TOM BROWN INC

Specialty Tape Products

A User's Guide to Glazing Tapes

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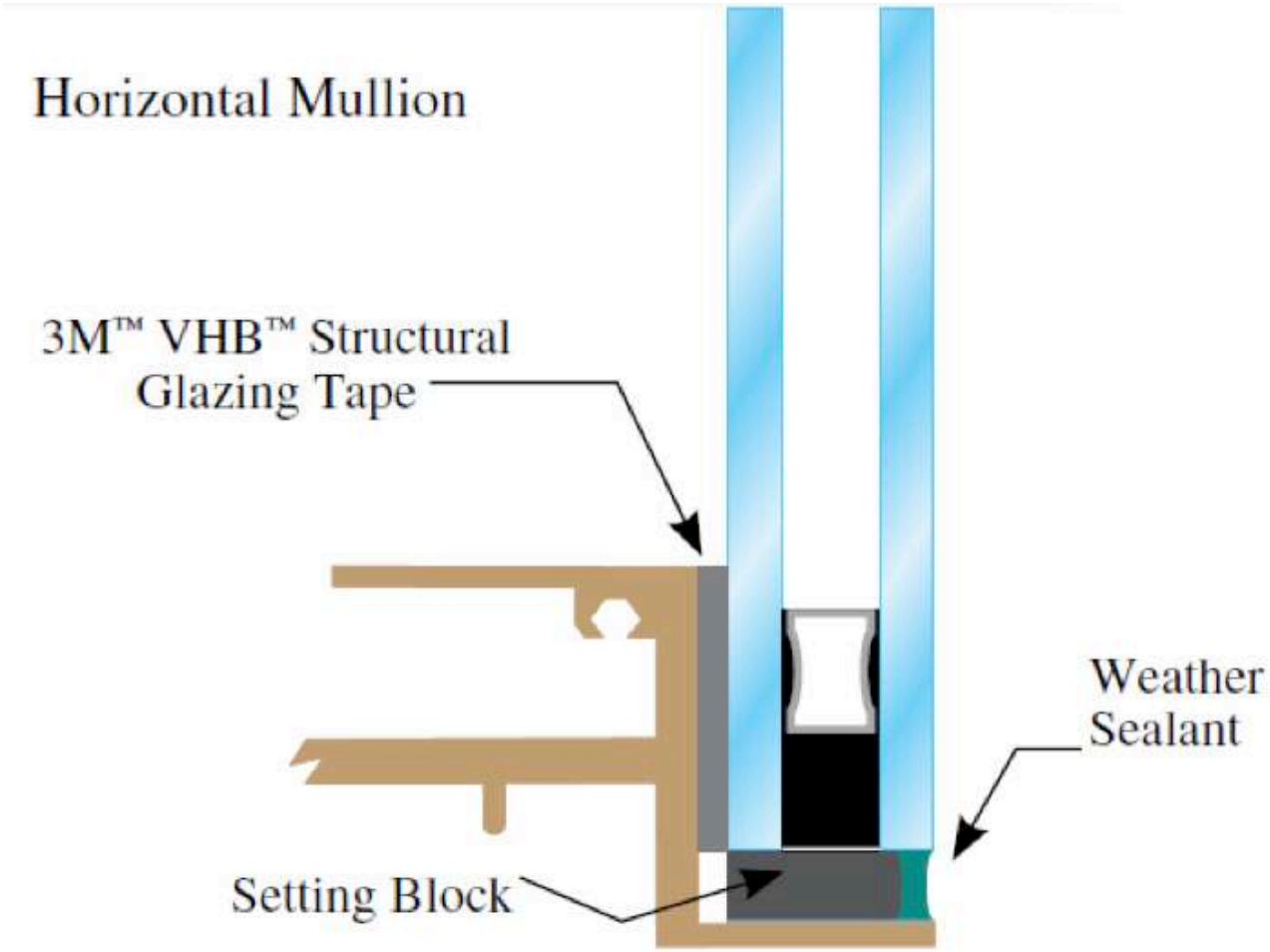
The term “glazing tape” is frequently used throughout the residential and commercial window industry but it can mean very different types of products to different users. In the following pages, we will present the most critical information necessary to understand how each type of glazing tape works for various commercial and residential applications, the typical physical properties, and the associated benefits a user can realize.

Structural Glazing Tapes

If you're in the curtain wall or window wall segment, the “glazing tape” you refer to could be a “structural glazing tape". This type of tape uses a high strength, monolithic, foamed acrylic adhesive system that can bond an insulated glass unit into a metal framing system. The acrylic foam is very viscoelastic and gives high elongation properties allowing it to effectively handle the varying loads of wind and weather.

3M is the premier provider of structural glazing tapes with their B23F (black) and G23F (gray) products.



3M™ VHB™ Structural Glazing Tape

G23F and B23F

3M™ VHB™ Structural Glazing Tape is a closed cell, double-sided acrylic foam tape that has the capability to develop very high bond strength and excellent long term holding power when bonded to a glass and metal framework.

It was developed to replace structural silicone sealants in structurally glazed curtain wall and window wall systems and commercial window units.

Construction:

Adhesive: High Performance Acrylic

Adhesive Carrier: Conformable Acrylic Closed Cell Foam

Thickness: 2.3 mm (0.090 in)

Density: 720 kg/m3 (45 lb/ft3)

Tape Color: Gray (G23F) or Black (B23F)

Liner: 0.125 mm (0.005 in) Red Polyethylene Film

Performance Properties:

The following technical information and data should be considered representative and should not be used for specification purposes.

1. Peel Adhesion: 440 N/100 mm (25 lb/in width,stainless steel, ASTM D 3330)
2. Normal Tensile: 480 kPa (70 lb/in, aluminum T-block, ASTM D 897)
3. Dynamic Overlap Shear: 450 kPa (65 lb/in^2,stainless steel, ASTM D 1002)

Adhesion Promoters

Glass Adhesion Promoters: 3M™ Silane Glass Treatment AP115

Silane coupling agents are required when bonding 3M™ VHB™ Structural Glazing Tape to an uncoated glass surface. Glass is known to be a hydrophilic (water loving) surface and this characteristic makes the acrylic adhesive bond susceptible to change under high humidity conditions or when exposed to moisture.

Simple surface treatment with a silane coupling agent diluted in a mixture of alcohol and water can help to reduce the “water loving” nature of the glass and enhance the tape bond in high moisture environments. 3M has tested silane coupling agents and has found 3-Glycidoxypropyl trimethoxysilane resin (Dow Corning Z-6040 Silane) to provide the best performance for this application.

Adhesion Promoters for Glazing Profiles:

3M™ Primer 94

3M™ Primer 94 is a one-part solvent based primer. It can be used to promote adhesion of 3M™ VHB™ Structural Glazing Tape to metal frames especially when the frame has been painted. This primer may also be required on glass when a reflective or opacifying coating is present on the interior side of a glass panel. The 3M Technical Service will help you determine if a primer is needed to achieve high bond strength of the tape to a metal frame or reflective coated glass.

3M™ Adhesion Promoter 111

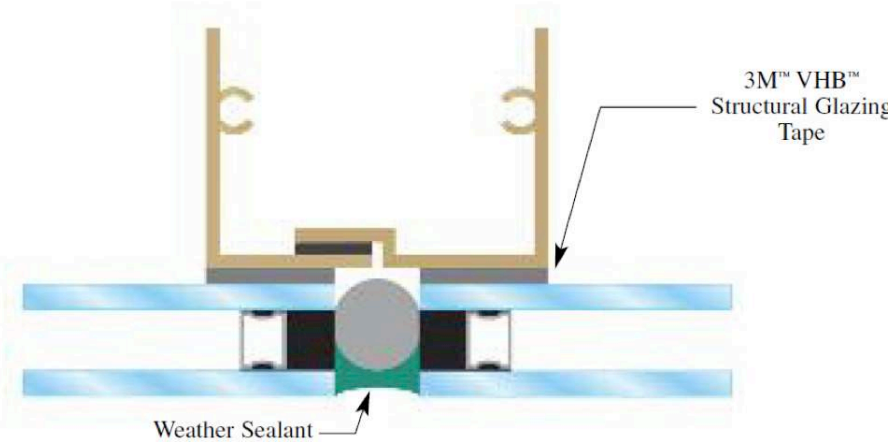
3M™ Adhesion Promoter 111 (AP 111) is an isopropyl alcohol based solution used to promote adhesion of 3M™ VHB™ Structural Glazing Tapes to metal frames especially when the frame has been coated with polyvinylidene fluoride (PVDF) based paints. A 3M Technical Service will help you determine if an adhesion promoter is needed to achieve high bond strength of this type of metal frame.

Technical Service

All 3M™ VHB™ Structural Glazing Tape projects require a thorough application assessment by 3M's structural glazing tape partner, Project Vision Dynamics, (www.ProjectVisionDynamics.com) and 3M Technical Service prior to the initiation of each project. Project Vision Dynamics provides an easy to use online portal to facilitate the review process.

Samples of the glass and lineal must be submitted along with drawings and project description information via the Project Vision Dynamics internet portal. Each project must be tested, reviewed, and approved by Project Vision Dynamics and 3M before the 3M™ VHB™ Structural Glazing Tape can be used on a project and a warranty provided.

3M issues an "SOP" (standard operating procedure) for each project and on-site training on exact installation procedure is provided for all fabrication personnel.



Vertical Mullion

Key Benefits

If the proper procedures are followed, the benefits of using structural glazing tape are many.

They include:

More efficient processing:

- Immediate handling strength-no cure time, faster through-put and unit delivery
- No mixing or curing or liquid adhesives-reduce process variable and risk
- Less than 5% waste- more accurate cost forecasting
- Reduced labor costs-no silicone testing, fewer process steps, no equipment maintenance

Improved appearance:

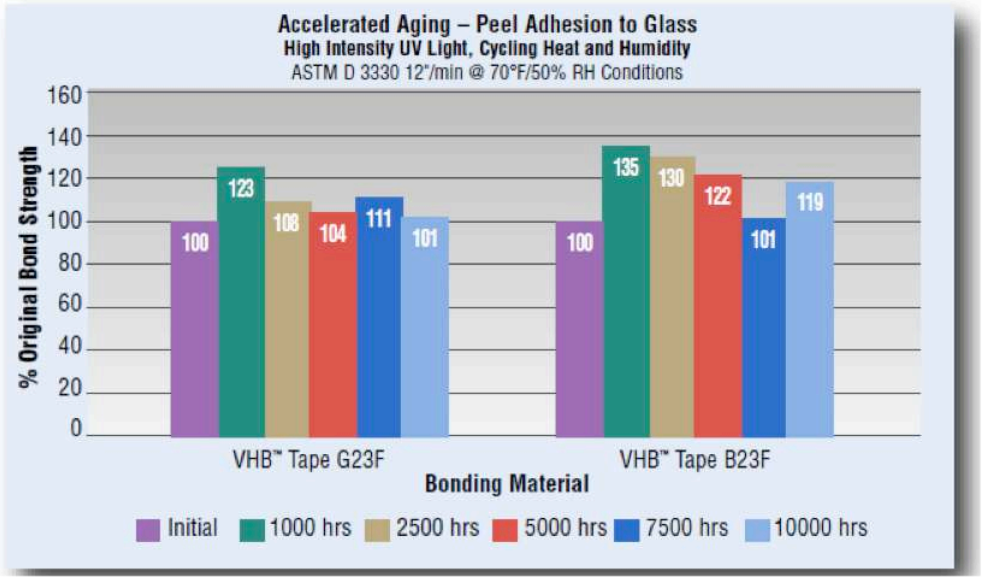
- No color mismatch and no streaking or voids
- Clean look from the interior side of the glass
- Consistent thickness and width

Reliable quality:

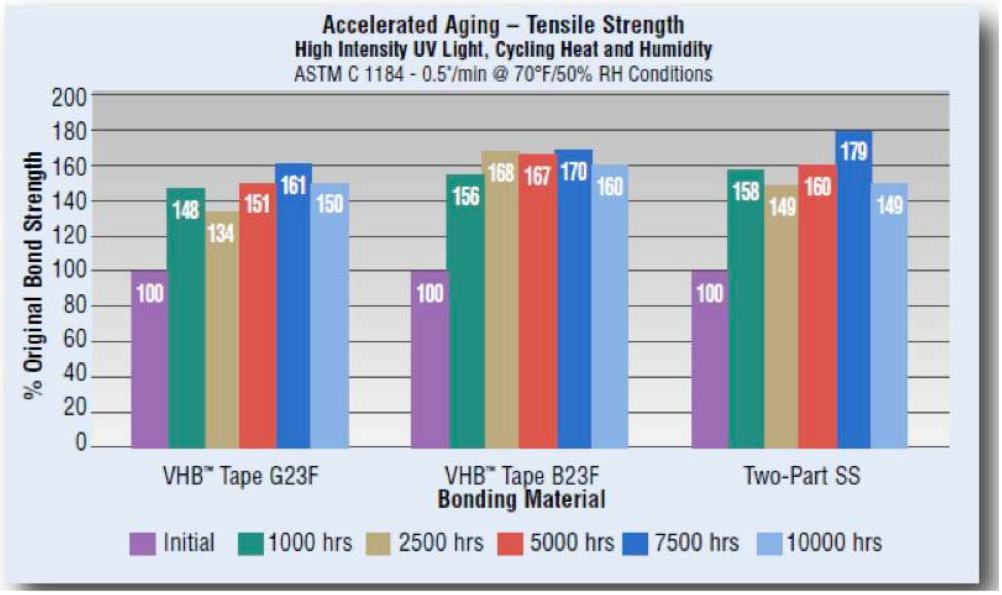
- Proven technology- used in construction applications since the early 1980's
- In process non-destructive testing-ability to test all panels without deglazing

The Proof is in the Performance

Accelerated aging was conducted at the 3M Weathering Resource Center in St Paul, MN, with exposure up to 10,000 hours. The objective of this test was to compare the durability and performance of 3M™ VHB™ Structural Glazing Tape to a two-part structural silicone sealant. The exposure used a 3M p roprietary test condition that has been found to be a good predictor of service durability and generally better than typical industry tests. Exposure was under high intensity UV light (Xenon Arc) with cycling heat and humidity. 3M™ VHB™ Structural Glazing Tapes G23F and B23F were bonded between glass and metal (black anodized aluminum) with UV exposure through 6 mm (0.25 in) clear float glass. Test configuration was 25 mm x 25 mm (1 in x 1 in) tensile (ASTM D897) and 25 mm (1 in) width peel mode (ASTM D3330). The same sample configuration was used for the two-part structural silicone sealant except the sealant thickness which was 9.5 mm (0.375 in). The peel test was only conducted on the tape samples.



A dynamic wind load acting on a curtain wall panel is best represented by a tensile strength test. The following graph compares the original tensile strength to that after different levels of exposure up to 10,000 hours.

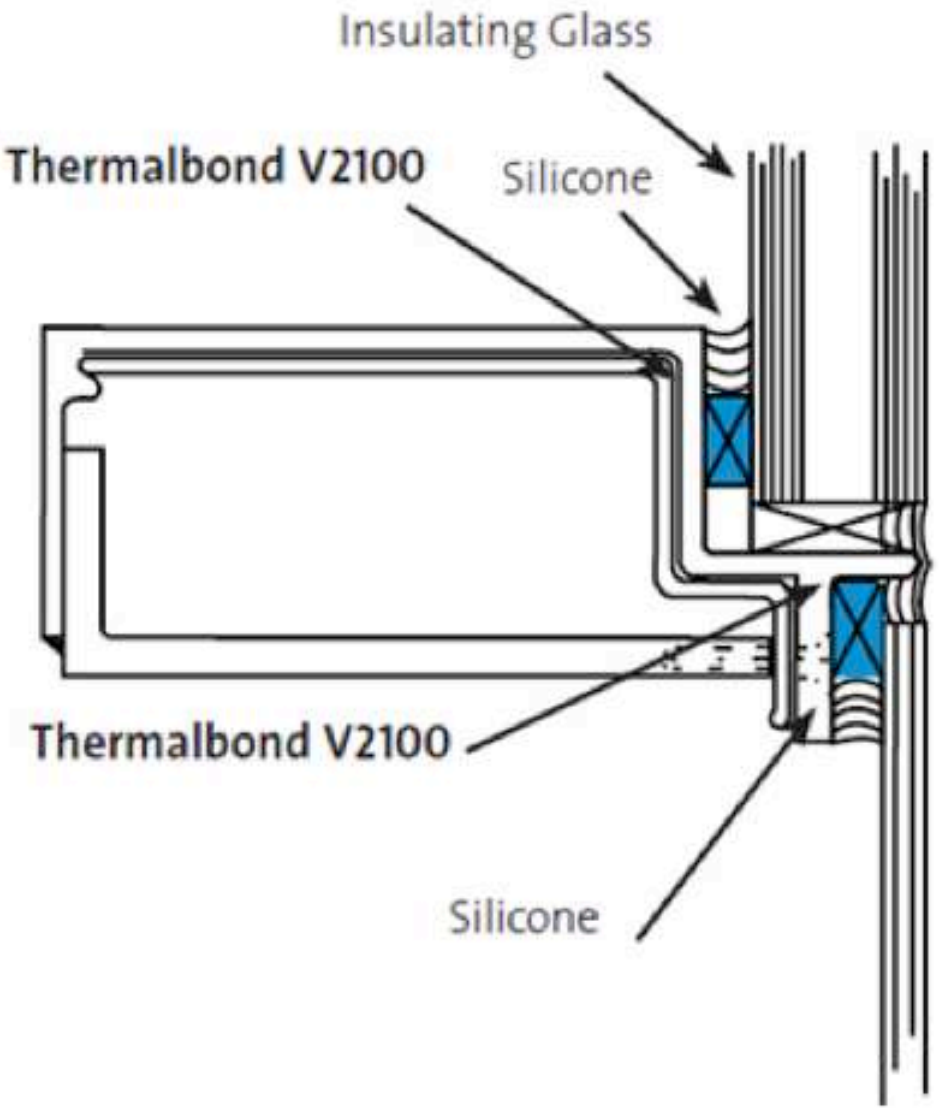


The 3M™ VHB™ Structural Glazing Tapes performance in tensile and peel is relatively unchanged after 10,000 hours of extreme exposure to high intensity UV light (Xenon Arc) with cycling heat and humidity. According to the 3M service life predictability model for this test, there is a 50% chance that this 10,000 hour exposure in the 3M proprietary cycle is at least as harsh as 28 years in Miami, 29.6 years in Phoenix and 54.2 years in Minnesota, and 50% chance that the exposure is less harsh.

Structural Spacer Tapes

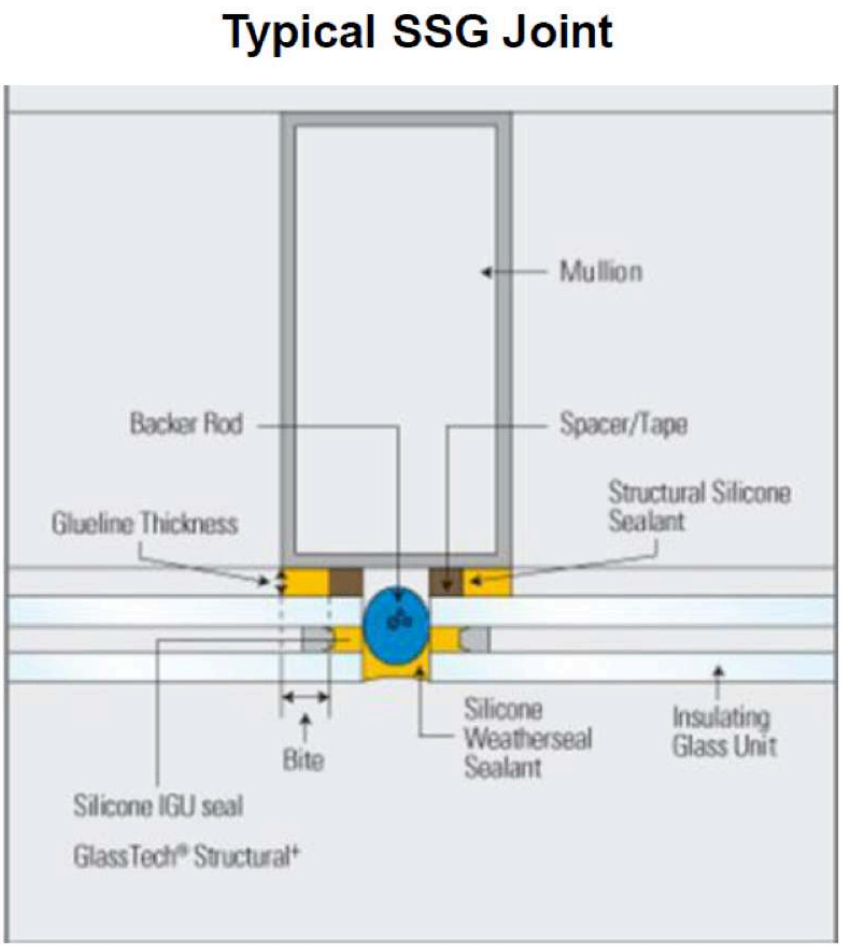
If you are a commercial glazier or fabricator making or installing storefronts, low rise office buildings, and schools, the "glazing tape" you refer to in many cases might also be called a "spacer tape" or "structural glazing spacer". This tape relies upon a semi-rigid, open cell polyurethane foam core that allows air and moisture to reach the structural silicone sealant that is the primary system bonding the glass unit in place. The open cell structure allows the silicone to cure and reach maximum bond strength. This is an example where tape and sealant work hand in hand to deliver the best of both worlds.

The premier manufacturer of structural glazing spacer tapes is Saint Gobain. Their Thermalbond® V2100 and V220 series are the proven performers for shop and field glazing applications.

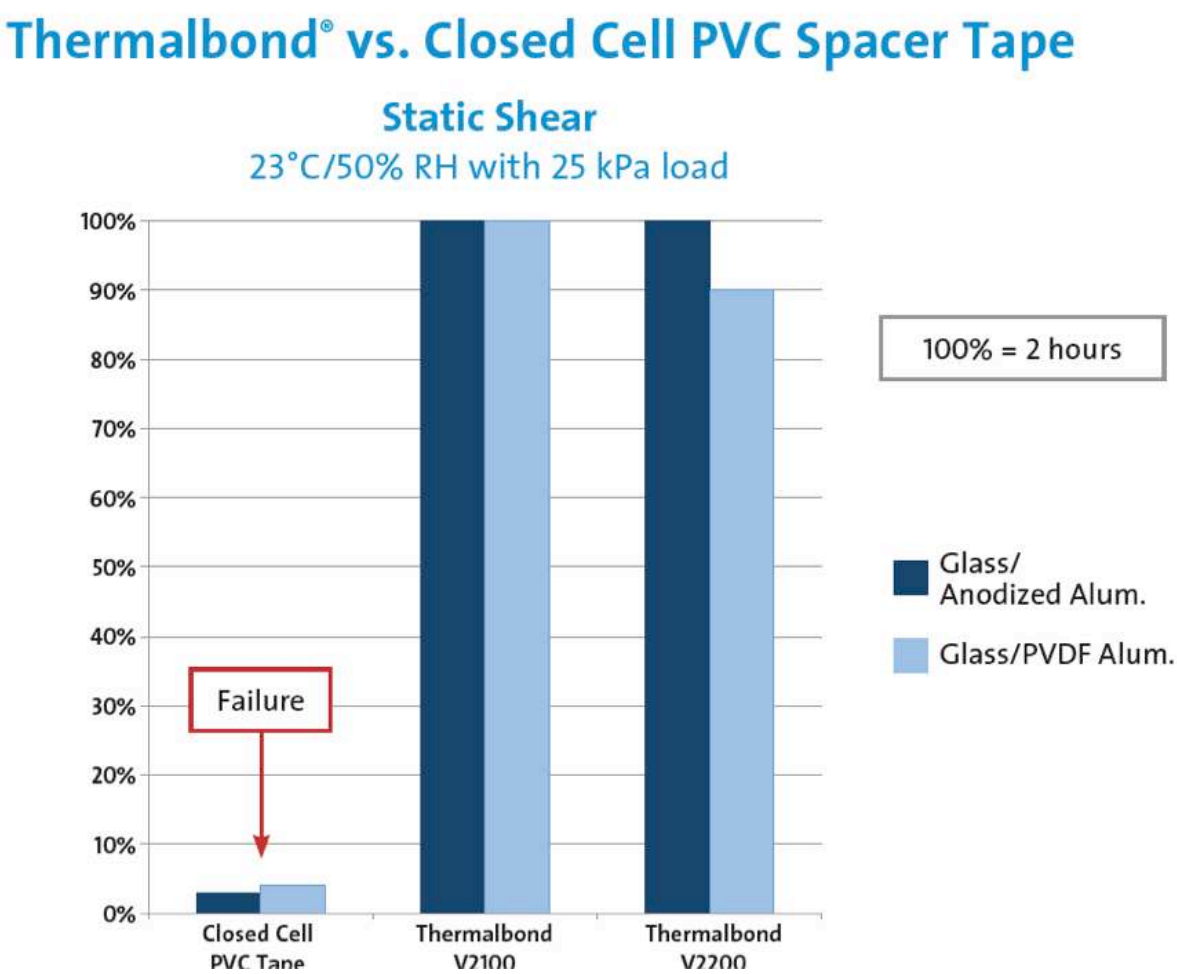


How Spacer Tapes Work

Structural Silicone Glazed (SSG) façade systems depend on the performance of the structural silicone to ensure the glass remains fixed in the aluminum or steel substructure for the life of the building. While the structural silicone holds the load, the adjoining spacer tape is critical in the system for several reasons, primarily to ensure no movement of the glass occurs during the silicone curing period as this could result in compromised bond strength.

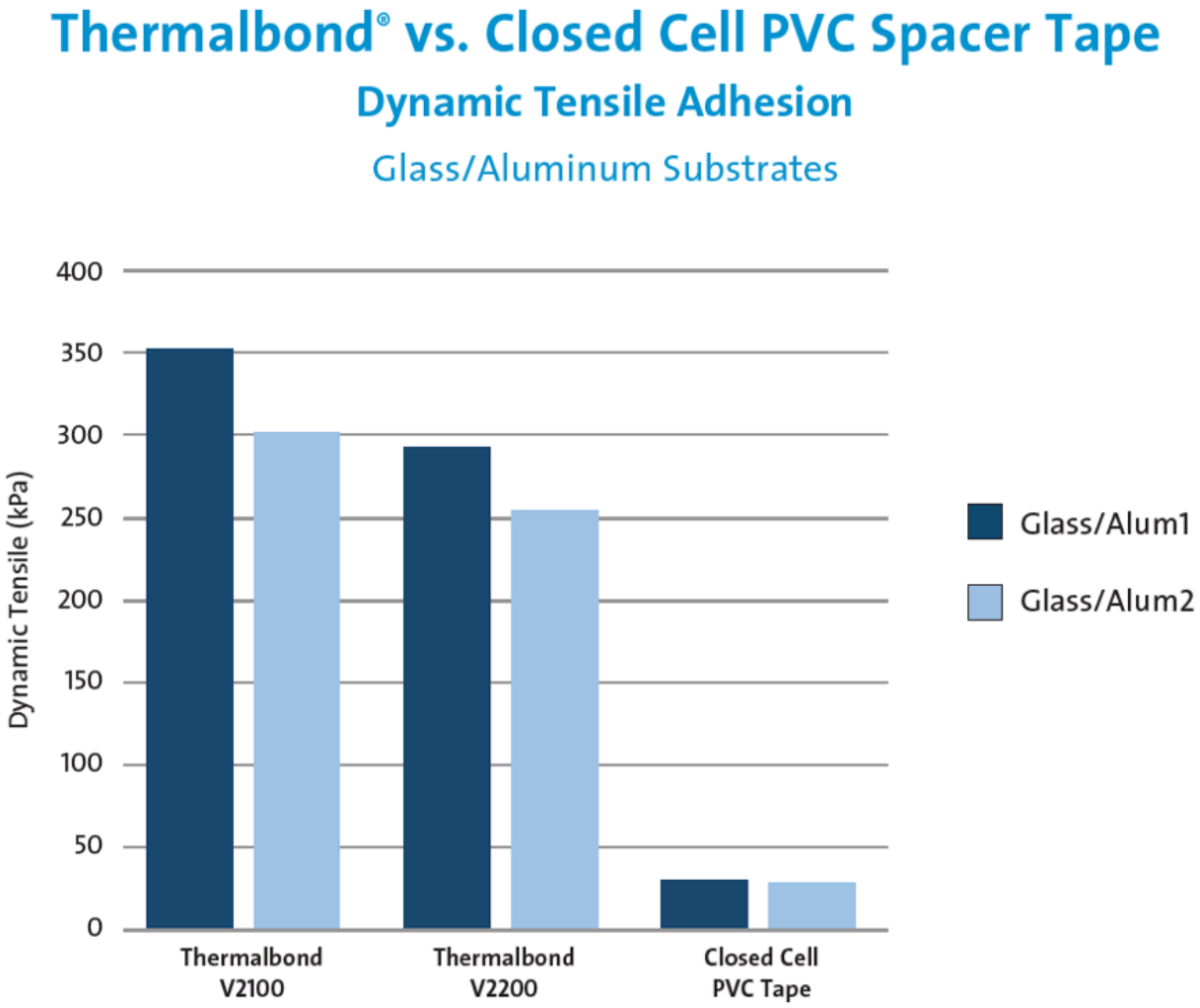


For field glazing, it is required that the glass be mechanically held in place during the cure period. While the adhesive properties of the tape will help stabilize the glass in position, it is not approved to hold the load. In the more common shop glazing environment, the tape is designed to stabilize the glass in position while the structural silicone cures. Often, the prefabricated glazed façade section is stored in a vertical position due to space limitations. In this situation, the shear strength of the adhesive system on the spacer tape is required to ensure no movement of the glass.

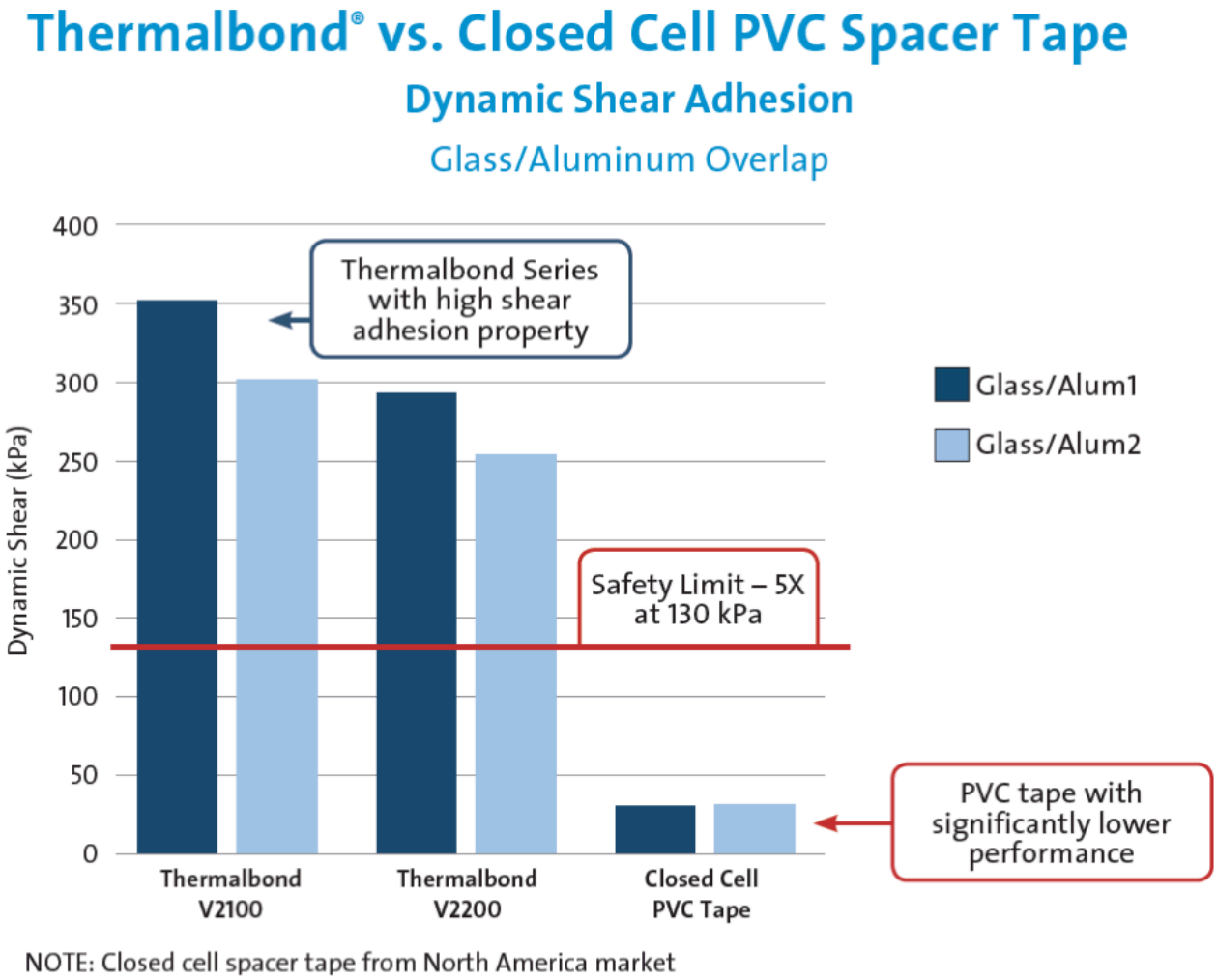


Movement can occur from handling during subsequent fabrication processes, during loading and transportation and while temporary retaining clips are being installed with field-glazed systems.

To understand the ability of the spacer tape to resist this force, a study was undertaken to measure the dynamic tensile adhesion — the adhesion strength in the direction perpendicular to the tape and glass surfaces. Commonly called the Z direction force, understanding this adhesion performance will allow you to ensure the unit remains fixed during the silicone curing cycle.



n addition to dynamic tensile testing which stresses the joint in the Z direction, it is equally important to stress the joint in shear to determine its' ability to hold in vertical mode during fabrication and transportation.



NOTE: Closed cell spacer tape from North America market

Spacer Tape and Gasket Options

There are other methods for creating spacing for silicone sealant curing including silicone gaskets and silicone compatible rubber compounds. Understanding these options and the various risks and benefits is important in making an informed decision.

SSG SPACER TAPE OPTIONS

Spacer property / attribute comparison chart

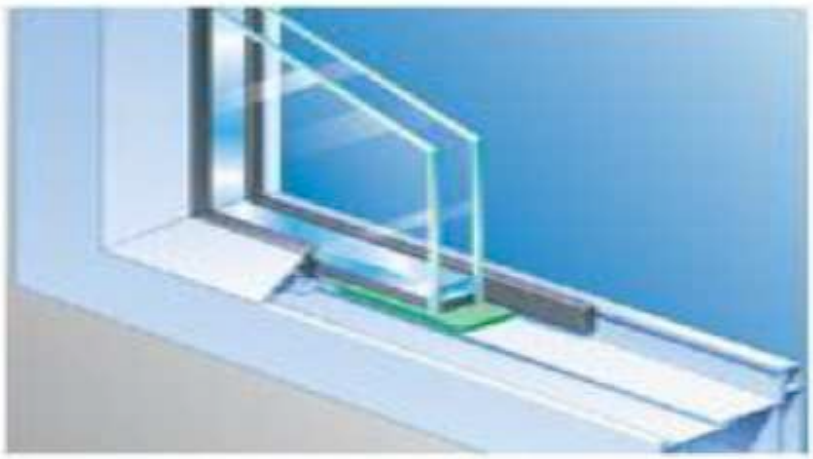
	PUR Tapes open cell	PVC Tapes closed cell	PE Tapes closed cell	EVA 'sticks' closed cell	Silicone profiles	SCR* profiles
Silicone compatability (long term proven)						
Spacer function (no load deformation)						
Open Cell (allow 1K Si curing)						
Adhesion property						
Location assured						
No stretch during installation						
Allow easy glass positioning						
Easy to handle configuration						
Low chance of silicone seeping into site line						
Wide range of dimensions (with low moq)						

Key Features and Benefits

- Semi rigid foam spacer maintains the joint between the glass and frame
- Compatible with structural silicone adhesives
- Adhesive on 2 sides allows for positioning and securing of the panels
    - Stabilizes the glass during the curing cycle
    - Prevents silicone form overflowing into the vision area
- Adhesive on one side available
    - Replaces silicone compatible rubber profiles where no adhesive on the glass side is desired
    - Coating on non-adhesive side facilitates easy glass positioning
- Open cell foam core
    - Vapor permeable to allow rapid silicone cure

Residential and Light Commercial Window Glazing Tapes

If you're a manufacturer of residential or light commercial windows, the “glazing tape" you use will likely be made from a polyethylene (PE) or polyvinyl chloride (PVC) core that has been coated with an acrylic or rubber –based adhesive system. These are lower density materials that are easier to compress to form a seal for the window. They are more economical than the commercial type products and are well suited to the sizes and loads common to residential windows.



The adhesive systems on these tapes are designed to adhere to PVC, painted metal and glass and the foam core will seal against air, water, and contaminants if they are compressed 30% of their original thickness. These tapes should be certified to AAMA 810.10 Expanded Cellular Gazing tapes to insure they meet minimum standards.

There are several manufacturers of polyethylene foam glazing tapes. One of the premier manufacturers is Adhesives Research. For double coated PVC glazing foam tapes, Saint Gobain is the premier manufacturer.

The most common thickness for polyethylene glazing tapes is 1/16" (1.6mm) and 1/8" (3.2mm). Common color options re white, black, and gray.

The double coated PVC tapes are available from 1/32" (0.8mm) thickness up to ¼" (6.4mm) although 1/16" and 1/8" are again the most commonly used. These tapes are also available in gray, white, and black.

Physical Properties for PE Foam Glazing Tapes

Test	ARclad® 4000 Series	Mode of Failure
Z-directional dead load shear, 100°F/95% RH, Aluminum T-blocks, 1" x 1" x 500g	>10 hours	100% adhesive failure
Z-tensile, Aluminum T-blocks, 0.1"/min.	45#/in²	100% adhesive failure
180° Peel, SS, 12"/min., Average	7.0#/in	100% foam split
Dynamic Shear, Aluminum panels, 0.1"/min.	38#/in²	100% adhesive failure

Physical Properties for PVC Foam Glazing Tapes

Properties	Value	Test Method
Density, kg/m³	240	ASTM D1667
Force to compress (25%), kPa	76	AAMA 810.1
Compression-deflection (25%), kPa	54	AAMA 810.1
Compression set (25%), %	0.6	AAMA 810.1
Water absorption, %	1	AAMA 810.1
Water penetration, %	3	AAMA 810.1
Tensile adhesion, kPa	414	AAMA 810.1
90° Peel adhesion, N/m	876	AAMA 810.1

Key Features and Benefits

• Flexible foam cores seal out water, dust, and light and can even be used on radius corners

• High performance acrylic adhesive offers improved bonds to the sash and the glass even under humid conditions. Units can be handled, packaged, and shipped immediately after the IG units are dropped in.

•Tear resistant release liner- allows easy removal without tearing

So as you can see, "glazing tape" is a rather broad term that covers many different yet high performing products. For further assistance on selecting the best glazing tape for your specific application or to receive samples for testing, please contact Tom Brown, Inc.