



The aesthetically pleasing 402 Dunsmuir in Vancouver, Canada, is home to North America's top tech and entrepreneurial talent.

Large Glass

An evolving choice for quality, stunning facades and interiors

Sponsored by the National Glass Association | *By Jessica Jarrard*

In the not-so-distant past, glass was not commonly specified for large expanses of buildings. Prior to the implementation of modern manufacturing and glazing techniques, monolithic glass offered limited insulating properties and, therefore, could not reduce unwanted thermal heat gain or loss. Because of this, many older buildings often have smaller windows and solid doors instead of full facades made of glass.

Advancements in glass and glazing technology and sustainability improvements have allowed for larger glass sizes that are more energy efficient while also providing the benefits of daylighting and connection to the outside environment. Architects and designers can create stunning glass facades using larger windows and glass installations in new construction, renovations, and

retrofits. Large glass installations can also enhance indoor aesthetics, both in residential and commercial applications.

INTRODUCTION TO LARGE GLASS

Large glass, also known as jumbo glass or oversized glass, refers to glass panels that can be used to envelope the building with large expanses and minimal framing.

Recent architectural trends emphasize an increasing desire to bring more natural light into the spaces where we work, learn, and live through glass exteriors and interior glass panels that help direct light into open spaces within the building. As designers adapt to these new demands, the size of glass products being specified is getting larger and larger.

Glass used in commercial and residential construction is typically manufactured in

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Learning Objectives

After reading this article, you should be able to:

1. List the qualities that designate a material as "large glass."
2. Describe how high-quality glazing systems are designed and implemented to support the health, safety, and welfare of building occupants.
3. Identify key considerations when specifying large glass.
4. Discuss techniques for handling and installing large glass.

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flat sheets using the float glass process. In this process, molten glass is floated on a bed of molten tin, allowing the sheet to have a uniform thickness and flatness. Typical glass thickness ranges from 1.7 mm to 12 mm, and can go up to 25 mm. After the glass is floated, it may be further processed with coatings or lamination, and may be fabricated into an insulating glass unit (IGU) and installed into an appropriate framing system.

While there isn't a consistent industry standard or measurement for large glass, large glass is generally considered to be 130 in. x 230 in. or larger, whereas standard glass lites are typically 96 in. x 130 in. However, large glass lites have been produced in lengths greater than 65 feet. Large glass can then be fabricated into IGUs to help support energy efficiency goals while providing uninterrupted views and natural light that can transform spaces.

Thanks to improved manufacturing and glazing processes, large glass is more commonly specified in new construction, but can also be used in renovation and retrofits of older buildings.

BENEFITS OF LARGE GLASS

Many popular, renowned buildings feature large expanses of architectural glass both externally and internally. These aesthetically pleasing buildings provide many benefits to occupants, including adequate daylighting, thermal comfort, energy efficiency, occupant safety and security, and stunning aesthetics.

Daylighting

Natural light is essential to ensuring the healthy function of our bodies and minds, affecting the regulation of melatonin and hormones. Many studies show the link to wellness and wellbeing with access to views and a connection to the environment. Windows and glass exteriors not only provide essential daylighting for occupants, but they also provide occupants with connection to nature and to the outdoors. In a report by Heschong-Mahone Group, proper daylighting was shown to reduce the likelihood of reports of fatigue, headache, difficulty concentrating, and eye strain.

Proper daylighting provides diffuse light and reflective light can eliminate the need for electric lights in spaces with large glass exteriors.

Later, we will discuss how various glazing options can help alleviate the unwanted side effects of daylighting, allowing occupants to enjoy all the benefits of view while indoors.



Large frosted glass panels decorate the interior of Fountain Place in Dallas.

Energy Efficiency

The use of IGUs can help manage heat gain or loss, depending on the season and building orientation. Large glass expanses that do not have proper insulating qualities, or are not properly installed, can result in air and moisture intrusion. Unwanted air intrusion leads to inconsistent temperatures while unwanted moisture intrusion can lead to the growth of mold and mildew, which can become harmful to occupants.

Glass windows and doors are part of the building envelope, the first line of defense against the elements. Large IGUs, coupled with the use of sealants, can create airtight barriers between indoor and outdoor spaces. Thorough sealing of the building envelope directly impacts occupant comfort and HVAC system requirements.

Safety

Large glass can also provide safety for occupants, thanks to various methods of glass manufacturing and glazing options.

Heat-strengthened glass is twice as strong as annealed glass, while tempered glass is four to five times stronger than annealed glass. Laminated glass offers strength and protection thanks to a plastic interlayer sandwiched between two layers of glass that holds glass in place if it breaks.

Heat-tempered glass and laminated glass may be tested and certified as a safety glass.

Safety glass is fabricated in a manner that will reduce the likelihood of injury should it break. Safety glass can be used in large glass applications as impact-resistant glass. Fire-rated glazing is typically specified in interior settings, especially corridors, stairwells, and doors. There are two different types of fire-rated glazing products available: fire-protective and fire-resistive. Fire-protective glazing helps to limit the spread of fire and smoke. In addition to preventing the spread of fire and smoke, fire-resistive glazing allows the glass to act as a barrier to radiant heat.

REDUCED SOUND TRANSMISSION

Large glass can also help reduce sound transmission and shield occupants from unwanted noise.

Laminated glass is often used in applications where sound transmission is not preferred. Outside noise pollution from cars, planes, and street traffic can infiltrate a space and become a nuisance. Thanks to advancements in manufacturing processes, occupants can enjoy the benefits of daylighting provided by large glass without the unwanted noise. This could be in expanses that separate interior spaces from exterior spaces, as well as in interior applications with glass floors, ceiling, stairs, or walls. Large glass dividers can also improve the sound quality of interior space while also allowing diffuse light to enter.

SUCCESS WITH LARGE GLASS

Of Glass Magazine's Top Glass Fabricators, 64% fabricated jumbo glass in 2020 and 38% of fenestration manufacturers plan to focus on larger windows and doors in 2021. (Window + Door Magazine's Top Manufacturers Report)

This is because there is an increase in demand for all-glass design architecture in both indoor and outdoor applications. In both residential and commercial settings, all glass balconies and railings and/or large bi-folding or sliding doors can easily open up a space or transform indoor/outdoor square footage into another space to enjoy. Large glass installations are also being specified in modern shower enclosures, in both walk-in applications and in applications with sliding doors.

Specify New Generation Glazing Systems

New generation, high-quality glazing systems help ensure successful specifications and installations of large glass applications. Hardware plays a vital role in allowing glass panels to grow in scale. Occupants rely on this hardware and its effectiveness to operate large systems.

How does the industry manage larger glass sizes while also providing smaller, more discreet hardware that meets ever-changing building code requirements? Technology advancements in new generation door and wall glazing systems provide increased functionality while also being able to carry heavier loads, addressing acoustical concerns, and providing beautiful aesthetics.

When specifying the systems, look for hardware that is minimalistic, but structurally sound and tested. You can also partner with a custom designer and develop a glazing system that is tailored to fit the project's specific needs. Large bottom rollers are one discreet option that can be used in heavy sliding doors, and luxury shower door hinges can be used to carry higher loads. Involve a structural engineer for any systems that need additional testing.

Glaziers provide value to installations because they have the knowledge and experience to accommodate larger glass and to explore new opportunities.

Rethinking Installations

In many cases, installations need to be reconsidered with larger glass sizes. Glaziers, architects, and installers must consider hardware from the very beginning. Size and weight must be considered in all cases. For example, will the selected hardware support a 200-pound glass lite? Does a floor closer or hydraulic hinge also need to be considered?

In addition to hardware, large, heavy-duty suction cups are very important, especially when installing tempered glass that can weigh nearly 7 pounds per square foot. Size and weight help determine the right suction cups to use rather than relying on manpower and training to move large, heavy pieces. Professionals can select and take courses through The Door and Hardware Institute to ensure all personnel are trained.

Another alternative is to specify and install unitized, or prefabricated, systems and send them to a job site for easy installation. These installations often do not require additional onsite tools.

Ensuring Sustainability

As glass panels get larger, it's only natural that glass will flex, which can have an impact on thermal properties and deflection. Energy efficiency and environmental concerns are still high priority when it comes to building codes, creating complexities for all-glass building designs. The National Glass Association's 2020 update to the Heavy Glass Door Design Guide is a great resource, providing information on glass and hardware capabilities, and how they work together.

Preparing for the Future

As technology improves, we've seen glaziers consider thicker exterior glass to withstand wind loads. Adding framing or spacers can give the glass more rigidity and adding foam inside of thermal extrusions or a film on top of the glass can provide additional thermal support.

Testing has improved as well, including panic handles that can bend with a glass panel.

In future, we'll also see more planning to include ADA compliance in both design and installation. Challenges will continue to arise and glass sizes continue to increase, however, glass industry partners keep innovating to ensure that glass remains a popular material in future building specifications.

Laminated glass and insulating glass provide higher Outdoor-Indoor Transmission Glass (OITC) ratings than other glass types. The Sound Transmission Class (STC) measures the sound transmission loss through interior walls, ceilings, and floors which can also be a useful measure when specifying glass for large indoor applications such as floor-to-ceiling glass windows and doors between spaces.

AESTHETICS

Large glass is aesthetically pleasing in commercial and residential settings, both in

exterior and interior applications. Choosing the appropriate glass for the setting, plus the coating, color or tint, allows architects flexibility and creative license to create stunning facades and inviting indoor spaces.

Exteriors

In exterior window and door applications, colored glass is not only decorative, but can also help with shading for occupants, especially in areas with direct sun exposure. Window tinting can be added to glass to lower visible light transmission (VLT).

Designers of large glass exteriors can

specify impact-resistant glass to reduce glass breakage, thus protecting occupants in the event of adverse weather and/or forced entry situations.

Interiors

Large glass is not just for exterior windows and doors. It can also be specified and installed in various indoor applications.

Room Dividers and Walls

In large commercial buildings, there are often spaces that do not have access to an outside wall and, therefore, do not have

direct access to natural light. Large glass room dividers and walls offer a modern appearance in both commercial and residential settings while allowing occupants to see into multiple spaces and have access to natural light.

Access to natural light can lower energy bills by reducing the need for extra lighting in interior spaces. It also improves occupant health, especially in office settings, by providing personnel with adequate daylight throughout the day.

Large glass interior walls provide occupants with additional comforts by physically dividing spaces without visually closing them off, thus allowing each space to have its own climate control.

Additionally, large glass walls and dividers can be specified to protect occupants against pathogens and intruders. Large glass can be tested and certified as safety glass for installation in areas subject to accidental human impact.

Skylights and Ceilings

Large glass skylights and ceilings can transform a space, providing natural sunlight and a unique facade. Large glass panels must be fully supported, but may require less framing, thus not adding any limitations to visibility or surface area.

This large glass application can be utilized in atriums and greenhouses as well as in residential settings. Large glass can be fabricated to be flat or curved and can be tinted to further enhance the interior and facade.

Flooring and Decks

Glass flooring can be specified in various applications to provide unique aesthetics and atmosphere in building interiors. This unique design allows light to transfer between spaces and can have additional lighting installed underneath. Glass flooring is typically made with laminated glass to ensure durability and to protect occupants if it is damaged. Fabrication, coatings, and lamination help protect the floor from scratches or other damage that can be caused by occupants and pets.

In residential settings, these stunning floors are popular for many reasons, including the transmission of light through spaces and easy maintenance. Spills can be easily wiped up without damaging the surface.

In commercial applications, glass flooring has all the aforementioned benefits and can also be used in catwalks and bridges. Structural glass beams can be used

in footbridges and other elevated walkways. Beams are created from layers of tempered, low-iron safety glass. Beams are drilled, edged, and polished to ensure structural integrity.

Glass decks have recently increased in popularity, providing additional light transfer as opposed to alternate opaque materials. The deck and stairs can include integrated railings and non-slip surfaces that meet ANSI safety standards. Glass deck flooring can be clear in order to see what's below, or frosted to allow natural light to filter in places where visibility may not be necessary or privacy required. Glass flooring in rooftops and bridges is also increasing in popularity in urban settings and as part of outdoor tourist attractions.

Stairs

Glass stairs can create a unique aesthetic in interior spaces. The tempered glass used in glass stair applications is typically laminated to ensure strength and durability while supporting the weight of people walking on them. Stairs can be created in a variety of shapes and sizes. Staircases can be straight or curved, can incorporate glass railings and span several floors. Floor panels can be coated to create a non-slip surface, providing safety for occupants.

Decorative Panels and Finishes

Large decorative glass panels are being specified and installed in more and more residential applications because of their versatility and aesthetically pleasing qualities. These panels can be used in shower installations, interior sliding glass doors, and glass facades and doors that lead to exterior spaces.

Panels can be frosted, etched, or digitally printed to include designs and offer privacy.

UNDERSTANDING HIGH-QUALITY GLAZING SYSTEMS

High-quality glazing systems are often applied to large sheet glass to make it stronger, more durable, and more energy efficient. There are many high-quality glazing options that can provide extra protection and benefits while also determining what percentages of heat and light are reflected, transmitted, or absorbed. Coatings may make the glass more durable and allow it to perform better while also affecting color, transparency, and reflectivity. Framing supporting the glass can also make large glass more durable, thus providing safety for occupants in the form of impact-resistant glass.

DAYLIGHTING AND BIOPHILIA

Biophilia, a concept introduced by Edward O. Olsen in his book of the same name, is the hypothesis that humans innately tend to seek connection with nature and other forms of life. This has led to more and more requests for indoor spaces that resemble the outdoors or that help occupants connect to nature. However, natural daylighting and connection to the true outdoors is particularly beneficial. Large glass allows occupants to experience proper daylighting in indoor spaces, thus improving the occupant experience.

ZOO AND AQUARIUM GLASS

Large glass may be specified in animal and fish encasements in zoo and aquarium applications. These aquariums and animal encasements can also be installed in commercial and residential buildings. Walls, floors, doors, and ceilings that are used as encasements, especially for larger fish or animals, should be treated with additional coatings to provide additional durability.

Coatings applied to glass can also be specified to be reflective depending on the animal's nature and needs. Some fish or animals may benefit from having reflective glass so they do not see visitors on the other side of the glass. They may be comforted by seeing their reflection as opposed to human visitors while other animals may see their reflection as a threat and become agitated or stressed. Two-way mirror glass can also be specified to allow humans to see the animals but not allow the animals to see the humans.

Photo courtesy of Timothy Hursley

FOUNTAIN PLACE EXTERIOR FACADE



Fountain Place in Dallas features a full glass exterior with various types of glazing and interior etched glass panels.

Location: Dallas, Texas

Architect: Gensler (Executive Architect) & James Carpenter Design Associates

General Contractor: Turner Construction Company

Metal Systems Manufacturer: Sentech Architectural Systems

Facade Engineering, Design & Material Supply: Sentech Architectural Systems

Contract Glazier: Admiral Glass Company

In 1986, I.M. Pei designed Fountain Place for the Dallas skyline. The renowned architect designed many notable buildings during his career, including the Louvre in Paris, the National Gallery of Art in Washington, D.C., and the National Center for Atmospheric Research in Boulder, Colorado, to name a few. In 2019, after two years of restoration work and \$50 million in upgrades, the 58-story Fountain Place office tower was complete. Restoration efforts included updates to the building lobby and exterior facade.

The building is best known for its large glass panels that measure 29 feet, 6 inches by 10 feet, totaling approximately 6,720 square feet of structural glass. The glass panels are 1-5/8 inches thick, low-iron, tempered laminated glass with interlayers.

Framing materials included adjustable moment-resistant structural perimeter channels, clad in stainless steel with a #4 brushed finish, and sliding moment-resistant head brackets. The renovation's scope of work also included structural glass vestibules, a structural glass pavilion wall, structural glass guardrails, structural glass interior walls, and elevator enclosures built with custom cast glass panels.

EMBODIED CARBON IN GLASS

Embodied carbon refers to the amount of carbon emitted during the construction of a building or material. It includes the extraction of raw materials, transportation of materials and products, installation of products, and disposal of old supplies and products.

Float glass is manufactured through an intense heat process that utilizes a 3,000-degree Fahrenheit oven to convert the raw materials into glass. The heat process used to manufacture glass makes up most of its embodied carbon measurement. Additional carbon is emitted during the coating and fabrication processes, although to a lesser degree when compared to the manufacturing process.

While fabrication contributes to the embodied carbon metric of glass, low-e coatings that improve energy efficiency year over year help offset some of the carbon generated when creating large glass.

Glass Color, Transparency, Tint, and Reflectivity

Large sheet glass, in both commercial and residential applications, is available in many colors. Specifying colored glass not only provides a decorative element but can also allow more or less light to enter a space. In addition to color, the architect can specify the percentage of transparency and reflectivity desired. How color and coatings are specified will be guided by the amount of privacy and light transmittance required, thus providing daylighting while managing glare. Light will vary by space, depending on window orientation, surrounding buildings and trees, and time of year. All of these factors should be considered when specifying large glass on exterior walls or ceilings. Ideally, the architect will specify glass, color, tint, and coatings in large glass applications to balance the need for additional shading devices.

Low-Emissivity Glazing

One of the most popular coatings in exterior applications is low-emissivity (low-e) glazing. A low-e coating consists of one or more thin layers of silver applied to the glass surface. It aids in reducing heat transfer from the outside and minimizes UV light that enters a space, providing additional comfort for occupants who want to experience the positive impact of daylighting without the negative impacts of UV exposure.

Heat gain and heat loss is measured through a U-factor, or U-value. This is the measurement of how effectively the glass can stop heat from passing through it. The use of low-e coatings allows building exteriors with large glass facades to have a lower U-value, which leads to better insulating properties and lower energy costs. Low-e glass contributes to the overall building system by helping to seal the building envelope. This prevents the HVAC system from over working to compensate for unwanted heat gain or loss. Consistent temperatures and humidity in a space lead to improved occupant comfort.

Protective Glazing

Impact Resistant

Impact-resistant glass utilizes laminated glass, which is created when two or more lites of glass are bonded together with an interlayer such as a clear thin film between the lites. This lamination helps hold the glass in place, making it more resistant to fallout. If the glass does break, any broken pieces will stick to the thin plastic film, which also helps keep out water, wind, and debris that could

cause further damage to the structure.

Impact-resistant glass is especially beneficial in areas prone to natural disasters such as hurricanes, tornados, or earthquakes, allowing architects to specify large glass facades when properly designed for weather. Impact-resistant glass can also help prevent intrusion with proper glazing installation and anchorage of the framing to the wall. This type of glass can be a deterrent for those who attempt a smash and grab in a storefront.

Specifying Large Glass

When specifying large glass, heat-treated glass may be recommended because this process helps increase strength, increase the resistance to wind loads, and reduce the risk of thermal breakage. Tempered glass may be recommended because, if fractured, it will break into smaller pieces, making it less likely to cause serious injury. Tempered glass is often specified in sliding glass doors, building entrances, and room partitions, or as required by the building code.

While the standard thickness for regular glass lites is typically $\frac{1}{4}$ inch, it is recommended that larger sheets of glass be thicker to increase stability and durability. This can help the glass be secure within the frame, thus preventing the edges from pulling out of the frame over time and also preventing glass deflection. Extreme amounts of deflection can lead to distortion.

Both the manufacturer and fabricator should be consulted early and often to determine if the sizes specified can be properly and successfully fabricated for the job. This is especially relevant for large glass sheets that have unique shapes or sizes. Since most exterior large glass is installed in insulating glass units (IGUs), a wider than standard glass bite may be needed for larger sizes of sheet glass. The GANA Glazing Manual gives recommended minimum face and edge clearance and glazing bite for various glass thicknesses. Movement of the IGU can add stress to the IG seal and should be considered. Follow the recommendations of the glass manufacturer, fabricator or sealant supplier for individual instances.

During the specification process, prior to fabricating large glass products, architects and contractors may review visual mockups. The visual mockup helps to align the expectations of all stakeholders in a project, including the architect, building owner, and glazing contractor.

Developing Mockups for Installation

A mockup is a section of the exterior envelope,

HOLT RENFREW FLAGSHIP LUXURY STORE



The exterior of the Holt Renfrew flagship luxury store in Toronto features 20-foot-high insulating glass panels that overlook the street.

Location: Bloor Street, Toronto, Canada
Architect: Gensler
General Contractor: Govan Brown & Associates
Contractor: GlazierL Stadia Industries
Glass Fabricator: AGNORA
Glass Supplier: Pilkington, Saint-Gobain
Interlayer Supplier: Kuraray North America

The Holt Renfrew flagship luxury store is in a 190,000-square-foot complex that encapsulates the grandeur of what the store has to offer. At the heart of the building's 250-foot-long facade are 20-foot-high insulating glass units (IGUs), overlooking the street and showcasing the Holt Renfrew sign.

Exterior sheets were made of 6 mm of low-iron glass fused to 6 mm, low-e coated glass with an interlayer to help reduce unwanted heat transfer and to provide UV protection. The building interior contains large sheets of two-ply laminate of 6 mm, low-iron glass also with a structural interlayer.

The sealed IGUs provide exceptional clarity, low deflection, resilience against break in, and great thermal performance for oversize windows.

typically including portions of windows or curtain walls that are designed by the architect, comprising the exact components to be used in the final installation. Mockups can be built using materials that are full-size for the purpose of studying the construction details, testing performance, judging the appearance of the glazing and framing members to confirm installation sequencing, or other specific project goals. Large glass products installed in window and curtain wall applications can be challenging to handle or move. The size and shape of the large glass panels can create challenges during installation that are not always obvious, objective, or measurable. Mockups are especially helpful in these instances because they can be used to align the expectations of visual quality and performance in the presence of all key

stakeholders before installation occurs.

Applicable industry standards should always be followed. Mockups can be used to fill in the gaps and to address concerns not explicitly covered by industry standards. Especially when installing large glass panels, visual mockups are recommended to ensure that the stakeholders agree before the products are installed on the building. Mockups should be considered standard practice, or benchmark targets rather than minimum standards.

After glass has been specified and manufactured, it must be inspected, packaged, transported, unpacked, inspected again, and installed.

INSPECTING LARGE GLASS DURING THE MANUFACTURING PROCESS

Inspection of large glass begins during the

Photo courtesy of the National Glass Association

402 DUNSMUIR



402 Dunsmuir Street in downtown Vancouver is located steps away from the historic Gastown District.

Location: Vancouver, Canada

Architect: B+H Architects Inc.

General Contractor: Ledcor Construction Limited

Glass Manufacturer: Guardian Glass

Glazier: Flynn Group of Companies

Glass Fabricator: Garibaldi Glass

GGII Solutions: Project Management, Design-Assist

GGII Services: Heat Soaked, IGU, Custom

The progressive office building located at 402 Dunsmuir Street in Vancouver, Canada, was customized to be the office for a global tech firm. The building contains spacious loft-style rooms with a large glass exterior that provides daylighting for the open office space inside. This building is close to the historic Gastown District, blending older urban industrial concepts with sleek new designs. This old building was retrofit with large glass panels covering all external walls of the building.

The doors and exterior walls on the first floor at street level are clear, inviting passerby into the space. Glass exteriors of the office spaces on the upper floors utilize reflective glass panels to provide privacy for occupants while they work and to also prevent direct sunlight from falling on occupants and task surfaces which could lead to unwanted glare. By utilizing tints and glazing to provide shading, occupants don't need curtains or blinds, thus allowing the facade to remain sleek and modern.

manufacturing process and continues at all phases of fabrication. Fabrication includes tempering, laminating, and insulating processes; as well as the application of decorative patterns, coatings, and edge treatments.

Distortion is defined as anything that affects the flatness or optical quality of the glass. Distortion may occasionally occur during the heat-treating process as the sheet glass passes over the rollers on the heat-treating furnace.

Modern technology has alleviated many of these concerns, with tolerances being specified during fabrication, and the advancements of software to monitor and manage adjustments in the heat-treating process.

PACKAGING, HANDLING, AND TRANSPORTING LARGE GLASS

After large glass is manufactured and fabricated, it is shipped to the job site. Large glass sheets may require special packaging and equipment to accommodate the weight and dimensions of the glass.

Large glass sheets must be carefully packed and protected to prevent damage during shipment. This includes the use of protective corners, protective film, shipping and separator pads between sheets, and edge protectors.

The larger the sheet glass, the more surface area will be exposed to the elements, both during packaging and transport, as well as during installation and for the life of the product. In addition, the weight of glass

should be considered and what special equipment may be needed to move and install it.

When handling large glass lites on the job site, evaluate the capacity of sling and suction cup frames to be sure they can accommodate the weight of the lites. Check clearances required for boom trucks, as the feet may form a wider base to stabilize heavier loads.

Evaluate site access required for large glass products intended to be installed from the interior of the building to be sure the products can be moved to the proper location for installation. Weight increases significantly as glass products get larger. Equipment needed to lift the weight and size of larger glass products can often require extensive infrastructure and space.

For indoor applications, ensure that large glass sheets can safely pass through all doorways and hallways to where the glass will be installed.

INSTALLING LARGE GLASS

After the final glass product has been manufactured, fabricated, inspected, packaged, and transported, it is ready to be installed.

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Jessica Jarrard is an independent writer and editor focusing on health, science, and technology. She contributes to continuing education courses and publications through Confluence Communications. www.confluencec.com



The National Glass Association (NGA) is the largest trade association serving the architectural glass and metals industry. A technical and educational resource, NGA envisions a future in which glass is the material of choice to enhance spaces where people live, play, learn, and work.