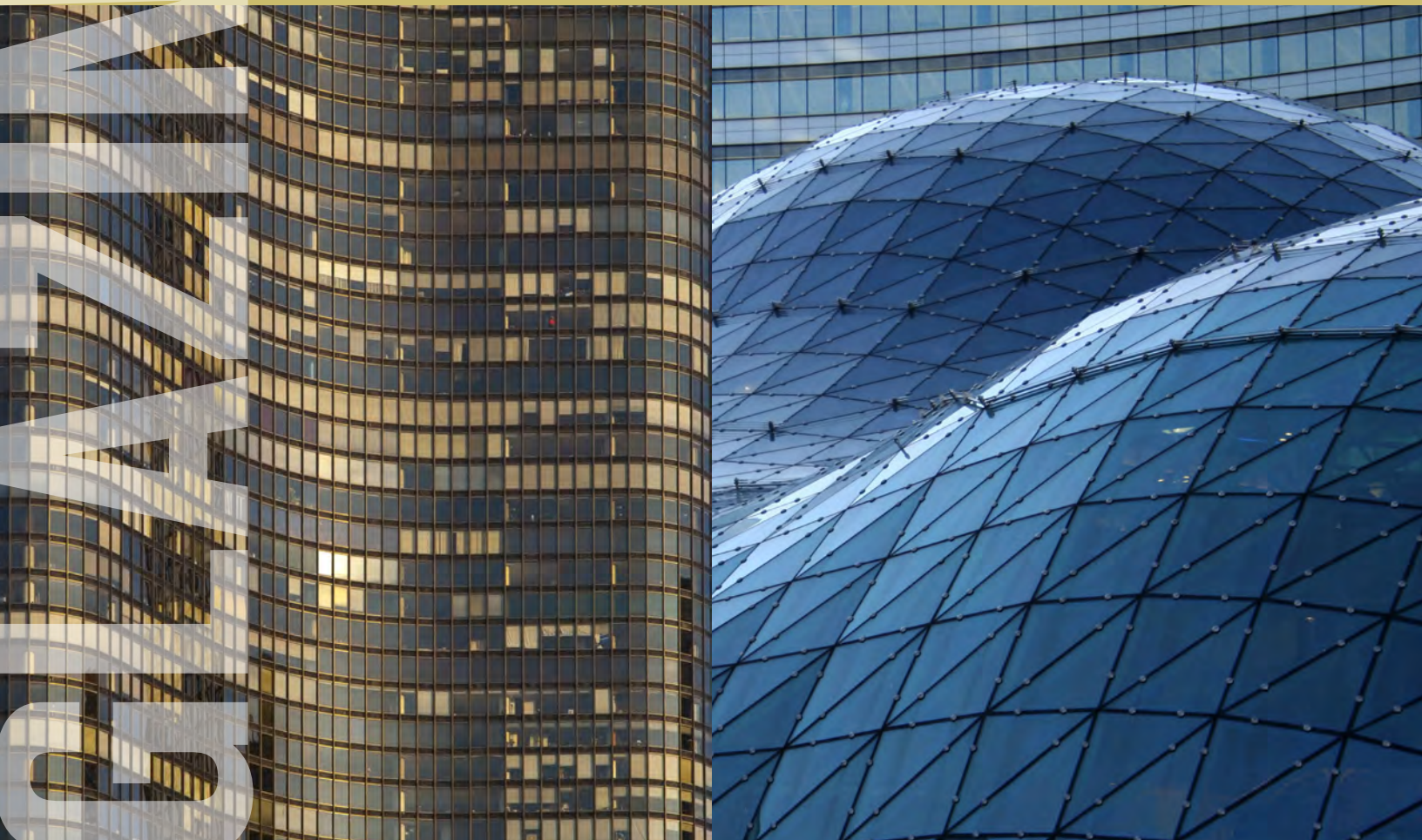




**TREMCO**  
Commercial Sealants & Waterproofing

## COMMERCIAL GLAZING GUIDE



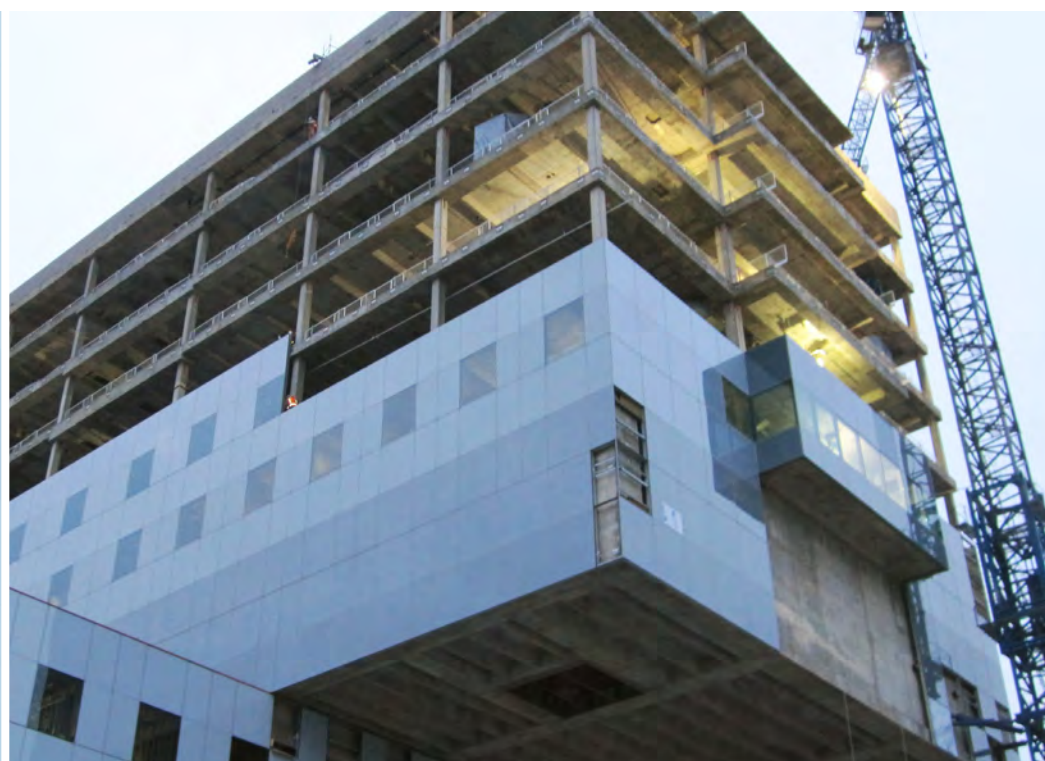


## INTRODUCTION

For more than 85 years, Tremco has been a market leader in the design, development and manufacture of glazing products for use in commercial construction applications. During this time, processes have changed dramatically for window and curtain wall systems. Window units have become larger, higher performing glass is available, and performance standards have increased — all placing a greater demand on the glazing materials used to seal and support the glass to or within the surrounding metal.

As a result, we have continued to evolve, culminating in the development of our Sustainable Building Solutions Test Facility, which is designed for testing connection points in wall assemblies, as well as other building and design challenges facing the built environment. The only single-source supplier offering a complete line of glazing sealants, tapes, and gaskets, Tremco is focused on protecting the entire building envelope and ensuring product compatibility through documented, tested performance. Tremco also supplies compatible perimeter caulking and weatherproofing materials to complement your window or wall system.

The details shown in this document describe available materials and their placement for generic applications and are not intended to reflect the actual design of the window unit or system. We recommend you work closely with your Tremco Representative. These experienced individuals will assist in the selection of the proper glazing materials to suit your application and project specification.



# Integrated Systems Designed for Superior Performance



Tremco CS&W has nearly 50 products certified to GREENGUARD and GREENGUARD Children and Schools criteria.

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# FACTORS INFLUENCING GLAZING PERFORMANCE

**Selecting the proper glazing system for a particular requirement must take into account a number of important factors:**

## Economics

Life cycle costing is being used more and more to determine the total cost over a specified period of time. What may seem to be an economical glazing component in terms of initial costs, may eventually become more expensive should it require frequent (and costly) maintenance, special installation and/or replacement.

In high rise construction, this situation can become particularly acute. The cost of frequent maintenance or replacement is more than the initial cost of installing a higher performance glazing system.

Conversely, the selection of an expensive glazing system may not be necessary on single story structures or buildings that afford protection from the elements. In the final analysis, a careful determination should be made between the glazing system's initial cost and its anticipated service life before a final selection is made.

## Workmanship

Any glazing system, regardless of its initial cost, must be properly installed if it is to achieve its maximum performance capability. The most expensive system, improperly installed, will perform no better than an inexpensive system.

Similarly, the use of an inexpensive system does not justify poor workmanship if the system is expected to properly perform. For example, sealants, regardless of costs, will not bond properly to dirty, damp,

or frost-laden surfaces. Two-component sealants must be uniformly mixed before applying to achieve proper cure. Surfaces to be caulked must be clean, dry, and free from contaminants to ensure a good bond. Glazing tapes must be butted (not overlapped) at corners. Setting blocks, spacer shims and edge blocks should be installed properly when and where they are required. Window washing should not be done until sealant systems have been allowed to fully cure.

It is important to remember that the finest workmanship can never compensate for poorly designed or "light gauge" sash, improperly specified sealant, adverse weather conditions, or damage by trades not directly engaged in the glazing operation.

## Sash and Pocket Dimensions

The design and dimensions of the sash can dramatically affect the ability of the glazing system to properly perform. Specifically, minimum face clearances as recommended by glass manufacturers, or greater as determined by the glazing system requirements. These clearances allow the glazing system to withstand the dynamic forces of shear, tension, and compression. In the case of gunnable sealants, the sealant configuration and the volume of the sealant that are required to be installed are important. A larger volume of sealant (wider face clearance) is better able to absorb and compensate for stresses and strains as compared to smaller volume of sealant.

## Type and Size of Glazing

The larger the lite of glazing, the greater the stresses placed on the glazing system. This is due to movements of the infill in the sash caused by deflection, and

differences in the coefficient of expansion between the infill and the sash.

Particular attention should be directed to sash design and dimensioning, sturdiness of the sash, proper anchorage of the framing members, and the use of a high performance glazing system.

Today's high-performance glass products such as reflective, heat absorbing, insulating and laminated place severe strains on the glazing seals. Heat absorbing glass, for example, transmits higher temperatures to the glazing seal than does clear glass. This may dramatically shorten the service life of lower performance sealants such as oil and solvent based sealants. High-performance glass requires the use of high-performance glazing seals.

## Type of Sash

All types of sash-PVC, steel, aluminum, or wood-are subject

to varying dimensional changes caused by fluctuations in temperature and atmospheric conditions. This imposes a burden on the glazing system in accommodating stresses in tension, shear, and compression while maintaining a positive bond to sash surfaces as well as to the glass or plastic sheet.

Projected, pivoting, sliding, and other operating sash create further demands on the glazing seals due to tracking, distortion, shock and vibration - as compared to non-operating sash. Additional design considerations



**Sash joinery must be properly sealed.**

## Principal Causes of Glazing Failures

- Glazing at temperatures below 40 °F (4 °C)
- Failure to properly seal miter and butt joints
- Glazing pocket not clean or free of contamination
- Lateral shifting ("walking") of glass
- Failure to properly bed, cushion, or center the glass
- Use of glazing system not suited for sash design and performance requirements
- Setting blocks used incorrectly, or not at all
- Frames or surrounds out of plane, out of square, and/or improperly anchored.
- Lack of, or improper use of, spacers or edge blocks
- Insufficient face clearance
- Damage to sash or stops or glazing seals
- Improper pocket depth
- Poor workmanship
- Failure to follow manufacturer's instructions
- Failure to ensure compatibility of glazing components

include, but are not limited to, whether or not the system will be shop glazed, field glazed, or how glass replacement will be handled. All removable glazing stops must be designed to properly support the glass for the required wind load conditions.

#### Weather Conditions

Glazing seals are subject to physical changes caused by variations in both temperature and humidity. When glazing at temperature below 40 °F (4 °C), the sash and infill may be damp or frost-laden, preventing a sealant from attaining a satisfactory bond. Normal curing of sealants is slowed when subjected to low temperatures. Tack-free time is extended, possibly subjecting the sealant to additional dirt pick-up.

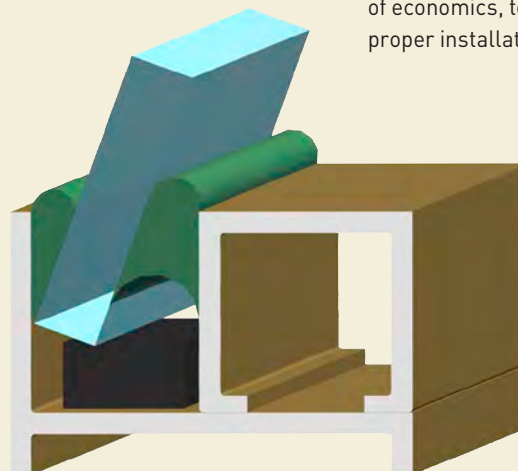
Moisture accumulating in the sash may affect the bond of some sealants. This is particularly true during freeze-thaw cycles or in areas of high humidity or frequent precipitation. Drainage systems are normally employed to effectively address this problem and will be discussed later in this publication.

Moisture accumulating in the sash may affect the bond of some sealants. This is particularly true during freeze-thaw cycles or in areas of high humidity or frequent precipitation. Drainage systems are normally employed to effectively address this problem and will be discussed later in this publication. As energy efficiency becomes a greater factor in the design and performance of windows and curtain walls, material used as thermal breaks become more prominent in these systems.

Thermal breaks provide excellent energy efficiency by resisting condensation and reducing conductivity of heat and cold thru metal systems. Often these thermal breaks possess a certain chemical composition that sealants may not adhere to.

Tremco sealants are commonly used when point or full contact with thermal breaks is required.

In the final analysis, proper glazing is a compromise between the ideal criteria for effective glass support, and the practical considerations of economics, tolerances and proper installation.



Glass to sash contact may result in glass beakage.

PRODUCT	APPLICATION
<b>Spectrem® 1</b>	High moving joints in curtain walls, precast concrete panels, window perimeters, cap beads, and bonding silicone gaskets.
<b>Spectrem® 2</b>	Versatile caulking/glazing sealant for 2-sided structural glazing, cap/heel/toe beads, and window perimeters.
<b>Spectrem® 3</b>	General purpose non-stain caulking for EIFS, curtain walls, and window perimeters.
<b>Spectrem® 4-TS</b>	Field-tintable general purpose non-stain caulking for EIFS, curtain walls and window perimeters
<b>POLYshim® II Tape</b>	Used for compression glazing where a wet seal is required. Incorporates an integral EPDM shim ensuring continuous edge cushioning for glass around its perimeter.
<b>Proglaze®</b>	In-plant glazing applications such as cap bead, glass butt joints and metal-to-metal joinery
<b>Proglaze® II</b>	In-plant 2- and 4-sided structural glazing for unitized curtain walls, blast-mitigation and hurricane-impact glazing.
<b>Proglaze® SSG</b>	2- and 4-sided structural glazing, weather seals, blast-mitigation and hurricane-impact glazing.
<b>Tremsil® 200</b>	Weather tight seal to glass, metal, porcelain, ceramic and most painted surfaces.
<b>Tremsil® 600</b>	In-plant glazing sealant for back-bedding, cap, heal and toe beads, and sash joinery.
<b>Tremco 440 Tape</b>	Used for non-compression glazing of vision lites and spandrel panels in PVC, metal and wood frames in low-rise building construction. Also used for lap sealing between panels.

For architectural specifications, please refer to section 08 8000 on the individual product page located on our website: [www.tremcosealants.com](http://www.tremcosealants.com)

# GUIDELINES FOR PROPER GLAZING

## Glaze Above 40 °F (4 °C)

It is always good practice to glaze above 40 °F (4 °C). Below this temperature condensation and frost can contaminate the surface and interfere with adhesion. If you must glaze in cold temperatures, wipe all surfaces first with a solvent, such as IPA or MEK, then wipe dry, followed by the immediate installation of the glazing product.

## Form a Watershed

Gunnable sealants, when applied as a cap bead, should form a bevel or watershed away from the glazing. When tape is used to the sight line, it should form a watershed when compressed. Do not undercut a sealant, compound, or tape below the sight line. Minimum cap bead depth should be 3/16" (4.8mm). Dry tool and finish sealant as required.

## Achieve Positive Contact

When applying a heel bead, lap onto the glass a minimum of 3/16" (4.76mm) and make certain of positive contact with the sash. When applying a toe bead, whether continuous or as a corner seal, ensure it is large enough to contact both the glazing and the sash. When the sealant is installed prior to setting the glazing, the glazing should be set before the sealant forms a skin.

## Setting Blocks

Setting blocks are generally produced in EPDM, Neoprene and/or Silicone with a Shore A hardness of 80-90 durometer. Check with your glass manufacturer to verify compatibility with the insulated glass edge seal. When used in combination with heel and toe beads, they should be first buttered with sealant, then placed prior to installing glass. This ensures an uninterrupted seal between the glass and sash member.

As a rule, setting blocks should be centered at 1/4 points. However, engineering requirements may dictate an alternate location for block placement. Setting blocks should be designed so as to prevent shifting, provide lifelong

support of the full thickness of the infill, establish minimum recommended bite and edge clearance, allow for the flow of water by the block to the drainage system, and provide for the installation of glazing seals and assembly of the system.

Setting block lengths are determined by the glass square footage. The block length is calculated: 0.1 inch (2.54mm) per square foot (.093m<sup>2</sup>) of glass, but not less than 4 inches (100mm).

## Surface Preparation

Immediately prior to glazing, clean the sash and infill surfaces to receive sealant with IPA, MEK or other approved solvent, then wipe dry, followed by a dry wipe with a clean, lint-free cotton cloth.

## Avoid Glass Damage

Glass should be carefully handled and glazed to avoid edge damage which can occur when units are rotated or "pitched" during positioning. One recommendation is the use of a rolling block to rotate the glass unit. This minimizes possible corner damage by evenly distributing the glass weight along the edges, rather than at the corners.

## Shims and Spacers

Shims and spacers, generally made from EPDM or Silicone, should be used to establish and maintain proper minimum face clearance. Follow glass manufacturer's recommendations for Shore A hardness and spacing requirements. While individual shims are acceptable, a continuous spacer or wedge is preferred. Soft or easily compressible materials such as polyethylene or polyurethane foam should not be used as shims or spacers.

## Tape Compression

Glazing tapes must be kept under proper compression. Depending upon the tape selected, this will vary from 10-50%. Follow tape manufacturers' recommendations.

## Air Seal

When glazing a pressure-equalized system, it is necessary to install an interior air seal, or vapor barrier, around the perimeter of the glazing. This equalizes the pressure in the glazing system, with that of the exterior. This is best accomplished with a continuous bead of compatible gunnable sealant.

## Clearances

Provide for minimum face clearances, edge clearance and glazing bit as recommended by the respective glazing and sealant manufacturers. These clearances allow the glazing to freely float in the opening without undue restriction by the framing members and allows the seals to perform within their designed capabilities.

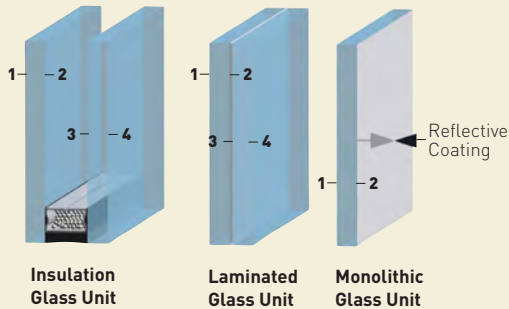
## Drainage Systems

Specific glass manufacturers recommend that when glazing insulating or laminated glass, the sill member should allow for proper drainage to the exterior. Weep holes should be of sufficient size, configuration and placement so as to completely evacuate water from the full length of gutter. Alternate designs have been used to fully evacuate water.

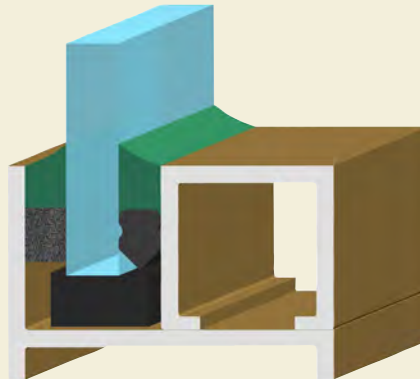
## Tape Installation

Install only that quantity of tape for which glass can be set in the same day. Remove the paper backing from the tape only when the lite is ready to be installed. Do not stretch the tape to make it fit. Do not overlap the ends of the tape. Instead, butt ends together and daub butt ends with compatible sealant to assure a positive seal.

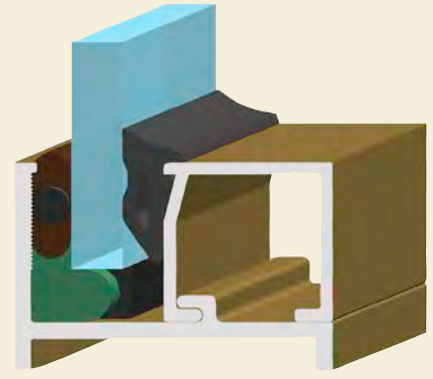
## Types of Glass



Type of glass units and how their surfaces are referenced. (All details are depicted with the exterior always on the left and interior on the right.) Check with Glass Manufacturer for proper handling and storage.



Gunnable sealants, when applied as a cap bead, should form a bevel or watershed away from the glazing.

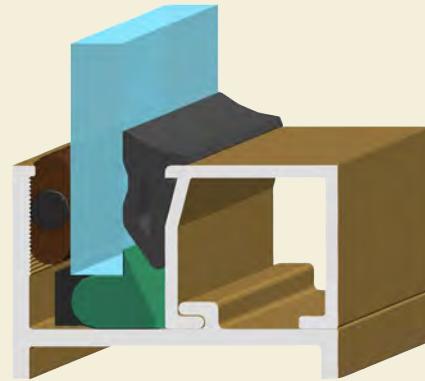


When applying a toe bead, whether continuous or as a corner seal, make certain it is large enough to contact both the glazing and sash.

## Insulating Glass

When glazing insulating glass:

- 1) Prevent water from standing in contact with the edge of the insulating glass. This may be accomplished by incorporating a drainage system in the sash design.
- 2) Provide a long life cushion and seal between the glass and the sash.
- 3) Glazing seals must be compatible with sealants used in the fabrication of the insulating glass assembly. Deviation from these rules may ultimately lead to premature failure of the unit.



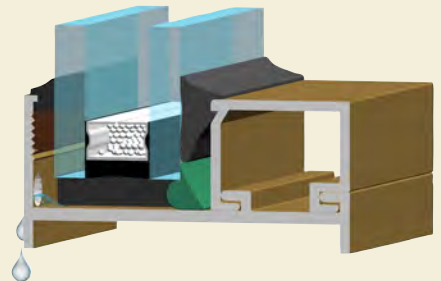
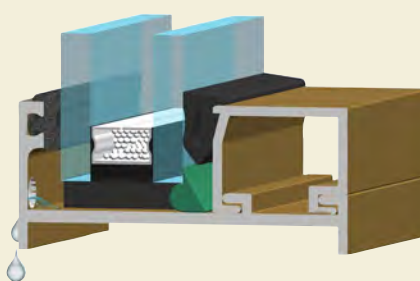
When applying a heel bead, lap onto the glazing a minimum of 3/16" (4.8mm), and make certain of positive contact with the sash.

## Follow Manufacturer's Specifications

Apply glazing materials according to manufacturer's specifications. Use qualified mechanics who specialize in glazing installation. Immediately report any unsatisfactory conditions to the general contractor for resolution before continuing.

## Glazing Mock-up

Conduct an on-site glazing mock-up with the specified glazing components. Use the mock-up area as the "Standard" for workmanship. It is recommended that the glazing system supplier(s) be present during installation and testing of the mock-up.



Provide a long-life cushion and seal between the insulating glass and sash. Pre-extruded tape, curing elastomeric sealant, or high performance compression gaskets are commonly used. When glazing insulated glass, incorporate a weep system in the sash design.

# WET GLAZING

Wet Glazing systems are designed to keep all air and water out of the glazing pocket. These glazing materials require clean substrates and should not be applied/installed below 40 °F (4 °C) for reasons mentioned earlier in this publication.

Spacer materials are designed to properly space the glass from the glazing stop and provide a joint for the application of sealant. We recommend that spacers be used continuously to properly control sealant joints and avoid improper placement of intermittent shims. These can be comprised of a variety of compatible materials from foam tapes to dense spacers. There are many standard sizes available to meet your specific glazing needs.

On large daylight openings, Tremco Technical Services should review face clearance dimension to ensure sealant or butyl tape will accommodate the shear stresses based on thermal movement.

Visit our website at [www.tremcosealants.com](http://www.tremcosealants.com) to learn more about our Glazing Solutions or contact your local Tremco Sales Representative.

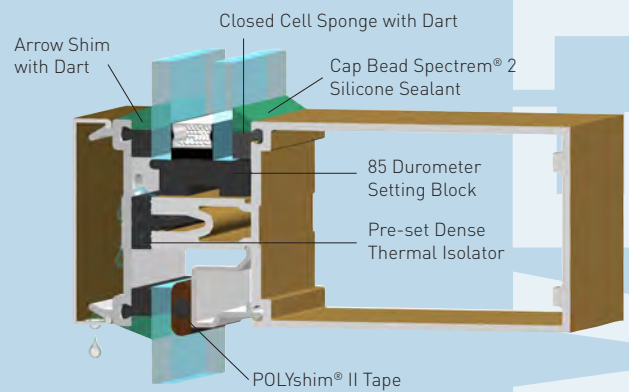
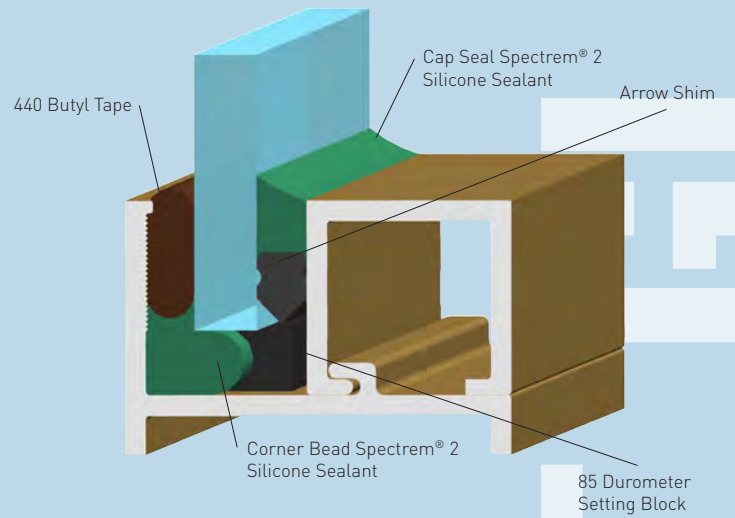
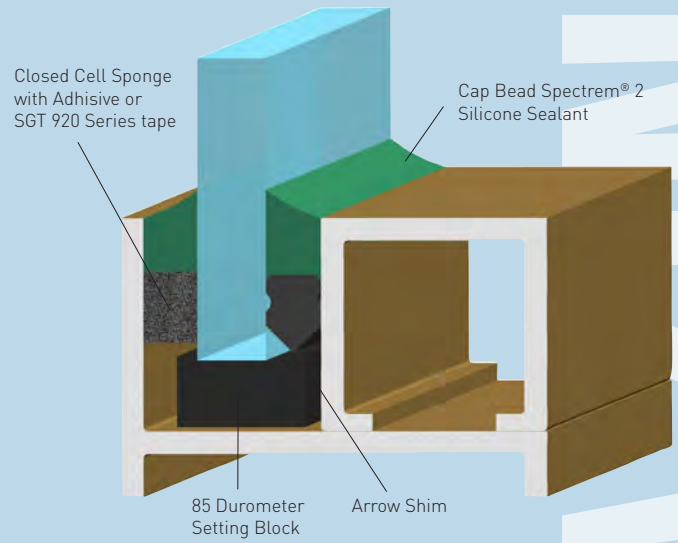
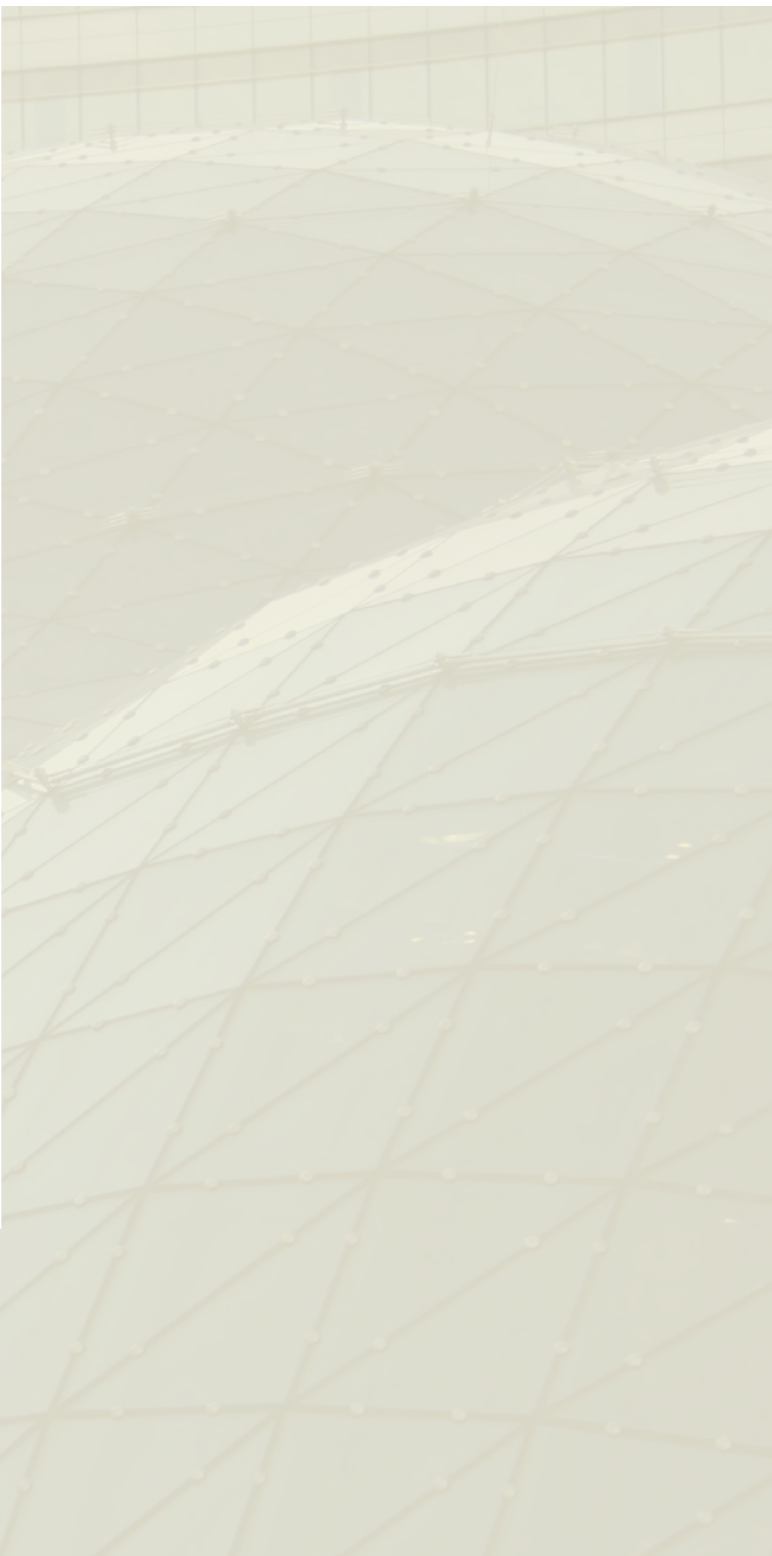


**PROJECT:** W Hotel Dallas, TX

**FABRICATOR:** Win-Con

**GLAZING CONTRACTOR:** Win-Con

**PRODUCTS USED:** Spectrem® 2



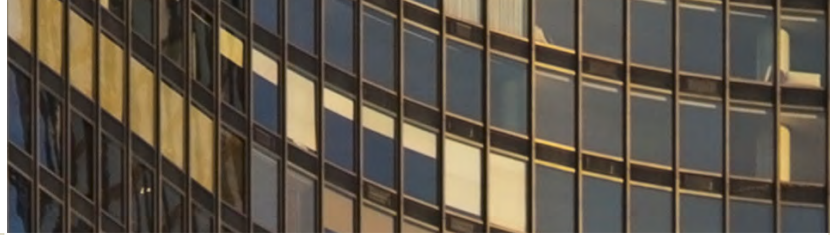
# WET/DRY GLAZING

Wet/Dry Glazing Systems use gunnable sealants or mastic tapes as the primary seal on one surface of the glass and an extruded gasket on the opposing surface. These systems are under compression; however, but their performance is not based upon the compression developed by the components, but by the seal provided by the sealant and/or tape.

Wet/Dry Systems offer the security of a positive seal achieved through the use of a gunnable sealant or tape and the ease of installation of an extruded rubber gasket.

The dense rubber gaskets used in these systems can be either a Tremco standard Poly-Wej, Arrow Shim with Dart, or a custom dense design to fit a specific metal condition. There are many custom designed profiles available for use.

As a single-source supplier, Tremco offers a wide range of fully compatible gunnable sealants, extruded tapes, and standard and custom rubber profiles suitable for use in Wet/Dry Glazing Systems.



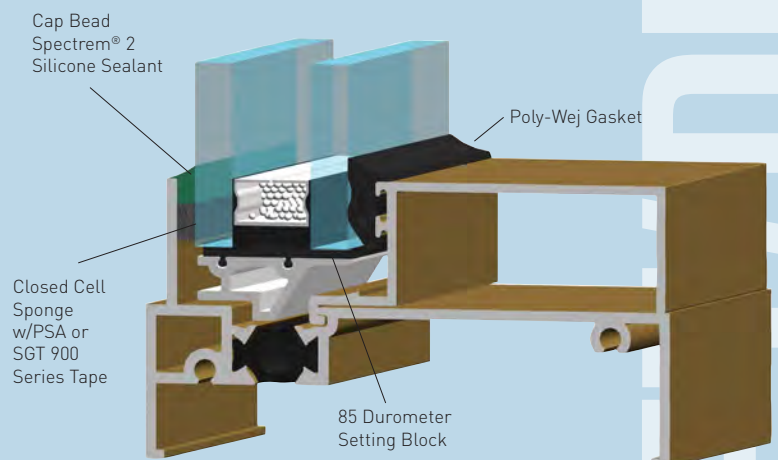
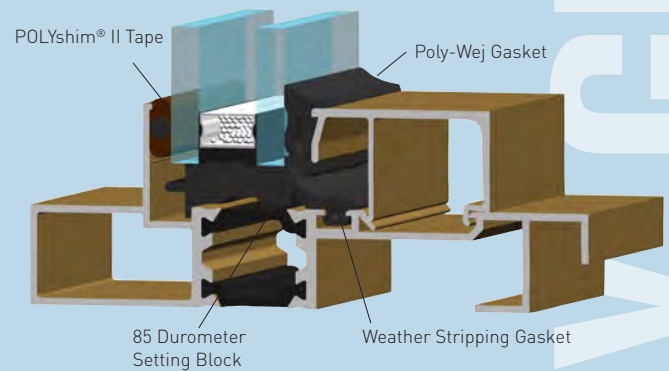
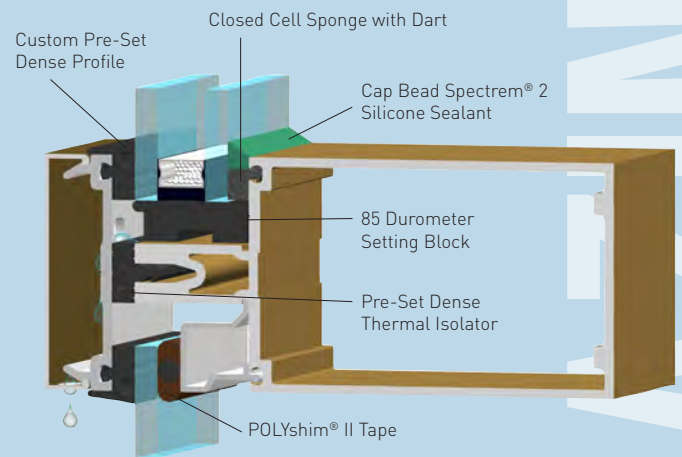


**PROJECT:** The Absolute Towers, Mississauga, Ontario

**FABRICATOR:** Toro Aluminum

**GLAZING CONTRACTOR:** Toro Aluminum

**PRODUCTS USED:** POLYshim® II, Tremsil® 600  
(Heel Bead & Back Pans), 440 Tape (Joinery Tape)



# DRY GLAZING

Dry Glazing is the common designation for systems utilizing preformed rubber gaskets on both sides of the glass as the seal for glass and panels which rely on their compression to provide a seal. The total in-place cost of gasket systems is usually lower than “Wet” or “Wet/Dry” systems.

The ruggedness of Dry Glazing Systems allows for installation under a wide range of environmental and job site conditions. Additionally, rubber gaskets offer ease of installation and afford greater opportunity for consistent workmanship and system performance.

Dry Glazing Systems limit air or water infiltration. Drainage systems and pressure-equalized, designed wall systems control and manage the overall system performance.

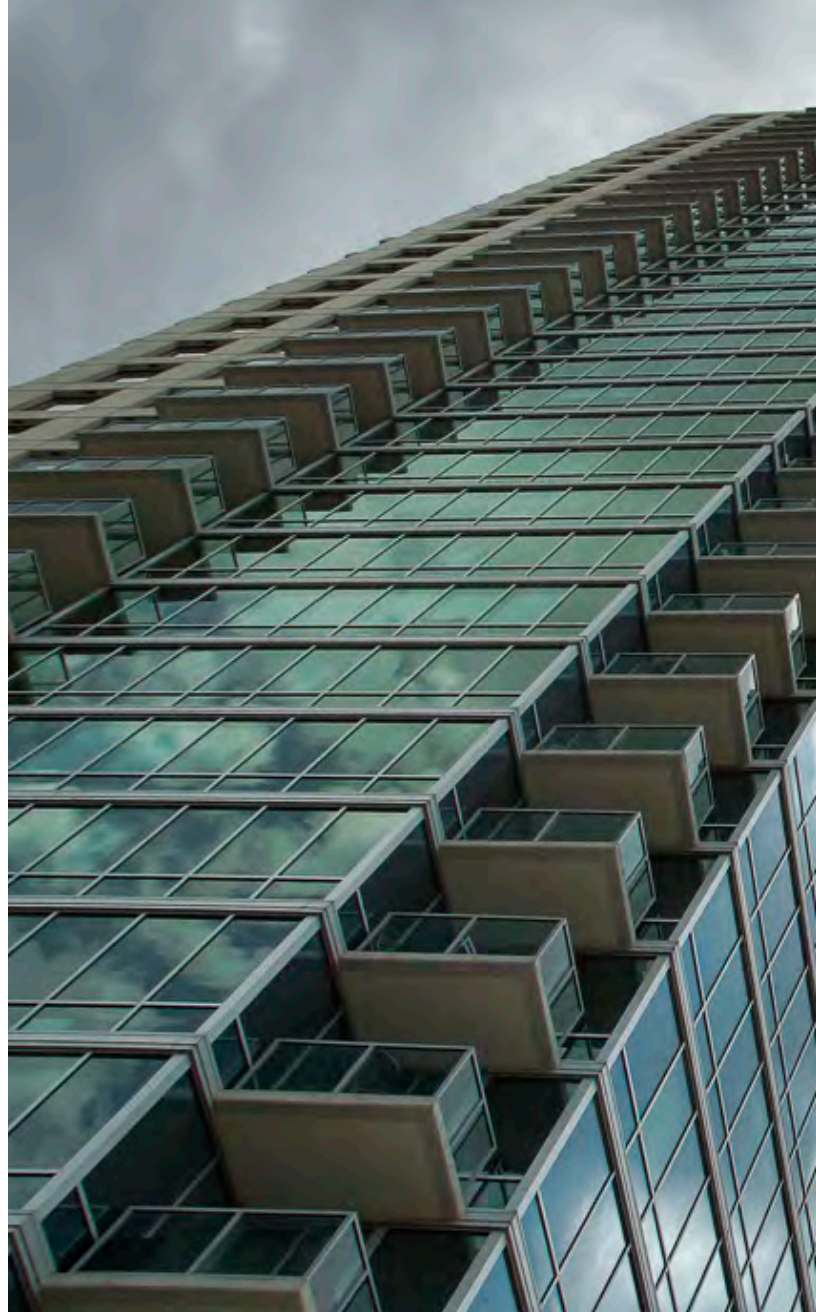
There are principally two types of dry glazing systems: Sponge/Dense and Dense/Dense. Both types of glazing systems perform equally yet have unique advantages for their given application.

A Sponge/Dense System will utilize a pre-set closed cell sponge profile on one side of the glazing pocket, while a dense wedge gasket is installed on the other side, compressing the sponge. Together they properly space and support the glass or panel in the pocket opening.

A Dense/Dense System is comprised of a low durometer (40 to 60) dense pre-set gasket on one side, while a 70 durometer dense wedge gasket is installed on the other side of the infill. Together they properly space and cushion the glass or panel in the glazing pocket.

Both types of glazing systems are available with molded corners. Providing gaskets molded into picture frames minimizes air and water infiltration at the corners and reduces workmanship costs and errors. Picture frame gaskets are custom fabricated to the Day Light Openings (D.L.O.) supplied by the window or wall manufacturer. Proper “Crowd” is added to the gasket’s length to compensate for the gasket’s relaxation which will occur over time.

As a single-source supplier, Tremco offers a full line of standard dense and sponge rubber gaskets, spacers, and setting blocks, in addition to design engineering for custom applications.



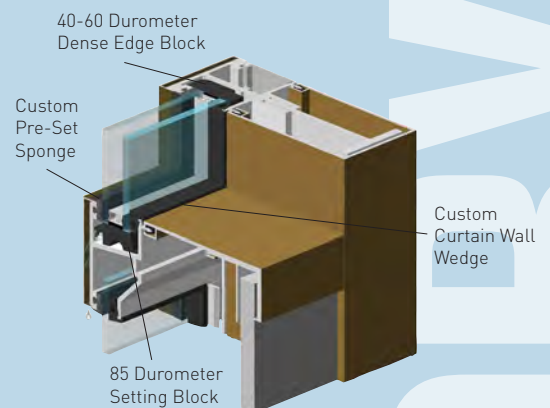
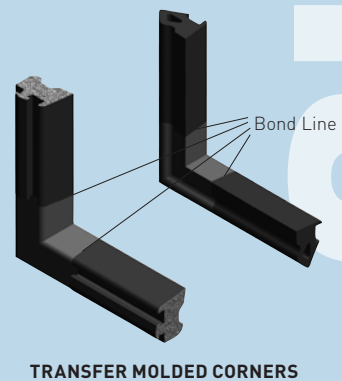
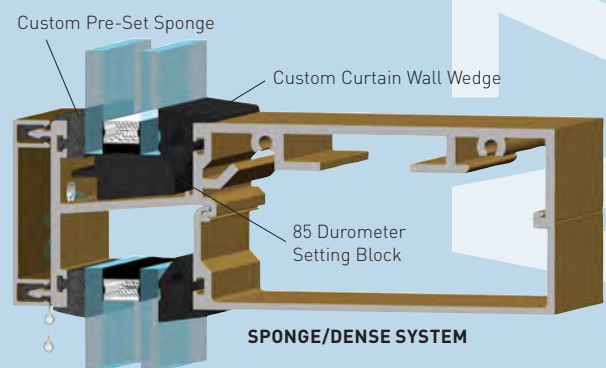
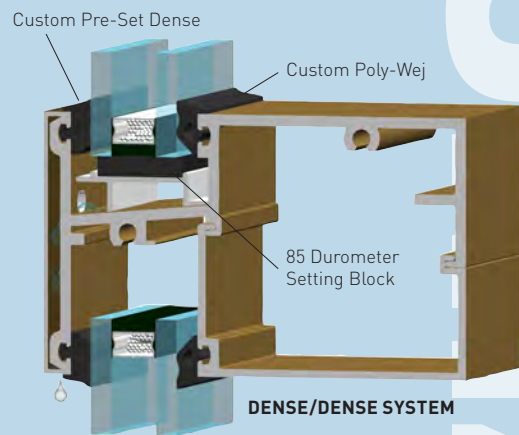


**PROJECT:** Spring Condos Austin, TX

**FABRICATOR:** Win-Con

**GLAZING CONTRACTOR:** Win-Con

**PRODUCTS USED:** Peroxide EPDM Gaskets



# STRUCTURAL SILICONE GLAZING

Structural Silicone Glazing is a system of bonding glass to a curtain wall's structural framing members utilizing a high-strength, high-performance silicone sealant specifically designed and tested for structural glazing applications. The dynamic wind loads are transferred from the glass, through the structural silicone sealant, to the curtain wall framing.

The full line of Tremco structural silicone sealants has been specifically formulated with proven physical properties and adhesion traits to exceed the ever growing demands of structural glazing. You are assured that the unique performance properties of Tremco structural silicone sealants will transfer the required structural loads from the glass to the framing system as well as provide the adhesion, weatherability, durability and total system compatibility that have brought a high level of confidence to Tremco structural glazing systems around the world.

Of primary concern with all structural glazing systems is component compatibility. Tremco's unique position as a full-line supplier gives us the ability to provide all the glazing components, e.g., spacers, setting blocks, gaskets and sealants, for a given glazing system. This assures compatibility and enhances longevity for the system. Certain glazing gaskets and spacers have proven to be chemically "incompatible" and may result in not only "staining," but also may cause a loss of silicone adhesion to the glass and metal surfaces. Long-term success depends on all products co-existing and being compatible with each other.

Tremco is a recognized market leader in total system compatibility essential to structural silicone glazing applications.

Tremco requires review of project details and adhesion/compatibility testing of all structural components. Drawing and samples should be forwarded to Tremco Technical Services for approval prior to initiation of work.

## Performance Factors

- Design Windload (PSF, N/m<sup>2</sup>, KPa)
- Glass Size
- Performance Criteria
- Framing Design
- Tensile Bead Sizing
- Substrate Finishes
- Substrate Preparation
- System Compatibility

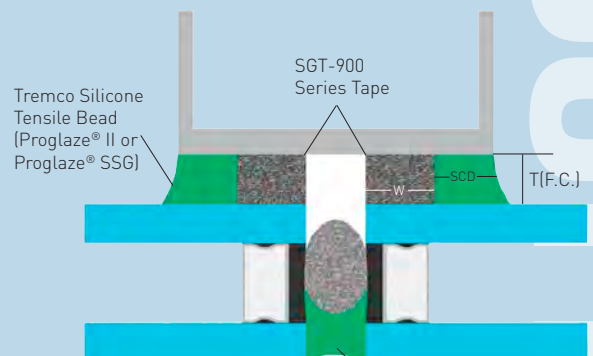
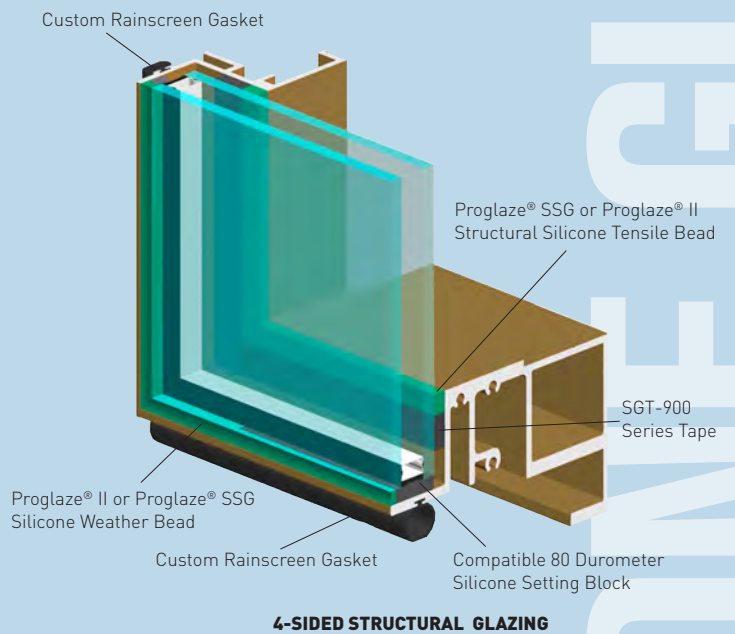
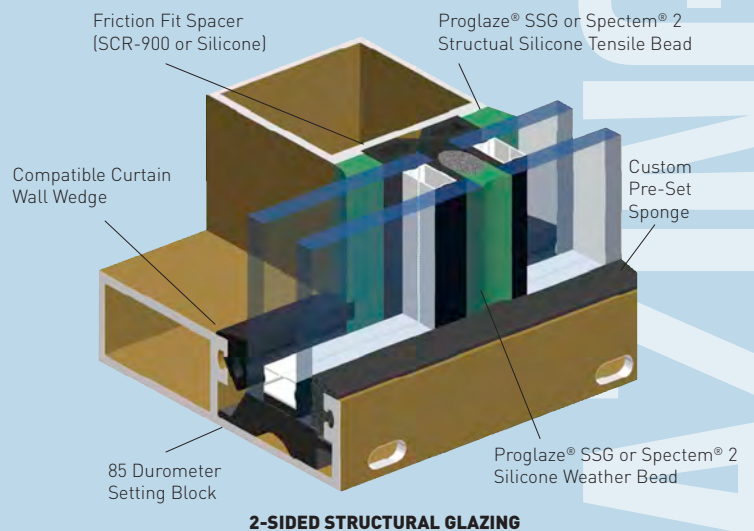




**PROJECT:** Parkland Hospital, TX

**GLAZING CONTRACTOR:** Win-Con

**PRODUCTS USED:** Proglaze® II, Spectrem® 2 and Tremco gaskets



T = Sealant/Tape Thickness 1/4" min [6.35mm]  
 SCD = Surface Contact Depth 1/4" min [6.36mm]  
 W = Width of Tape (Adhesive side)  
 F.C. = Face Clearance

# SLOPED GLAZING

Glazing conditions 15 degrees or more off vertical are considered sloped applications and must be treated differently than typical vertical glazing applications. Consideration must be given to the weight of the glass or panel on the interior gasket and its ability to properly support this weight. Non-shim tapes and sponge gaskets should not be used on the interior because the dead load of the glass or panel may over-compress the glazing material.

Special design considerations must be given to the exterior framing systems, if used, so as not to allow water to pond on gaskets or sealants.

System design must accommodate drainage of condensation and water infiltration.

As a single-source supplier, Tremco offers a complete line of Wet, Wet/Dry, Dry, and Structural Silicone Glazing components which meet the performance demands of sloped glazed systems imparted by the dead load of the glass, live loads (snow, wind, rain) and the intense exposure to heat and U.V. due to the inclination of the wall.



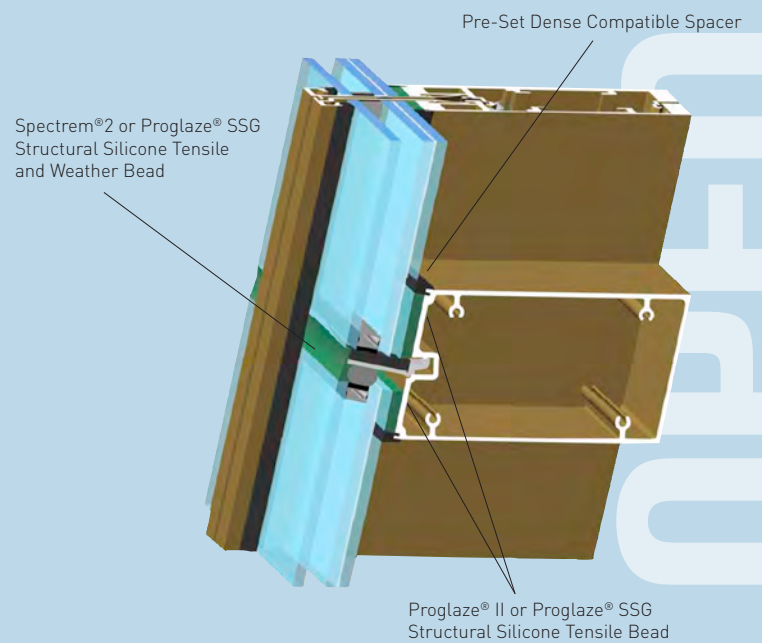
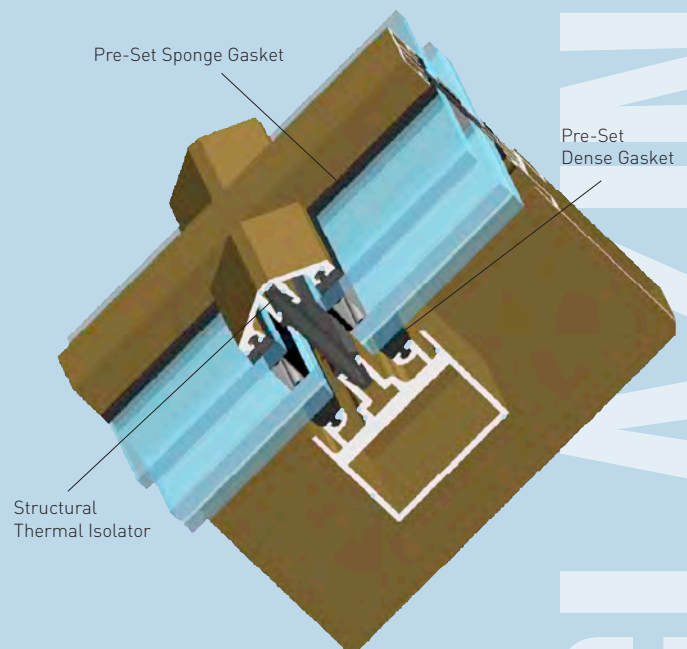
**PROJECT:** 25<sup>TH</sup> Sheppard Avenue West Toronto, Ontario

**FABRICATOR:** AFG

**GLAZING CONTRACTOR:** AFG

**PRODUCTS USED:** Proglaze® II, Spectrem® 2, EPDM gaskets, POLYshim® II tape





# PLASTIC GLAZING

When glazing acrylic or polycarbonate sheets, special considerations are required. Sealants must be compatible with each other and with the type of plastic glazing sheet used. Some sealants used with glass may not be used with plastic. Contact the specific manufacturers for recommendations.

Building exteriors are subject to wide temperature changes that can exceed 100 °F (38 °C). Plastics experience approximately eight times more thermal expansion and contraction than glass, which places a greater demand on the glazing components.

Sash designs suited for glass are not necessarily suited for glazing plastics. As the size of the plastic sheet approaches 72" (1,829mm), the required bite on the plastic sheet increases over what the glass bite is on the same pocket opening. The sealant and/or tape thickness (face clearance) is increased to accommodate the greater shear movement.

These recommendations should be followed for glazing plastic:

- Sash designs must allow the plastic sheet the freedom to expand and contract without restraint.
- Allow sufficient pocket depth so thermal contraction of the plastic will not cause withdrawal of the light from the frame.
- Avoid through-bolting or other inflexible fasteners, which do not allow for expansion and contraction of the sheet.
- It may be permissible to set the sheet on the bottom of the sill member. However, it may be necessary to use setting blocks with pressure equalized systems and weep systems.
- Use compatible sealant compounds, tapes and gaskets, which will accommodate thermal expansion and contraction.

As a single-source supplier, Tremco offers a variety of custom Wet, Wet/Dry or Dry Glazing Systems to meet the demands associated with glazing plastic sheet.

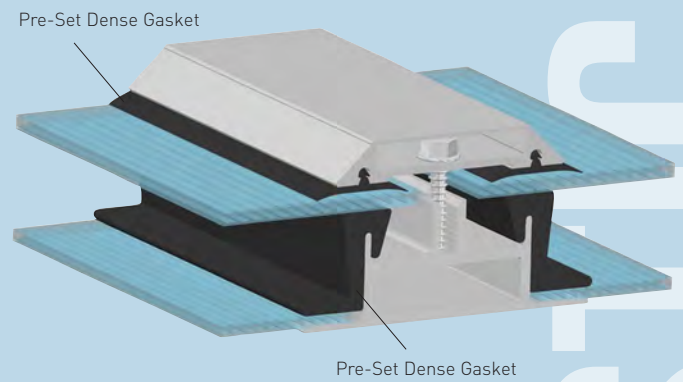
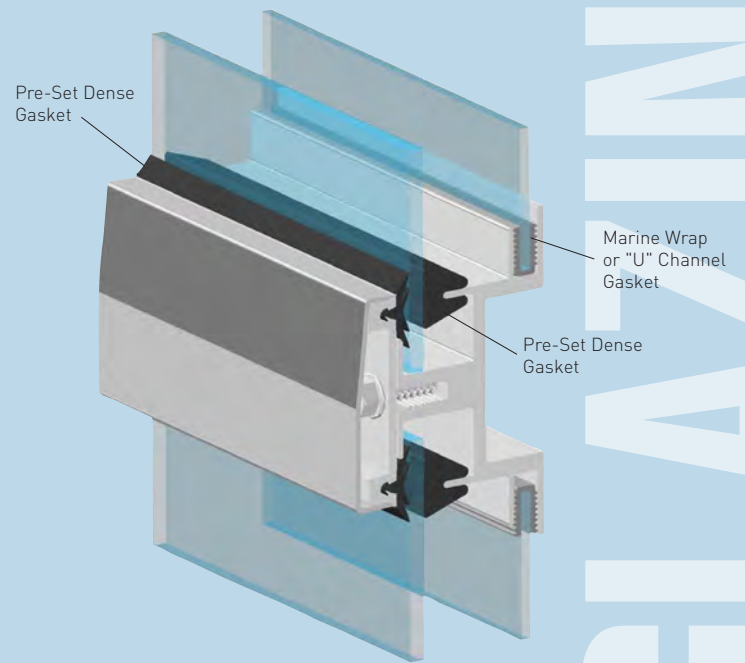


**PROJECT:** Marin County Civic Center

**GLAZING CONTRACTOR:** Best Roofing & Waterproofing

**PRODUCTS USED:** Spectrem® 1





# PROTECTIVE GLAZING

Hurricanes, tornadoes and other natural disasters require that window and/or wall systems incorporate special design considerations to provide additional protection. Windborne and man-made explosive debris may result in flying glass, which may cause massive injuries for occupants and those in surrounding areas. The attachment of glass to the framing system is typically the most critical factor in the performance of the entire window system. A protective glazing system using Tremco glazing materials is critical to providing an added level of security to help counter these natural or man-made threats.

For a system to withstand these types of conditions, all components within the glazing pocket must be designed as a complete and unified system, including the structural framing system, anchors, laminated glass, protective films, gaskets, sealants, butyl and/or foam tapes. Compatibility of these components is critical to ensure there is no loss of adhesion to the glass and metal surfaces over time. Tremco ensures this total compatibility by providing gaskets, structural silicone sealants, and spacer tapes used in protective glazing.

There are two basic types of protective glazing assemblies – Wet Glazed and Dry Glazed.

In a Wet Glazed assembly, Tremco Structural Silicone Sealants such as Proglaze® SSG can connect the edge of the security film to the interior surface of a window frame when retrofitting a current window with a film application. Under blast conditions, the film retains glass fragments in a single sheet that is suspended in the frame by the sealant. The surface contact depth of the silicone sealant onto the frame and film surface are critical for proper performance, typically a minimum 3/4 inch surface contact.

For new construction, the wet seal is used the same as any conventional sealant bead, depending on the design of the glazing system. If installed properly, wet anchoring systems can both meet performance requirements and be cost-effective.

Depending on the level of security required, dry glazing can also be an ideal solution. Instead of PVB (polyvinyl butyral) interlayers requiring an adhesive structural bond to hold the glass within the opening during the required cyclical tests, it relies on rigid, structural glazing interlayers to provide windload transfer from the glazing infill to the supporting frame. Dry glazing uses gaskets to support the glass to the supporting structure. Dry glazing with a structural glass laminate can provide sufficient stiffness post-breakage to ensure extremely high windload design performance.

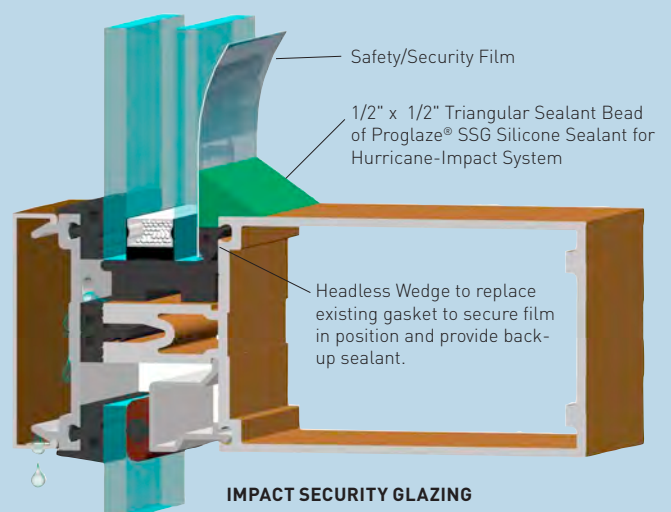
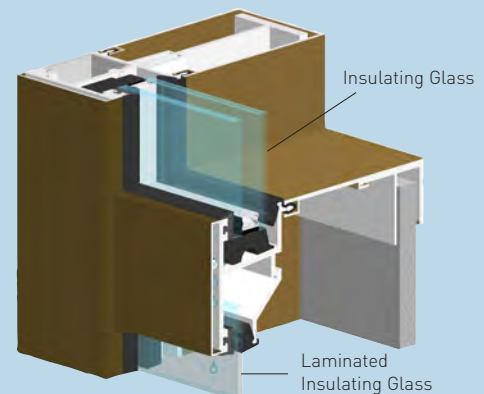


**PROJECT:** Southwest Regional Airport, Fort Myers, FL

**FABRICATOR:** BCIndustries, Inc.

**GLAZING CONTRACTOR:** BCIndustries, Inc.

**PRODUCTS USED:** Proglaze® II Structural Sealant, Spectrem® 1 Ultra-Low Modulus Silicone Joint Sealant



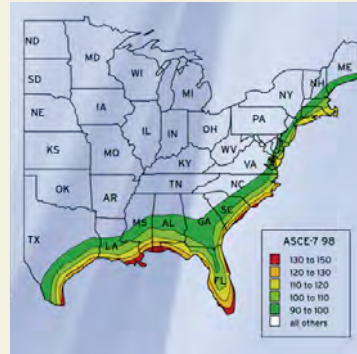
# HURRICANE/IMPACT RESISTANT SYSTEMS

The damage to a building envelope from extreme wind-induced pressures and windborne debris that accompany these winds can be devastating. Building codes have been created to protect the public from natural hazards and poor quality construction. Codes continue to evolve as technology in the building industry advances. It is important to understand these codes and the test methods required to meet the standards. For a comprehensive and current list of building codes, test methods and technical information related to protective glazing systems, visit Solutia's (protective interlayer manufacturer) website at [keepsafemax.com](http://keepsafemax.com).

For hurricane impact requirements, Tremco has worked with some of the leading fabricators in North America to design glazing systems that are critical to withstand wind cycle loads and missile impacts. Proglaze® SSG, Proglaze® II and Spectrem® 2 along with compatible Tremco gaskets have been tested and have either met or exceeded the standards enforced by Miami-Dade County. Tremco glazing products have been listed in a multitude of NOA's (Notice of Acceptance), which are issued by the Building Code Compliance Office of Miami-Dade County.

## Blast Mitigation

Hazard mitigating windows are designed to reduce the hazards associated with breaking windows by controlling the mode and type of failure. Windows generally represent the weak link in a structural protective envelope and typically produce the majority of injuries when damaged in bombing events.



The ASCE-7-98 Wind Zone Map (Minimum Design Loads for Buildings and Other Structures) shown at left reflects the coastal states that are impacted by Windborne Debris (WBD) protection. WBD protection is part of the International Building Code and requires window systems, not the glass alone, to endure large and small missile impact followed by cyclic pressure testing (ASTM E 1886 and ASTM E 1996).

The minimum criteria needed to specify a blast-resistant window system is:

- Window size/shape
- Performance level/level of protection/condition required
- Peak pressure (psi)
- Load duration (msec) or impulse (psi-msec)

Tremco Structural Silicone Sealants, gaskets, and tapes have been tested (closed arena blast testing, shock tube testing, or finite element analysis) and are part of many blast-resistant buildings today. Contact your local Tremco Sales Representative for assistance related to glazing materials in your blast-resistant projects.

Although there are other standards for protection published by the Department of Defense, Department of State, and ASTM, the GSA/ISC criteria is the most widely recognized classification for design levels for glazing hazard protection.

## GSA/ISC Performance Conditions for Window System Response

PERFORMANCE CONDITION	PROTECTION LEVEL	HAZARD LEVEL	DESCRIPTION OF WINDOW GLAZING RESPONSE
1	Safe	None	Glazing does not break. No visible damage to glazing or frame.
2	Very High	None	Glazing cracks but is retained by the frame. Dusting or very small fragments near sill or on floor is acceptable.
3a	Very High	Very Low	Glazing cracks. Fragments enter space and land on floor no further than 3.3 feet from the window.
3b	High	Low	Glazing cracks. Fragments enter space and land on floor no further than 10 feet from the window.
4	Medium	Medium	Glazing cracks. Fragments enter space and land on floor and impact a vertical witness panel at a distance of no more than 10 feet from the window at a height no greater than two feet above the floor.
5	Low	High	Glazing cracks and window system fails catastrophically. Fragments enter space and land on floor and impact a vertical witness panel at a distance of no more than 10 feet from the window at a height greater than two feet above the floor.

Table represents the GSA Performance Conditions for Window System Response used to rate the performance of window systems subjected to air blast-loads.

# RESTORATION

All building materials will deteriorate over time. The life of the building envelope is dependent upon the ability to recognize and address early indicators of deterioration. When glazing components fail due to deterioration that occurs over long periods of time, building owners and property managers need long-term solutions that could be implemented quickly without major disruption or exorbitant costs. In most cases, evacuating the building is not an option, so re-glazing/restoration must be done on-site with the building occupied instead of disassembling and replacing the window system.

Every project is unique, requiring a thorough analysis of existing conditions and a customized solution. Custom gaskets have been developed by Tremco's Design Engineers to go over or bridge existing gaskets for a "like new" appearance. In addition to allowing the building to remain occupied during restoration, a well designed silicone gasket and sealant solution offers several key advantages:

- Offers a clean sight line compared to a wet seal using elastomeric sealant.
- Can minimize or eliminate the removal of existing sealant; eliminating a labor-intensive step in the repair process.
- Installation can often be performed from the exterior without glass removal.
- All the various glazing configurations on a building can be addressed with custom extrusions and preformed shapes.

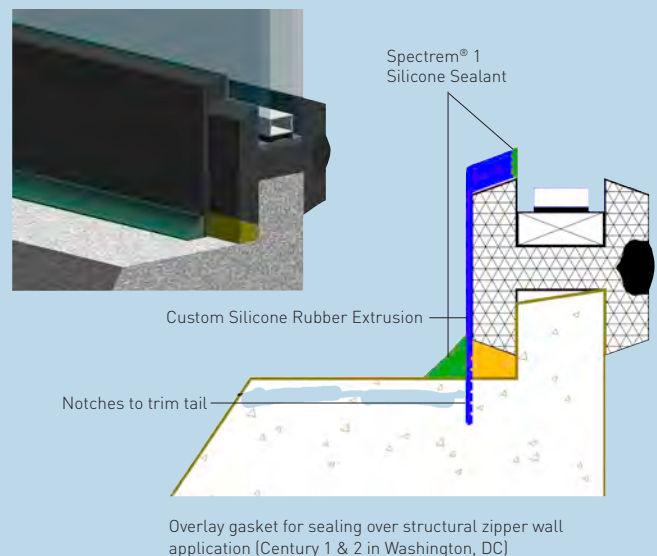
It is always recommended that the building owner or facilities manager have a good maintenance program in place to periodically examine the integrity of the glazing system as it ages.



**PROJECT:** Low Memorial Library, Columbia University, NY, NY

**GLAZING CONTRACTOR:** David Shuldiner, Inc.

**TREMCO PRODUCTS:** Tremco's SGT-921 Double-Sided Foam Tape, Spectrem® 2 Medium Modulus Silicone Sealant, Tremco Custom Color Silicone Extrusion



# REGLAZING CURTAIN WALL AND WINDOW SYSTEMS

Gaskets used to seal and cushion the glass in a window or wall system will not usually last as long as the glass and metal. Their replacement interval will vary depending on the types of rubber compounds used and their exposure, as well as how they were originally installed. Drainage and pressure-equalization are designed into dry-glazed systems to control and manage the overall system performance. The occurrence of leakage may require restoration measures to address failing gasketing or internal seals that were omitted or improperly installed.

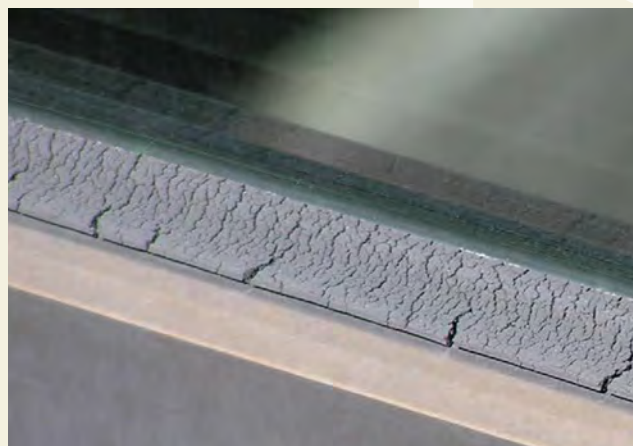
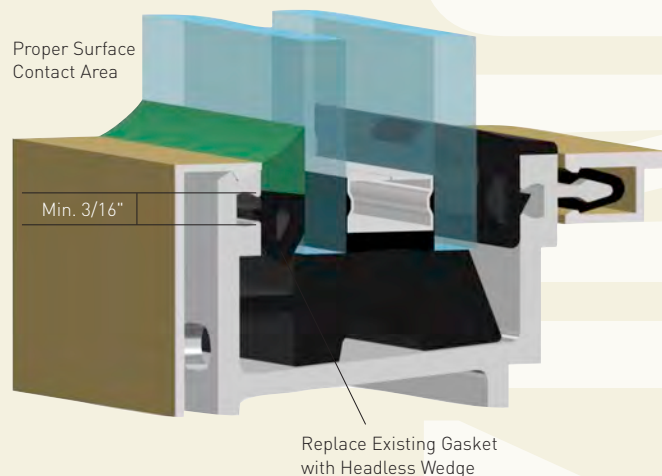
Important steps toward designing effective remedy to leakage include:

- Thorough investigation of the window/wall system to determine how the system was erected
- Determination of internal seal condition
- Determination of condition of flashing and interfacing of building components

Tremco Headless Wedges and Arrow Shims are available for reglazing applications where a cap bead of Tremco's Spectrem® 1 or Spectrem® 2 silicone sealant will be applied on the exterior of the façade to prevent infiltration of air and water. Tremco Headless Wedges are designed and selected to key into the metal race and provide the proper bonding surface areas of the silicone sealant to the metal and the glass. They can be used for re-sealing exterior set pressure bar systems, exterior set curtain wall system, and interior set curtain wall system.

Tremco Headless Wedges are available in various compound options and sizes to provide the proper gasket compression and support, compatibility with silicone cap bead, while providing the required bonding surfaces for the sealant.

Tremco Design Engineers are familiar with the many curtain wall systems in existence today. They are available to provide the proper recommendations for your re-glazing applications.

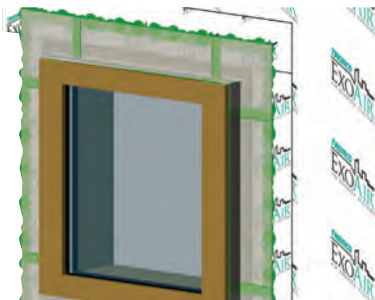


Exterior gasket cracking and degrading from environmental exposure.

# PROTECTION THAT DOESN'T STOP AT THE GLAZING ASSEMBLY...

Preventing air and moisture infiltration at the transitions from window or curtain wall assembly to the wall assembly is critical to the long-term life of a building. Any breakdown in the assemblage could allow warm air to enter the building and condense in the wall cavity, leading to deterioration of the building envelope components and increased energy consumption and negatively impacting the indoor air quality.

The best way to protect a building is by making sure there is connectivity from foundation to roof. Tremco strives to produce compatible products that provide high-performance connections for the high-performance building.



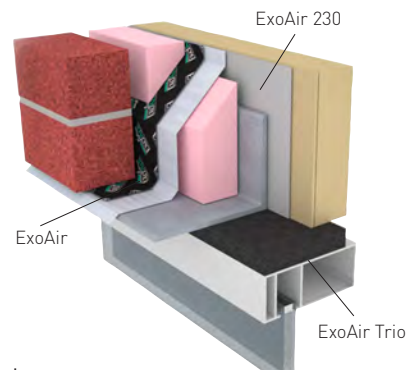
Proglaze® ETA Engineered Transition Assembly from Tremco provides a patented and PROVEN solution that ensures a long-

term, durable connection able to withstand the differences in air pressure on both sides of the wall and allow greater movement. Designed for installation in the shop or in the field, Proglaze ETA provides a turnkey solution which eliminates involvement by

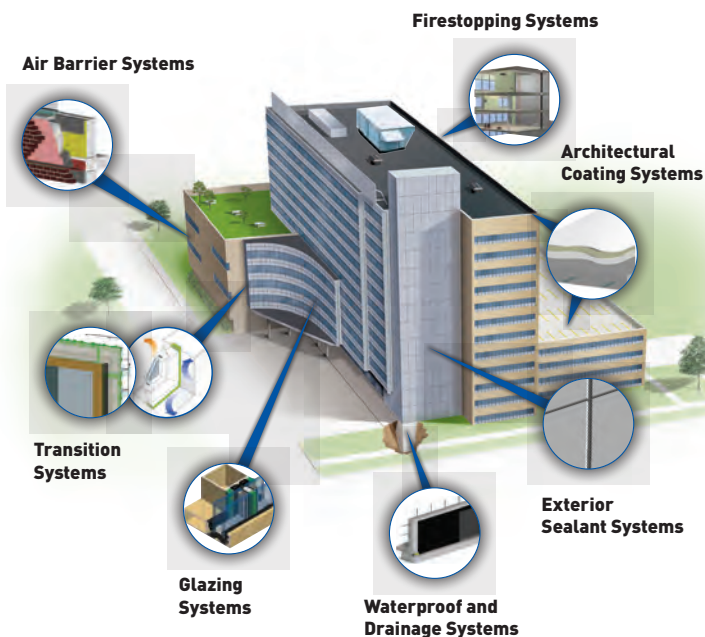
a variety of contractors, applicator variations and ensures greater control and efficiency during the construction process. Lower floors of the structure may even be erected, sealed off and waterproofed, allowing interior buildouts to begin sooner.

Available in three different system designs, along with a myriad of options within the Proglaze ETA Connections line, as well as 3-D molded corners, Tremco is able to complement the high performing window and curtain wall glazing assembly with the highest performance connectivity solutions in the industry. When Proglaze ETA is used in conjunction with Tremco's ExoAir® Air Barrier Systems, the long-term continuity of the building envelope can be assured and backed by the industry's only performance warranty against air and moisture infiltration at the window-to-wall interface.

Tremco is able to take connectivity a step further with "T3" design technology. Using ExoAir® Trio or combinations of ExoAir® Duo, ExoAir® Eco, ExoAir® LEF (Low Expansion Foam) and Tremco sealants, it is now possible to manage air leakage and moisture infiltration and provide a thermal component between the window/curtain wall and wall assembly.



## Protection throughout the TOTAL BUILDING ENVELOPE...



From the foundation to the roof, Tremco offers comprehensive building envelope protection by providing compatible products and systems coupled with single-source accountability. Tremco also provides knowledgeable company representatives, in most major markets, across the country to help analyze job requirements, ensure proper product selection, conduct appropriate tests and provide on-site assistance.

For more information, please visit our web site at [www.tremcosealants.com](http://www.tremcosealants.com)

**TREMCO**  
Commercial Sealants & Waterproofing