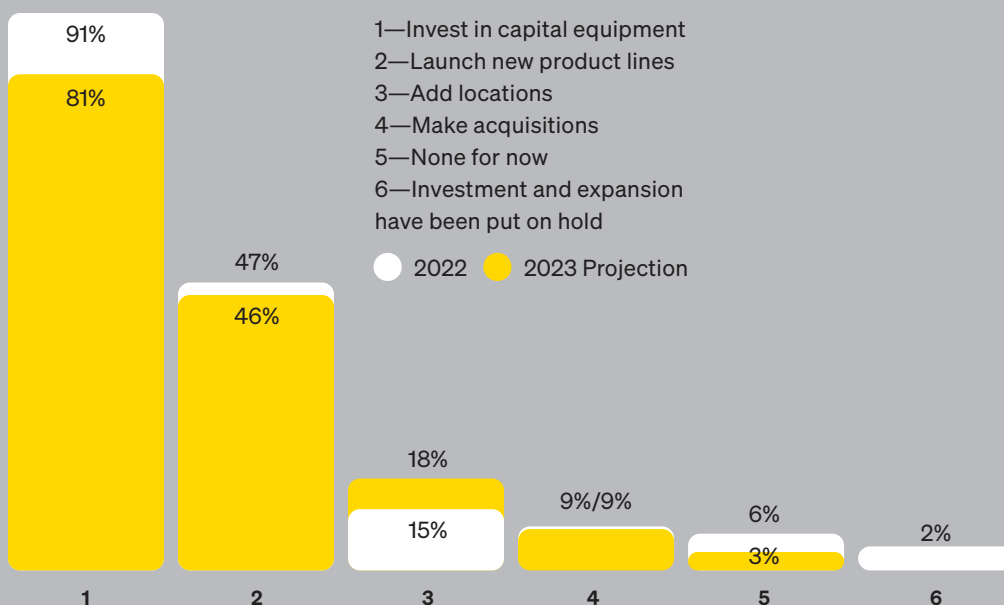
● High-performance glass products showed a 7 percent increase year over year, leading the specialty glass types. Top Glass Fabricator respondents did not report an increase in bird-friendly glass production, as 53 percent of respondents marked it as a trend in 2022, compared to 59 percent in 2021.

● Trends data did suggest an increase in dynamic glass—25 percent of respondents said it was a notable 2022 trend, a seven-point year-over-year increase.

● Top Glass Fabricators reported only a small increase in jumbo glass manufacturing in 2022. Forty-five percent of respondents marked it as a major design trend in 2022, contrasted with 71 percent in 2021. But given the number of fabricators that now fabricate jumbo glass, this may simply indicate that it is a regular part of many fabricators' product mix, given steady demand.

INVESTMENT

DO YOU PLAN TO ADD PRODUCTION CAPACITY IN THE NEXT YEAR?



PERCENTAGE OF FABRICATORS WHO ADDED PRODUCTION CAPACITY IN 2022

87%

66%

OF RESPONDENTS PLAN TO AUTOMATE MANUFACTURING PROCESSES IN 2023

THE TAKEAWAYS

Automation continued to expand in 2022, as entrenched labor constraints inhibit capacity. Fifty-three percent of last year's respondents said they planned to automate in 2022, and this year's results exceeded expectations, with 65 percent of survey respondents saying they automated part of their manufacturing process in 2022. Sixty-six percent of fabricator respondents plan to automate processes in 2023, including the addition of new insulating glass lines, jumbo glass cutting lines and laminating lines.

Given the rise in automation, it is unsurprising that 80 percent of respondents reported using more software for plant optimization in 2022, a flat increase from 2021. Many respondents say they use software across the plant for all production processes as well as for shipping and logistics, project management, and sales.

Higher overall sales coincided with more capital investment for many companies in 2022. Of the 87 percent of respondents who said they expanded production capacity in 2022, 91 percent invested in capital equipment, a 10 percent increase from last year's report. Eighty-one percent plan to do so in the coming year.

Forty-seven percent added new product lines, with a similar number planning to invest in new products in 2023.



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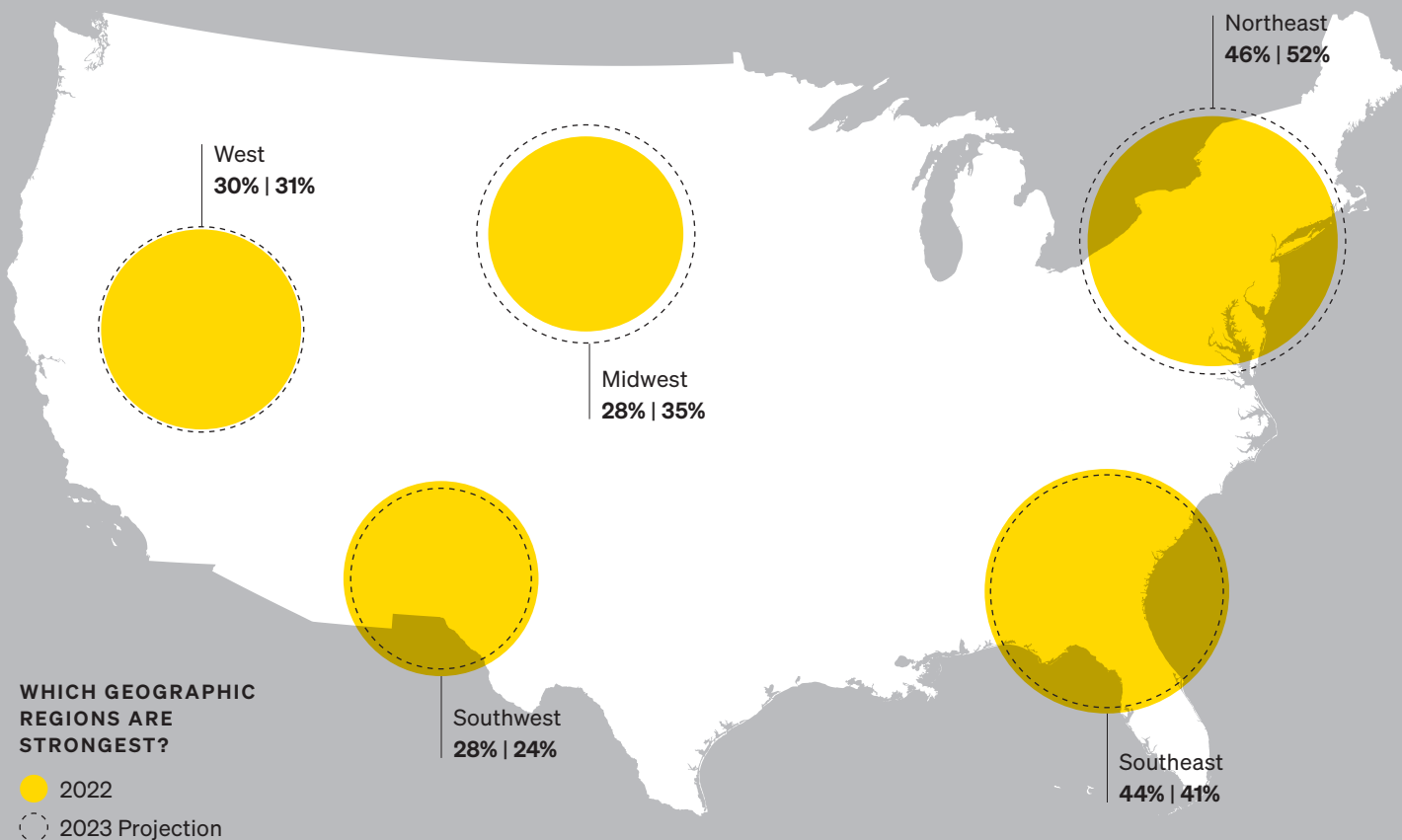
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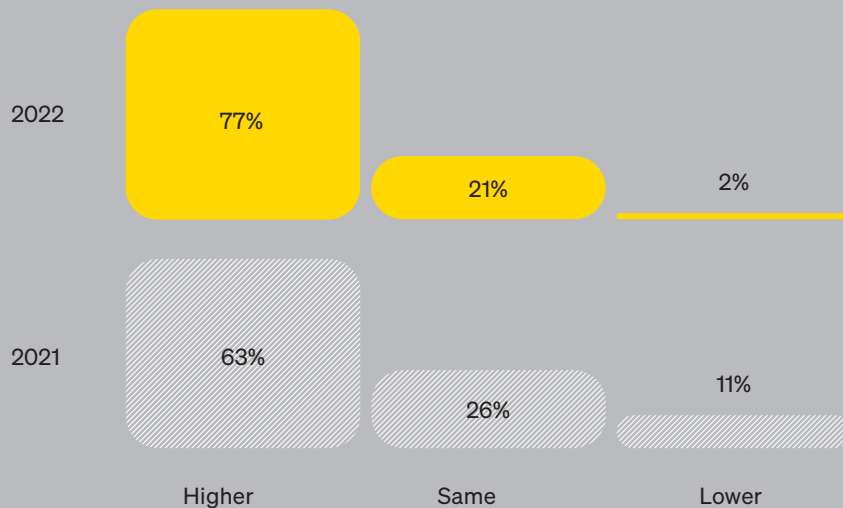
THE TAKEAWAYS

● Sales continued to rebound in 2022, with 77 percent of respondents reporting higher year-over-year sales. This compares favorably to last year's report, where only 63 percent of Top Glass Fabricators reported higher sales. Only two percent of responding fabricators say they posted lower year-over-year sales, as contrasted with 11 percent in last year's survey.

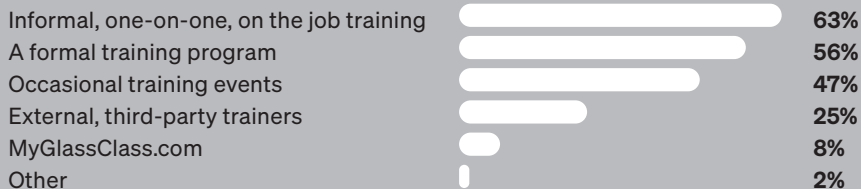
● Last year's predictions for sales growth by geographic region largely came true this year, with the Northeast showing the strongest growth in 2022, and the Southeast as a more distant second. Only 14 percent of last year's respondents predicted growth in the West for 2022, but 31 percent of responding fabricators for this year's report said they saw growth in the region in 2022.

● Respondents predict growth will continue along the same lines next year, with the Northeast leading again. Western growth displaced the Midwest in the ranking for 2023, but only by two points.

HOW DID SALES LEVELS COMPARE TO THE PREVIOUS YEAR?



HOW ARE YOU CURRENTLY TRAINING YOUR EMPLOYEES?



● The number of companies doing retrofit work appeared to be relatively similar to last year, with 93 percent reporting that less than half of their business is retrofit.

● While labor remains the biggest challenge, as discussed in the next section, companies also plan to invest in increased capacity by training workers. Thirty-three percent of respondents said they plan to invest in a training program for employees this year. A little over half of responding fabricator companies use a formal training program, and 25 percent employ a third-party company to train staff.

33%

OF RESPONDENTS SAY THEY WILL INVEST IN TRAINING IN 2023

HOW MUCH OF YOUR BUSINESS IS RETROFIT?

93% Less than half

7% Half or more

SALES CONTINUED TO REBOUND IN 2022, WITH 77 PERCENT OF RESPONDENTS REPORTING HIGHER YEAR-OVER-YEAR SALES.

CHALLENGES

WHAT IS YOUR BIGGEST PAIN POINT OTHER THAN LABOR?

Inflation
37%

Procuring raw glass
30%

Logistics/trucking
19%

THE TAKEAWAYS

● Fabricators once again report high demand, and many sought to increase capacity to meet it. “Our capacity expansion and higher sales required additional staff to keep up with customer demand,” says Mike Calandro, supply chain manager, Press Glass. “We added a weekend shift to meet customers’ demands,” says Joey Wiggins, vice president of operations, M3 Glass.

● Only two percent of fabricators reported reducing shifts, compared to 15 percent the previous year, again pointing to healthy demand and business stability.

● To meet rising demand, 34 percent of fabricators reported adding shifts this year, compared to 24 percent in last year’s report. In survey responses, most companies mentioned being impacted by the ongoing lack of workers. “There is no one to hire,” says Doug Betti, director, operations, Viracon.

● Beyond labor, inflation replaced transportation and logistics as the major pain point affecting fabricator companies. “There was a rising cost in all materials due to inflation,” says Greg Grothoff, vice president of strategic business development, Glassfab Tempering Services.. Many companies struggled with the availability of glass. “Float glass manufacturers seem to be over-capacity, which can extend lead times for us as we are waiting longer for glass,” says Alex Oanono, president, Blue Star Architectural Glass. “This is especially an issue with jumbo-size coated glass.”

DID YOU ADD SHIFTS
DURING 2022?

34%

SAID YES

DID YOU REDUCE SHIFTS
DURING 2022?

2%

SAID YES

“SIGNIFICANT PRICE
INCREASES AND SUPPLY
PROCUREMENT DELAYS WERE
VERY PROBLEMATIC ISSUES
FOR OUR ORGANIZATION IN
2022, WHICH WE CONTINUE
TO STRUGGLE WITH AS WE
ENTER 2023.”

Getting hardware
5%

Other*
5%

Getting spacers
4%

*Suppliers discontinuing products, including inks, laminates, substrates. Also difficult to get larger companies to take on new clients to supply.

● Inflation combined with ongoing and unpredictable supply chain issues. “Significant price increases and supply procurement delays were very problematic issues for our organization in 2022, which we continue to struggle with as we enter 2023,” says Shane Merryman, CEO, Consolidated Glass Corp.

● Continued supply chain disruptions have forced companies to alter operations. “The largest challenge has been the continued disruption to the hardware supply chain,” says Shelby Parks, office manager, Echols Glass & Mirror Inc. “It has forced us to diversify on a greater scale and outsource other hardware manufacturers.”

● Project delays also had the potential to compound other difficulties. “Many projects have been delayed, which has an impact on supply chain management,” says Roland Rossmann, project leader, Garibaldi Glass Industries Inc. “Staffing resources have been difficult to maintain, and as a result, there has been instability in overall manufacturing.” ■

HEAVY GLASS DOORS

TOP CONSIDERATIONS
FOR SAFE AND
SECURE DESIGN AND
INSTALLATION



A

All-glass entrances featuring heavy glass have become increasingly popular with architects and interior designers. The systems incorporate heavy glass, metal rails, small metal patch fittings and sometimes structural silicone, and they can be used as an exterior entrance for a monumental building or a simple interior mall storefront. Heavy glass with polished

edges provides sleek-looking entrance doors that make an elegant statement for the building or shop owner, and the open and modern aesthetic makes the entrances a focal point for pedestrians.

GLASS MAKEUP

Heavy glass is generally defined as fully tempered glass equal to or



greater than $\frac{3}{8}$ inch in thickness, or tempered laminated glass constructed with two or more lites of glass equal to or greater than $\frac{1}{2}$ inch thick. All heavy glass doors, since they are manufactured using fully tempered glass, are intended to meet the safety glazing requirements of ANSI Z97.1 unlimited class and CPSC 16 CFR 1201 Category II.

Editor's note: This article is excerpted and adapted from the National Glass Association's updated version of the Heavy Glass Door Design Manual, published in 2021. Download the full guide in the NGA Store using the QR code.



THE ENTRANCES TO A BUILDING OR BUSINESS GIVE ONE OF THE FIRST AND LAST IMPRESSIONS OF THE BUILDING TO THE PEDESTRIAN TRAFFIC ENTERING AND EXITING.

SAFETY

Correct selection of push-pull and operating hardware is an essential element in safe design. Door swing arcs should be limited by the closer hardware or doorstops to prevent one door from swinging into the path of another door. Where pairs of doors are required, 6-foot-wide openings with a pair of 3-foot-wide doors are recommended, as narrower openings tend to impede the flow of pedestrian traffic. Design sidelites so they will not be mistaken for clear openings that invite pedestrian traffic to walk into the glass. Visual patterns, decorative railings or plantings will help prevent this type of problem. If the entrance doors are recessed from the face of the building, it will prevent the door from swinging into pedestrian traffic and also protect exterior doors from crosswinds.

WEATHER

When designing storefront or entrance systems, the effects of wind, rain, and cold or hot weather should be considered. Severely cold climate areas usually require vestibules with both exterior and interior doors. Heavy glass doors are not typically weathertight, so they are most frequently used as interior vestibule doors, shop-front entrances in interior shopping malls, and interior office applications.

PEDESTRIAN TRAFFIC

The entrances to a building or business give one of the first and last impressions of the building to the pedestrian traffic entering and exiting. The configuration of the entrance doors relative to surrounding conditions is a vital factor. The flow of traffic from the sidewalk, mall corridor or parking area will determine the number of entrances required. Doors must be located so as not to swing into the path of pedestrian traffic.

BUTT GLAZING

For glass entrances containing butt-glazed glass panels, the height of the opening (and not the width) will determine the glass thickness required. Butt-joint glazing should not be confused with structural silicone glazing. Both have the same exterior appearance, but structural silicone glazing has interior vertical mullions to which the glass adheres with structural silicone sealant.

Individual glass lites attached to the structure at the top and bottom only (head and sill) are considered typical butt-joint glazing. If, in addition to the top and bottom support, one vertical edge is structurally supported, the glass is supported on three sides. If all four edges are structurally supported, the lite has four-sided support. Butt-jointing one glass panel to another glass panel when both are in the same plane does not structurally support the glass.



SECURITY

Varying levels of security can be achieved using standard rail and patch locks as well as more sophisticated systems that include electric bolts, shear/magnetic locks and panic devices. Traffic volumes, floor slab thickness, egress requirements and ADA considerations will determine closing device location and selection. Several glass door types can be adapted to incorporate automatic and power-assisted operators to meet ADA requirements.

SEISMIC CONSIDERATIONS

Heavy glass doors and entrances can be



Photo courtesy of Frameless Hardware Co.

installed in seismic regions. The design professional must specify the various loads anticipated during a seismic event. Because heavy glass is often butt-glazed, the joint width between panels should be designed to avoid glass-to-glass contact due to the anticipated sway of the building or opening frame. The perimeter glazing channel should also be designed to provide sufficient edge clearance to avoid glass-to-frame contact due to building sway.

INTERIOR APPLICATIONS

Heavy glass doors are becoming increasingly popular for interior applications. Although wind load is not a consideration, other types of structural loading may limit the size of interior doors. Interior fully tempered glass sidelite panels are not always sealed. Traffic volume for interior applications needs to be considered the same as with exterior applications. Interior doors are often locked in both the open and closed position, eliminating the need for closers.

NGA TECHNICAL VOLUNTEERS

Volunteers from the following NGA member companies contributed time and resources to update and publish the second edition of the Heavy Glass Door Design Manual.

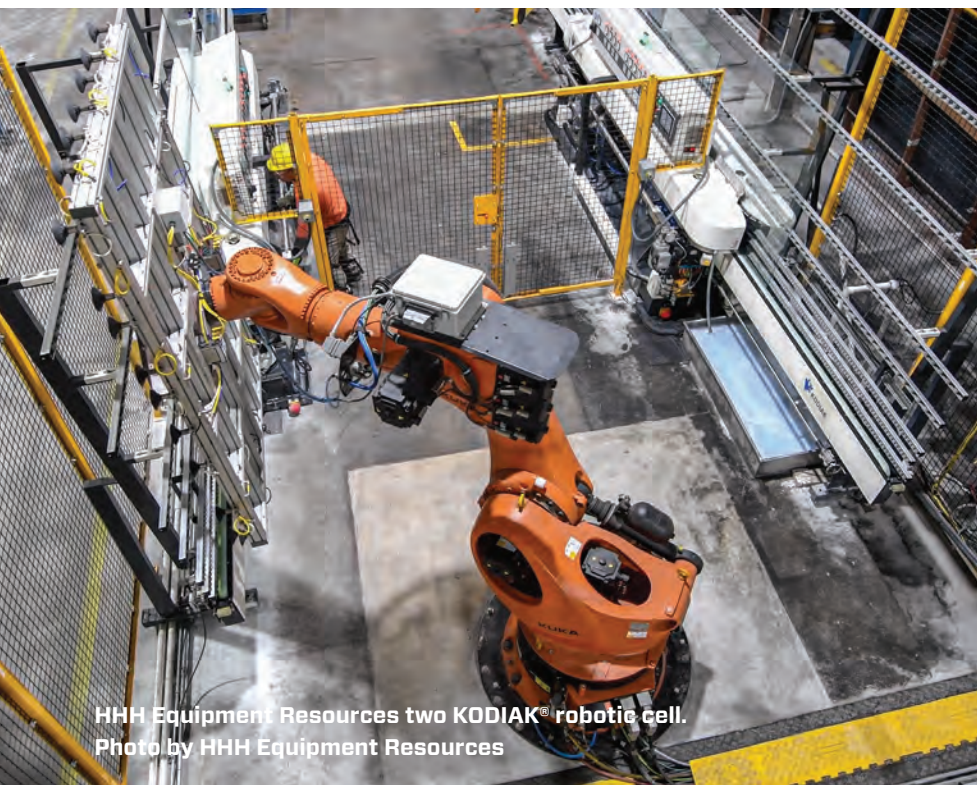
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DOOR SIZE

Door sizes need to be limited due to glass flexibility and hardware limitations. Closers and pivots have weight limitations. Doors that are too wide are difficult to control in windy conditions and may exceed hardware limits. Larger doors may be used when locked open or infrequently used. Full rails, top and bottom, are recommended for larger door sizes.

INSTALLATION

No entrance, however perfect in design and manufacture, will function properly unless it is installed correctly. The opening must be plumb and square, with the pivots aligned and firmly secured to solid supporting construction with adequate provision for anticipated movements due to seismic or thermal effects. Installers should reference the manufacturer's specifications for detailed installation instructions. If a satisfactory installation is to be realized, the installer must become thoroughly familiar with all these specifications and requirements. ■



HHH Equipment Resources two KODIAK® robotic cell.
Photo by HHH Equipment Resources

HELPING TO MANUFACTURE THE FUTURE

SALEM PREPARES GLASS FABRICATORS FOR EFFICIENCY WITH END-TO-END SOLUTIONS

BY KATY DEVLIN
CONTENT
DIRECTOR,
EDITOR-IN-CHIEF

TARA LUKASIK
MANAGING
EDITOR

Glass fabricators are staying the course in 2023 despite slow growth, uncertain market conditions, persistent labor shortages, rocky supply chain conditions and production challenges. The industry is still locked in the mindset of doing more with less, possibly more so than ever before as a majority of fabricators, 65 percent, reported to Glass Magazine that they automated some part of their manufacturing process in 2022. A majority, 66 percent, also said that they would automate processes in 2023, including the addition of new insulating glass lines, jumbo glass cutting lines and laminating lines.

With more than 100 years of experience, Salem Fabrication Technologies Group Inc.—through its Salem Fabrication Supplies and HHH Equipment Resources divisions—brings

complete and customizable surfacing supplies, quality polishing tools and glass fabrication machinery equipment to the glass industry. Headquartered in Winston-Salem, North Carolina, the Salem team takes a guided approach to preparing glass fabricators and glazing professionals with end-to-end glass fabrication solutions as well as specialist consultation, maintenance and service to help provide solutions to customers' challenges.

Glass Magazine spoke with Mike Synon, president of HHH Equipment Resources, and Ashley Price, Eastern regional sales director at Salem Fabrication Supplies, about end-to-end glass fabrication, the challenges and opportunities involved with integrating automated machinery into a fabrication plant, and how Salem's product and process expertise can help customers navigate current industry challenges. Synon has been with the company since 2013 and brings more than 24 years of industry experience, including involvement within the manufacturing, fabrication and installation sides of the glass industry. Meanwhile, Price joined the company in 2010 and has more than 23 years of experience in the glass and stone fabrication industries working as a CNC technician and tooling specialist with both U.S. companies and Italian machinery manufacturers.

Let's start with your customers. What are their pain points right now? What are they asking for and how are you providing for them?

Mike Synon: From the machinery aspect, employment seems to be the largest pain point—finding people, getting them on the payroll, training them and maintaining training through turnover. [Customers are] consistently asking us for robotic systems, automatic grinders to seam their glass before it goes into the tempering furnace. Anything that can eliminate a body, so to speak.

Ashley Price: Supply chain is one of

the biggest pain points right now. Lead times continue to extend, a shortage in raw materials, and energy cost increases really create a burden for our customers. Cost increases on our consumable products have affected us across the board and we have to be diligent in how we manage that inventory for our customers. We continually look at alternative options and bring in multiple lines of products that offer good-better-best options for our customers.

What are the top challenges for glass companies in integrating automated machinery into a fabrication plant?

MS: First of all, there are the space requirements. It takes additional space to put the automated machinery in and get those systems set up. The other thing is the cost of investment in automation. ... However, if a fabricator is feeling the crunch and the pain of staffing, they'll make the investment.

AP: Adding to that, you need competent operators and maintenance staff. You have to combine the challenge of training those individuals with the capabilities of the machines; knowing up front what each can and can't do. Do you have confident people that can retain information and perform those duties of operation? The maintenance staff needs to be knowledgeable enough to work on any new piece of equipment in conjunction with the machine partner's technical service department. Also, when you talk about automated equipment, you have to consider the quality of the consumable supplies used that are crucial to the performance of each piece of machinery.

If a fabricator is new to adding automated solutions, where should they look first or what do they need to know?

MS: What they should do first is to check with every OEM, manufacturer

and distributor to see what product line they're offering and what the configurations are. And most importantly, determine what will be the fabricator's responsibility in terms of service. ... A fabricator is going to need a technical team to walk them through that process. Finally, consider maintenance. I don't want to say that maintenance is a dying art, but there are a lot of factories we go to that have three tempering furnaces, five edgers and just one maintenance guy.

AP: Fabricators must also understand what they truly want. What processes are they really looking to automate? What are the limitations of that piece of equipment they are considering? Knowing the full capabilities of the machinery is absolutely necessary. There are so many different options and process conditions that you must think about along with technical service. Choosing a solution that has a U.S.-based service team to keep that machine up and running and in production at all times is important.

When a fabricator commits to adding automated machinery, what does that pre-planning look like?

MS: We start with the floorplan of the facility. We get a CAD drawing of the plant and then we work our way backwards from there, figuring where the machines will fit within the facility so they can analyze the flow and where they can gain time, reduce cost and so on. We can exchange drawings with fabricators 15 to 20 times before we decide on a location. You have to figure out where the electric's coming in, if there's enough amperage and the correct voltage. You need to establish proper drainage—what are you going to do with the water? It's a long, drawn-out process. Then comes the purchase, the installation, and the most important part, the service because this is all going to be new to the fabricator. It takes all of this to make a successful launch.

Let's talk training. Automation makes things simple, but what are your fabricators' top challenges when it comes to training their people, and how do you support them?

MS: Getting people comfortable with working with a robotic system and the technology is the first step. The install and commissioning of a vertical CNC takes approximately two weeks. We get them trained, get them running, and then we have our tooling guys come in and help them with the tooling setups and make sure that it's all correct. We come back for one more week to correct mistakes and answer additional questions. That's a three-week commitment to getting the machine up and running correctly.

AP: We have a multitude of training opportunities for tooling setup. From PowerPoint presentations and videos to in-person tooling specialists that will demonstrate how to perform a variety of operations. There are different forms of training for new hires or seasoned workers that cover tips, tricks and strategies to help further their education and knowledge on a specific process. Often, the main issue our customers face in training is retention of knowledge. We offer training to all customers, even when they're not asking for it, because there are many operators on the floor that are afraid to ask questions that expose the fact that they are not comfortable in their job duties. The key for us is to educate each operator and give them the needed tools and knowledge so that we set them up for success. ■



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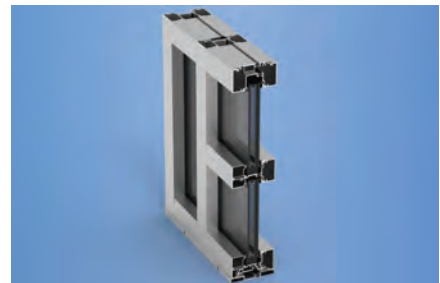
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01



02



03

01. Hinges

C.R. Laurence has three new hinge designs: Bellagio, Como and Lugano. Each family of shower hinge has been tested to 100,000 cycles. These shower hinges feature matching brackets and snap-on covers that conceal the screws. The new shower hinges are available in four finishes, matte black, brushed nickel, satin brass and chrome.

800/421-6144 | CRLAURENCE.COM

02. Bird-friendly glass

Trosifol's BirdSecure Pro bird-friendly glass has a dot pattern applied directly to the BirdSecure Pro interlayer that has been optimized and now shows better results, say officials. In the revised color composition of the dot pattern, the dot size and spacing have been significantly updated. Both Trosifol and SentryGlas BirdSecure Pro were developed according to the specifications of the American Bird Conservancy. In addition, the new interlayer acts as a UV blocker.

800/635-3182 | TROSIFOL.COM

03. Storefront system

YHS 50 TU by YKK AP is a pre-glazed storefront system designed for insulating glass 1 inch to 1 1/8 inch thick and tested to meet demanding conditions. With varied infill and components, YHS 50 TU can meet the requirements for impact resistance and blast mitigation. It is thermally broken by means of a poured and debridged pocket that employs ThermoBond Plus to improve the adhesion of the polyurethane to the extruded aluminum.

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02

01. Threshold

FST95 by Frameless Hardware Co. is a frameless sliding shower door threshold designed to solve leaking problems with barn door sliding shower kits. It is designed for FHC Frameless Sliding Showers and can be cut-to-size in the field. The threshold is designed to fit from the handle-side wall to the center guide, providing a continuous seal below the door. Available in a 95-inch length and in five finishes, this threshold requires no drilling into the base.

888/295-4531 | FHC-USA.COM

02. Motion sensor

Unicel Architectural Corp.'s motion sensor operation technology accompanies its Vision Control IGU. The new operator is compliant with the Americans with Disabilities Act and includes two sensors enabling easy and automatic louver operation, with one sensor activating the louvers' upward direction and the other activating the downward direction. Momentary hovering above either of the sensors triggers the louvers to close in the desired direction.

800/668-1580 | UNICELARCHITECTURAL.COM

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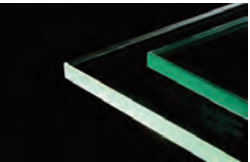
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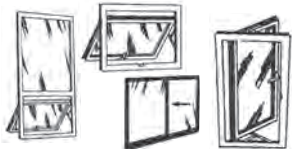
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HoLampCo International	78	800/875-6268	holampcoresources.com
Jordon Glass Machinery	76	800/833-2159	jordonglass.com
Joseph Machine Company	44	717/432-3442	josephmachine.com
Kuraray America Inc.	45		email: trosifol@kuraray.com
Lattuada North America	53	567/249-4486	lattuada-na.com
LGH	46		rentlgh.com/gm
Liberty Glass & Metal Industries	80	800/843-2031	lgminc.net
MAGID	23	800/444-8030	magidglove.com/glass-mag
MarketPro Point of Sale Solutions	71	888/616-3706	marketpropos.com
McKeegan Equipment & Supply	74	734/459-5870	mckeeganequip.com
Modernfold	19	800/869-9685	modernfold.com
Mueller Technologies AG	77	905/427-3400	muller.ch
MyGlassClass	12	866/342-5642 ext. 161	myglassclass.com
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PAC-CLAD Petersen Aluminum	25	800/PAC-CLAD	pac-clad.com
Precision Glass Bending Corp.	32, 70	800/543-8796	e-bentglass.com
repurposedMATERIALS	78	303/321-1471	repurposedmaterialsinc.com
Salem Fabrication Supplies	47	800/234-1982	salemftg.com
Seclock	3	800/847-5625	seclock.com
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Viprotron	38-39	313/384-3855	email: ric.schmidt@viprotron.com
Viracon	43		viracon.com/VIN
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Industry Spotlight profiles people across the glass and glazing industry, showing off the work of individuals while demonstrating the range of exciting careers in glass. To suggest someone to profile, write to Senior Editor Norah Dick, ndick@glass.org.

WHY WORK IN GLASS? ONE WOMAN LEADER EXPLAINS WHY

Women in Construction Week has passed, but the importance of recruiting and retaining women in the industry is still very relevant. Glass Magazine Assistant Editor Rachel Vitello sat down with Ahlam Qaimari, general manager of Griffin Glass & Metal Werks, to talk about Qaimari's start in the industry, how the professional landscape has changed for women and what the glass sector has to offer.

Q How did you get started in the glass industry?

While I have worked for many manufacturing companies in the past, my career in glass started in February 2020 when I joined Griffin Glass & Metal Werks as a manufacturing engineer. I found out about the position from a family friend and then I applied.

I was especially drawn to the industry when I discovered all the large projects the company was involved in. You never realize exactly how much work goes into every building you see, especially when it comes to glass and doors. The level of detail is amazing.

Q How is the number of women in the industry changing?

We made an effort to hire female engineers and fabricators in the company and were successful in doing so. I also hope to continue to find well-



qualified women as we grow.

In our industry, it is critical to highlight the work women do to attract more of them to the field. I want my daughter to look up to me and see that women can be engineers and lead divisions too, even in manufacturing environments.

Q What are the benefits of being in the glass industry as a woman?

It is such a diverse industry as glass has so many applications. You get to work with so many different types of people with a variety of skill sets.

Also, because there tends to be a shortage of women in these fields, you are highly sought after and tremendously respected for the work you do. While it is never necessary to prove your worth to anyone, at the same time it's motivating to me that I work in a field where I may be viewed as an outsider, as I always am pushing myself to prove that I can do anything and do it well.

I also am very fortunate to be working for Griffin Glass & Metal Werks. From

our leadership on down, they have been very supportive of me and have opened so many doors for me, which motivates me to continuously look to do more and improve.

I recently was promoted to general manager of my company, which is just added proof that women can do anything in this industry. If you work hard and persevere, you will be recognized and rewarded for your work.

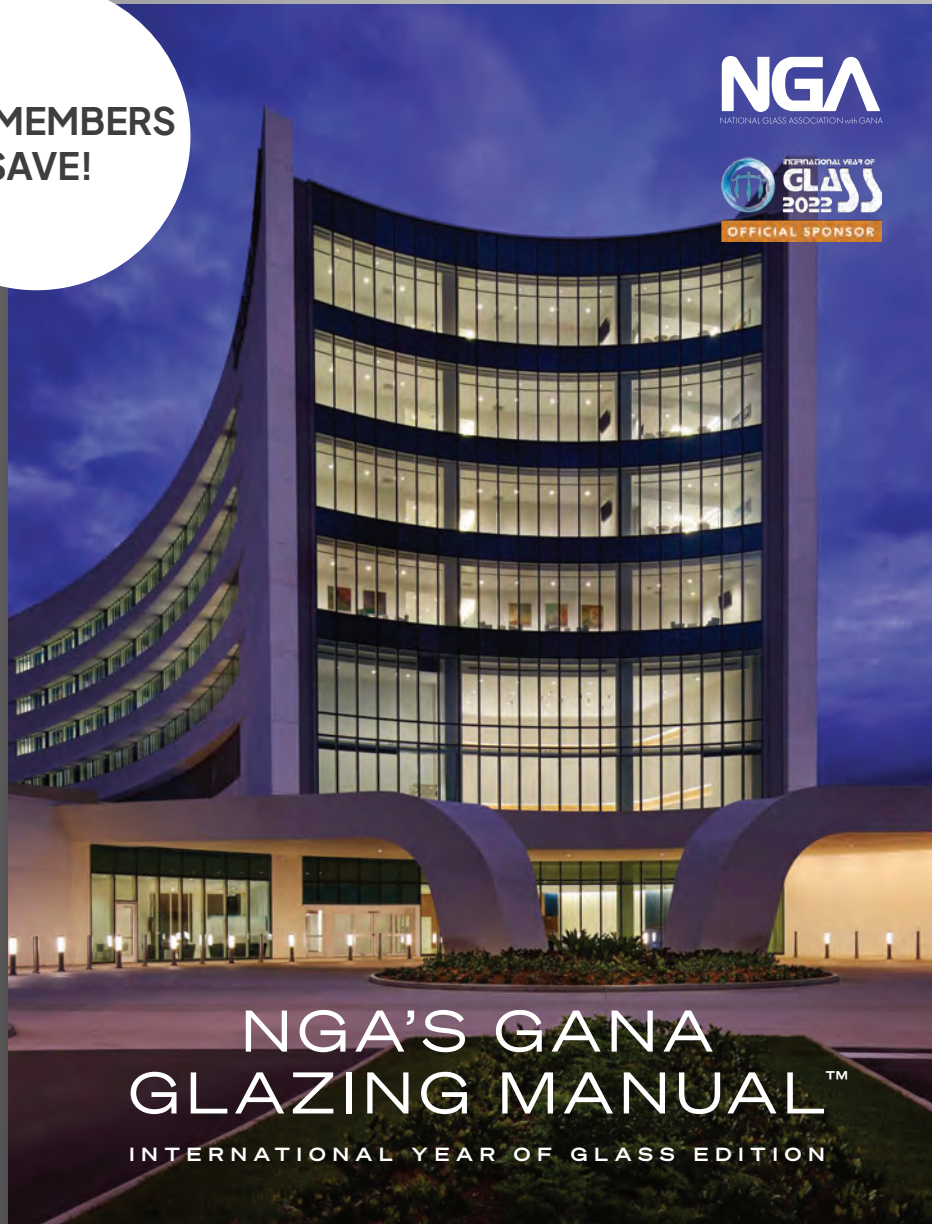
Q What do the glass/construction industries have to offer women?

Truly, the same that the industry offers men. It's a very exciting industry where you get to see the product of your work come alive in front of you. Also, it's a very stable industry as we will always need glass in our structures and buildings.

You are involved in very impactful projects. There are remarkable women in the field that network and support each other, as is evident at National Glass Association events. ■

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