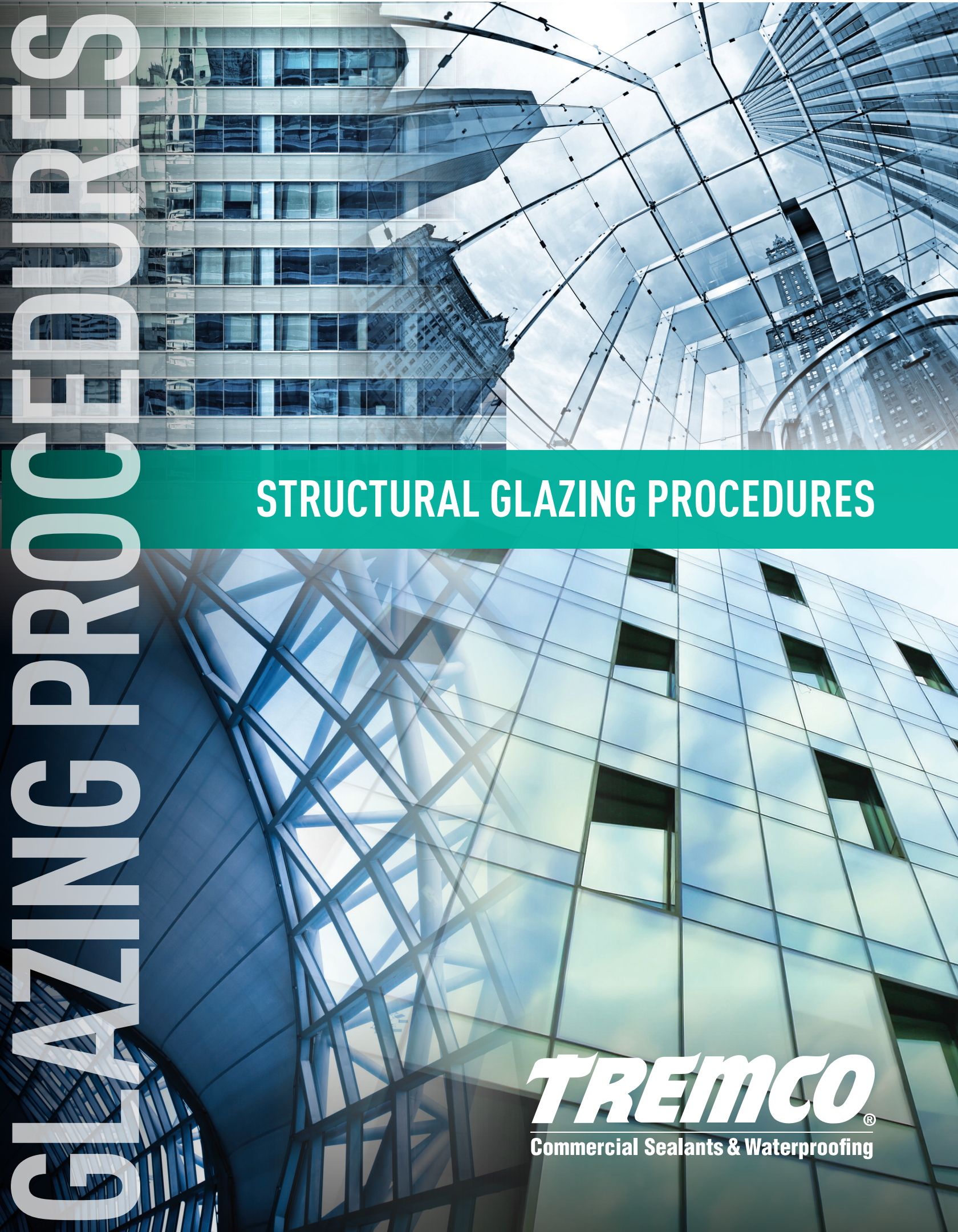

STRUCTURAL GLAZING PROCEDURES

TREMCO®

Commercial Sealants & Waterproofing

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I. PROJECT CHECKLIST

The list of items below must be completed for a SILICONE STRUCTURAL GLAZING PROJECT to be compliant with best practices and to be eligible for a Tremco Structural Glazing Warranty. As each item is completed, record the date in the appropriate space. For items that are not applicable on a project, please mark “NA” (not applicable).

DESIGN DETAILS

Date Completed

_____ **CUSTOMER submits shop and elevation drawings to TREMCO.**

_____ **CUSTOMER submits maximum positive and negative wind load force values for the project to TREMCO.**

_____ **CUSTOMER submits metal finish/paint code for the project to TREMCO.**

_____ **TREMCO provides project specific shop drawing review letter.**

ADHESION AND COMPATIBILITY TESTING [AND NON-STAIN TESTING IF REQUIRED]

Date Completed

_____ **CUSTOMER provides TREMCO with representative sample of project-specific metal (including finish).**

_____ **CUSTOMER provides TREMCO with representative sample of project-specific glass.**

_____ **CUSTOMER provides TREMCO with representative sample of project-specific accessories, including setting blocks, spacers and gaskets.**

_____ **CUSTOMER provides TREMCO with representative sample of project-specific porous substrates for sealant stain testing when required.**

_____ **TREMCO provides lab report including test date(s).**

QUALITY ASSURANCE

❑ **CUSTOMER completes and documents daily QC tests as outlined in this manual.**

❑ **CUSTOMER deglazes shop units to verify adhesion and documents on log sheets.**

❑ **CUSTOMER provides TREMCO with documentation of QC tests performed (as noted above).**

II. INTRODUCTION

Tremco, as a recognized supplier of structural silicone sealants and compatible glazing materials, understands the high performance requirements and potential liabilities inherent to structurally glazed walls. For these reasons, Tremco offers preconstruction project reviews and testing programs to ensure product performance characteristics and glazing integrity. This program, founded in industry practice and specifications, is offered to our clients at no additional charge and demonstrates Tremco's commitment to quality and attainment of the highest standards.

Each structurally glazed project in which Tremco is involved is reviewed and tested in accordance with the parameters of this in-house program. Pertinent recommendations and results are shared with the customer with the assistance of Tremco. Each member of this team has a keen sense of commitment to the success of each project.

A. REQUIRED INFORMATION

Following is an overview of the minimum information required by Tremco prior to the beginning of each structural glazing project.

General information on the project such as:

- Project title, size and location
- Architect and consultant involved in the project
- Fabricator
- Glazing and caulking subcontractors
- Glazing start and completion dates

Review of the structural glazing details to identify:

- Proper use of Tremco glazing materials including sealants, gaskets, tapes and setting blocks.
- Proper tensile bead location. Structural tensile beads are normally located on the interior face of the lite or panel (#2 or #4 surface) with bonding to a structurally sound substrate such as a horizontal or vertical aluminum mullion with a specified architectural finish.
- Confirmation of glass supplier and types (e.g., monolithic, I.G. unit, laminated) and identification and description of coatings (e.g., reflective or opacifier) with their respective sizes approved for structural glazing.
- Confirmation of coating/anodizing company, identification of coating (type, name, code and batch number) and location of metal and substrate finishes. Mill finished substrates are not acceptable for structural glazing applications.
- Verification of proper sealant selection and usage.

Project specification review to identify:

- Design windload force requirements for the project (positive and negative windload force).
- Proper tensile bead sizing: the sealant bite or sealant contact depth (SCD) is calculated from the design wind load and glass dimensions. Based on these calculations, Tremco recommends a minimum tensile bead size of 1/4" x 1/4" (6 mm x 6 mm). Tensile beads (sealant bite) exceeding 1/2" (13 mm) warrant special consideration as sealant curing characteristics may be affected. Please consult your Tremco Technical Sales Representative for special guidelines, or contact us by clicking “Ask the Expert” under the Technical Resources Tab on the Tremco website www.tremcosealants.com.
- Identify the type of structural glazing application (2-sided, 4-sided, sloped), on-site or in-plant application, vision and/or spandrel application.
- Testing designated and required beyond that typically done.
- Information and/or performance requirements specific to the project.

Substrate requirement for adhesion testing:

- Substrates typically tested in order to determine proper cleaning techniques and priming requirements include aluminum framing and glass or other glazing panels.
- Substrates should be submitted to Tremco Technical Services Department and be representative of those to be used on the actual project (production run sample). See Technical Service Bulletin No. S-08-47 (Lab Testing Requirements) in Appendix.
- Adhesion testing is performed according to Tremco and/or ASTM C794 methods. Results of testing are normally available 4 to 6 weeks after receipt of the substrates.

Identification of substrate in contact with the silicone structural glazing sealant:

- Tremco will verify that all the elements installed within the glazing pocket are compatible when in contact with the silicone sealant (tensile bead) and will not affect its in-place performance.
- Compatibility testing can be run according to Tremco Modified ASTM C1087. See Technical Services Bulletin No. S-08-47 (Lab Testing Requirements) in Appendix. The test will determine color change or adhesion loss as a result of sealant contact or proximity of incompatible materials.
- Substrates to be tested include, but may not be limited to, setting blocks, structural spacer (tapes or gaskets), compression gaskets, insulating glass edge seals, glass laminates, backer rod, weatherseal, and thermal break.

B. REPORTING:

Upon completion of the drawing and specification review and adhesion and compatibility testing, a formal report is issued which details recommendations and test results specific to the success of the individual project. These results and recommendations are intended to serve as a base of information which should be confirmed on actual project applications at ongoing intervals as described in the following structural glazing procedures. This promotes consistent performance and quality and confirms laboratory results.

Tremco Technical Services will issue a report(s) for the structural glazing application after all evaluation and testing for the specific project are completed Any work done beyond this point by the contractor without the letter of approval becomes the contractor’s sole responsibility.

C. PUMP MAINTENANCE

Refer to your pump manufacturer’s guidelines for specific instructions.

III. TREMCO CONTACT INFORMATION

Technical Services:	866.209.2404
Customer Service	
United States:	800.321.7906
Canada:	800.363.3213
Extruded Rubber Customer Service:	800.321.6357
Tremco CS&W Website:	**www.tremcosealants.com**
Your local Tremco Sales Representative:	Use the Rep Locator on our website to find a sales representative near you: **www.tremcosealants.com/distributorrep-locator.aspx**

IV. GUIDE FOR WORKMANSHIP

A. SURFACE PREPARATION

All components receiving the structural glazing silicone sealant (i.e., aluminum and glass) shall be thoroughly wiped with a clean lint-free cloth dampened with a recommended cleaner, as approved by Tremco and immediately followed by a dry wipe (2-rag method). Use a clean cloth for the dry wipe. Special precautions must be taken in cold weather to ensure surfaces are free from frost and/or condensation. For factory glazing, both the glass and framing should be stored indoors in a controlled environment for 24 hours prior to glazing. This will prevent the formation of frost and/or condensation that may occur if cold materials are brought into a warm area.

All surfaces once cleaned and/or primed should be handled carefully so as not to contaminate the surfaces.

B. FRAMING

All framing shall be checked prior to glazing to make certain that the opening is square, plumb, and secure in order that uniform sealant bite, face and edge clearances are maintained. Inspect all butt and miter joints. If these joints are open, they shall be sealed prior to glazing using a sealant confirmed to be compatible with the structural silicone sealant. Maintain minimum edge clearances between glass and sash, as outlined by the glass manufacturer, and sealant contact depth (sealant bite) as recommended by Tremco for this specific project.

C. SETTING BLOCKS

Setting blocks shall be used, as required, to support the glass/I.G. unit in structural glazing applications. The use of setting blocks will prevent the addition of stress applied on the structural tensile bead due to the dead load of the glass/I.G. unit. Setting blocks should be of a 80+/- 5 Shore A Durometer hardness in order to support the dead load of the glass/I.G. unit.

Locate setting blocks on the sill member as recommended by the glass manufacturer. When the sill section is structurally glazed (for both 2-sided and 4-sided systems), setting blocks shall be recessed to allow for adequate sealant contact (weatherseal) and glass support. When using insulating glass in a structural glazing application, the industry generally agrees that setting blocks should be recessed 50% of the thickness of the outboard lite of glass. The I.G. unit sealant supplier in conjunction with the structural sealant supplier shall confirm the polymer type of setting blocks that are compatible and can be used in the structural glazing application.

D. STRUCTURAL SPACERS

Structural spacers used in this application must be compatible with the structural silicone sealant and positioned on the frame to ensure correct sealant contact depth as recommended and specified by Tremco. The silicone compatible spacers shall be of the required hardness to maintain a recommended uniform face clearance for all glass sizes.

The sealant cavity created by the installation of the structural spacer should be located in plane with the nozzle of the gun allowing direct entry of the sealant into the cavity. Out-of-plane or indirect access of the sealant to the cavity should be avoided.

E. DETAIL DRAWINGS

Full sized details of the structural glazing pocket(s) showing the metal system(s) must be submitted to Tremco for review prior to the beginning of the project. Placement of materials must be shown on the details. If framing from the fabricator differs from the submitted details, the principal parties must resolve differences before proceeding further with the project.

F. PRE-INSTALLATION MEETING

All materials shall be used in accordance with Tremco's printed instructions. A meeting to review procedures, tests required and sealant application should be held during bid stage and prior to the beginning of the work on the project. A Tremco representative should be present at the start of each job to review procedures and instruct in sealant application.

G. ADHESION TESTING

Proper adhesion of the sealant to the substrate must be achieved prior to movement of the units to storage. Proper adhesion is achieved when the adhesion test results in cohesive separation of the sealant.

Typically units fabricated with Proglaze II can be moved horizontally within 4 hours as long as they are blocked and stabilized to ensure that the sealant adhesion is not compromised. These units can be moved from a horizontal to a vertical position after adhesion is checked and found to be acceptable.

Units can then be moved to the job site after proper sealant adhesion is verified. This is typically done within 24 hours after fabrication. Units should be packaged for shipment in a fashion that will prevent additional stress on the sealant substrate bondline.

Adhesion tests must be performed by the contractor at the beginning and during the project application. A logbook recording all tests and verifications must be kept by the contractor as it will be used for contractor control (refer to Sealant Quality Assurance Programs in Sections VII and VIII of this guide). These documents should be submitted for warranty administration. A warranty cannot be issued without this information.

V. GUIDE FOR SEALANT APPLICATION

It is essential that Tremco Structural Glazing Sealants are installed in accordance with Tremco's recommendations and specific written instructions. Proper surface preparation is extremely important to the longevity and performance of Tremco structural silicone sealants. Substrate samples tested must be actual production run samples and must be representative of the materials to be used on the job site.

A. CLEANING

1. Isopropyl alcohol (IPA) is the recommended solvent for cleaning metal and glass intended for structural glazing applications.

2. The solvent acts as a degreaser to remove the cutting oils and other contaminants used in the fabrication of the framing system. The solvent must be clean and fresh and must comply with local occupational safety codes. When used indoors, such as in a factory environment, proper ventilation must be provided.

3. Cloths used for cleaning of all framing members should be white, lint free and resistant to the recommended solvent. Do not use chemically treated rags. Do not hesitate to change the cloths frequently as they will become soiled during the cleaning operation. It is easy to see the soiling if white rags are used.

4. Pour the approved solvent onto a clean, dry cloth. Do not place cleaning cloth into the solvent solution container. This prevents solvent contamination, which can lead to a sealant adhesion problem. Vigorously rub the glass and metal surfaces to remove the contaminants. Continuously rotate the cloth, lifting off the oils loosened by the solvent.

5. Do not allow the solvent to air dry during the cleaning procedure. After the solvent wipe, follow immediately with another clean dry cloth to wipe the surface dry (2-rag method). Allowing the solvent to dry on the surface without wiping with a second cloth negates the entire cleaning procedure because the contaminants are redeposited as the solvent dries.

6. When cleaning deep, narrow joints, wrap the cleaning cloth around a clean, narrow-blade putty knife. This permits force to be applied to the surface to be cleaned.

7. Clean only as much area as can be sealed in 1 hour. If cleaned areas are exposed to contaminants (oils, dirt, dust, etc.), the surface must be cleaned again.

8. Keep solvent containers closed when not in use. Temperature and humidity will affect the evaporation rate of the applied solvent therefore affecting its cleaning power.

9. Caution:

- **a.** Never use a paintbrush for the cleaning procedure. It is not effective in removing the contaminants off the surface. The rubbing action of the cloth is critical and essential for loosening up the contaminants from the substrate.
- **b.** Some "cutting oils" used in the fabrication process may not be soluble in IPA. This should be verified before commencing the project.
- **c.** For porous substrates, contact Tremco for appropriate cleaning surface preparation.

B. PRIMING

1. Primer, when properly used, will promote strong and consistent adhesion of the silicone sealant to the substrates to which it may otherwise be difficult to bond. If a primer is required, it will be confirmed during the adhesion test executed prior to the beginning of the work.

2. Tremco offers TREMprime Silicone Metal Primer for most metal finishes. This primer is non-film-forming and moisture sensitive. This sensitivity to water may result in cloudiness or development of white precipitates (settling) in the container. Should either of these conditions exist, the primer should be discarded.

3. Always pour TREMprime Silicone Metal Primer onto a clean applicator. Never place the applicator into the primer container.

4. Apply a thin film of TREMprime Silicone Metal Primer using a clean lint-free cloth. DO NOT use a brush for application. Excessive application may result in a white powdery deposit, which must be removed before sealant application. This white deposit can be removed with a clean cloth dampened with the recommended cleaner. Reapply a fresh, lighter application of primer. A light application on a non-porous surface may best be accomplished by application with a clean, non-treated cloth or tissue dampened with primer.

5. Caution: Primers are not to be substituted for good surface preparation. The substrate to receive the primer shall be thoroughly cleaned using the recommended cleaner, and dried, prior to the installation of the primer.

6. Allow the primer to dry for a minimum of 15 minutes before sealant application. Protection of the primed area from contaminants is essential to ensure proper adhesion. If the primed area can not be kept clean, the primer is to be removed using the cleaning techniques described earlier and the area re-primed.

   If the primed area can not be covered within 1 hour, it must be removed with a clean cloth dampened with the recommended cleaner and the area reprimed.

7. Please refer to the Tremco Primer Selection & Usage Guide for further information on TREMprime Silicone Metal Primer. Please make sure the primer has not expired.

C. MASKING

1. To provide a neat sealant sight line, masking tape is commonly used to outline the joint to be sealed. This reduces sealant smears, which are often found aesthetically unacceptable.

2. When masking is required, the tape must be immediately removed after the tooling has taken place and before the cure of the sealant begins.

D. SEALANT APPLICATION

1. The structural silicone sealant shall be installed according to Tremco's specific job installation recommendations. All surfaces must be properly cleaned and/or primed before sealant application.

2. The surfaces to which the silicone sealant will adhere should be designed smooth: free of nubs, serrations, grooves or other features, so as to not impede the flow of the silicone sealant or wetting of the sealant to the substrates on its entire surface contact depth.

3. Compatible structural spacers shall be installed to keep the glass properly spaced as per the approved drawings. Refer to the approved structural glazing detail for the configuration of the sealant and the placement of the spacer. Face clearance created by the structural spacer should be a minimum of 1/4" wide to accommodate penetration of the sealant to the full depth of the cavity.

4. Prime surfaces as advised by Tremco, taking care to protect the surfaces that do not require primer. If primer is applied accidentally on surfaces other than the one specified, it should be removed immediately with the help of a clean cloth dampened with the recommended cleaner.

5. When gunning the silicone sealant into the cavity created by the structural spacer between the glass and the metal, a back pressure should be created such that the silicone sealant swells up behind the nozzle tip above the sight line, promoting full depth penetration of the sealant. Air pockets or voids along the edges are not acceptable and should be reported to the job foreman for immediate repairs.

6. All sealant beads must be tooled immediately after application, forcing the sealant into contact with the sides of the joint, promoting a full and continuous contact of the sealant with both substrates. This reduces the risk of air entrapment within the tensile bead. Avoid pulling the sealant out of the joint by frequent cleaning of the tooling instrument. Dry tooling is the recommended tooling method. Do not tool with soap, solvents, or detergent solutions. Tooling time for Proglaze II is equal to half the snap time value. Tooling time for Proglaze SSG is equal to the skin time value as published in the data sheet.

7. Areas that have been smeared or otherwise contaminated with unwanted silicone sealant should be cleaned before the sealant has an opportunity to cure. This is best accomplished with an IPA solvent-soaked cloth followed by a dry rag wipe. Failure to do so immediately can lead to very costly removal methods later on.

8. Follow Tremco's recommendations regarding curing periods and transport time for factory and field sealant applications. These recommendations can vary from job to job.

9. Use structural silicone sealants within their stated shelf life. Verify the batch numbers and expiration dates of both the curative and base components of the silicone sealant upon receipt. Store in a dry environment 60 to 80 °F (15 to 27 °C).

Notes: All cleaners or primers to be used on the structural glazing application should be poured from the original container into small containers and poured from this vessel onto the cleaning cloth to prevent contamination of dirt into the container. Pour off only enough primer required for immediate use. Should the cleaner or primer become contaminated with dirt, discontinue use and obtain fresh primer. Follow the manufacturer's safety recommendations for solvent and primer use.

VI. GUIDE FOR ADHESION CHECK

During the course of the sealant installation for this project, testing of sealant adhesion to the substrate should be performed on a continuing basis. Tremco recommends a field adhesion check at a minimum rate of one per every 50 units glazed. Actual job site test applications are the best means for a glazier to perform a quality assurance check. This provides the installer with a level of confidence that the sealant and established application procedures are in compliance to Tremco's written instructions. Two adhesion test methods are available: The tab adhesion and the hand pull tests.

A. THE TAB ADHESION TEST METHOD

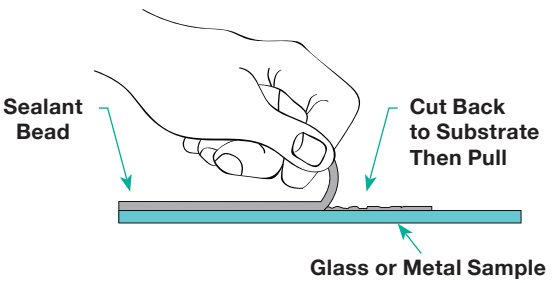
When construction design permits, this method is performed at the time of sealant installation. For a tab adhesion/pull test, a location on the framing assembly must be available that is accessible but will not be exposed on completion of the work, as this method will permanently deface the area of test.

This adhesion/pull test is performed as follows:

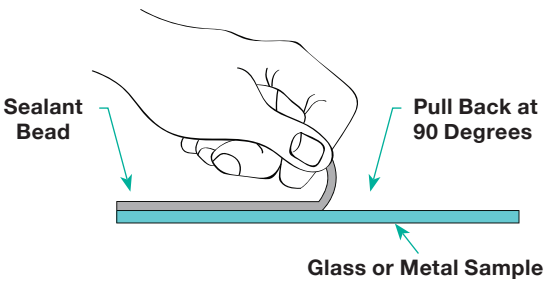
1. The on-site "tab" sample is to be applied based on Tremco's recommendation for this specific project including appropriate cleaners and primers. The "tab" sample consists of a single 3/8" (9 mm) diameter bead of sealant that is tooled to a thickness of 1/4" (6 mm).
2. After the cure period, take a razor blade and under cut one end of the tab, exposing a "flap" that can be grasped with fingers.
3. Pull this "flap" at approximately 90° angle. Cohesive failure of tab is the desired result.

This method takes advantage of not disturbing the original structural sealant after its installation and subsequent repairing of the sealant.

Adhesion Test Procedure



Cohesive Failure Within Sealant Bead
(Recommended)

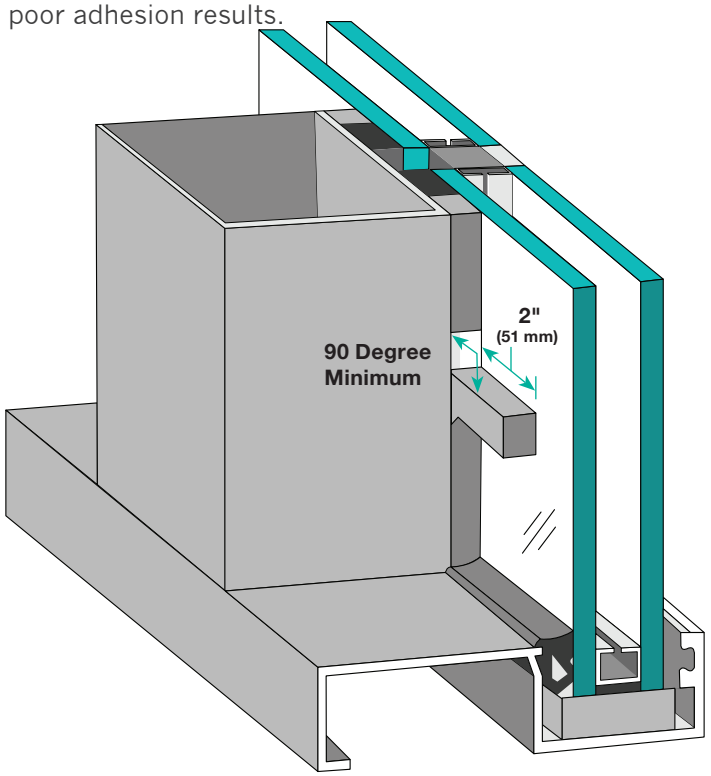


Adhesive Failure at Bond Line
(Not Recommended)

B. THE HAND PULL ADHESION TEST METHOD

This most popular test method is performed on the sealant installation after an appropriate sealant cure time period as approved by Tremco to ensure proper adhesion development. For Proglaze II the cure time should be 3 to 7 days at 77 °F (25 °C) and 50% RH. For Proglaze SSG and Spectrem 2 the cure time should be 14 to 21 days at 77° F (25° C) and 50% RH. This hand pull test procedure is performed as follows:

1. With a sharp knife, cut the sealant horizontally from one side of the joint to the other. Caution: Care should be taken not to damage painted metal finish.
2. Make two vertical cuts approximately 2" (51 mm) long at the sides of the joint, meeting the horizontal cut at the top of the 2" (51 mm) cuts.
3. Grasp the 2" (51 mm) piece of sealant firmly between the fingers and pull down at a 90° angle or more, and try to pull the uncut sealant out of the joint.
4. If adhesion is proper, the sealant should tear cohesively within itself before releasing from the substrate.
5. If sealant does not tear cohesively, contact Tremco Technical Services to assist in determining the cause of poor adhesion results.



C. REPAIR OF SEALANT IN ADHESION TEST AREA

The test sealant may be repaired (test area) by simply applying more sealant in the same manner it was originally installed (assuming good adhesion was obtained). Care should be taken that the new sealant is in contact with the original and that the original sealant surfaces are clean so that good bond between the new and old sealant will be obtained. Check with Tremco Technical Services for proper repair techniques.

VII. ONE-PART SILICONE SEALANT – QUALITY ASSURANCE PROGRAM

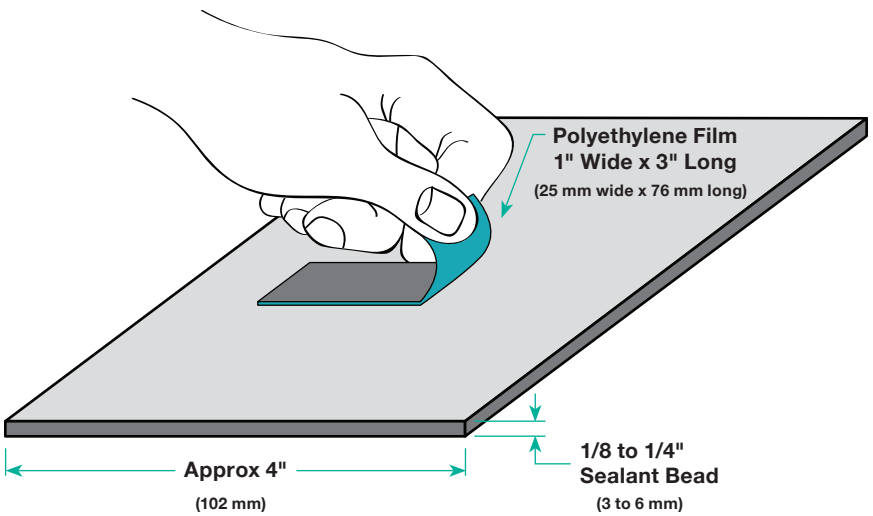
PROGLAZE SSG AND SPECTREM 2

Successful use of Tremco Proglaze SSG and Spectrem 2, one-part silicone sealants, includes proper record keeping. When Proglaze SSG or Spectrem 2 is selected for use in a structural glazing application, the following is recommended:

1. All containers should be stored below 80 °F (27 °C).
2. All incoming batches/lots should be recorded and tested within 30 days after receipt of material per attached methods.
3. All results must be recorded and maintained in the appropriate logbook.

A. TEST #1 - TACK FREE TIME

1. Apply a bead of sealant 1/8" to 1/4" thick (3 mm to 6 mm) onto a sound substrate. Strike off sealant to ensure consistent thickness. Immediately record the date and start time in the logbook.
2. Obtain a 1" x 3" piece (25 mm x 75 mm) of low-density polyethylene film 0.15 to 0.20 mm thick (6 to 8 mils). Install the polyethylene sheet on the sealant and maintain slight pressure with your finger to ensure contact between the two for about 5 seconds.
3. Withdraw the film progressively at a 90° angle to the surface. Repeat every 15 minutes until the sealant does not stick to the polyethylene film. Record in the logbook the time at which the sealant does not stick to the film.
4. The difference in these times will provide the tack-free time of the sealant.
5. If tack-free time exceeds 2 hours, contact Tremco Technical Services. The tack-free time value will vary depending on the local atmospheric conditions present during the curing of the



Tack Free Time Test

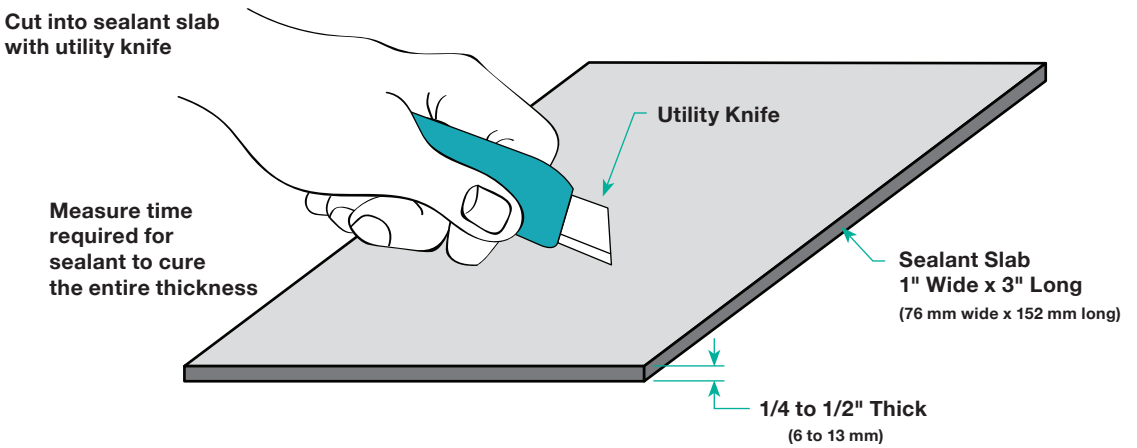
B. TEST #2 - THROUGH CURE TEST

1. Apply a bead of sealant about 1/4” thick (6 mm) onto a sound substrate. Strike off the sealant to ensure consistent thickness. Immediately record the date and start time in the logbook.

2. Allow the sample to cure 24 hours. Cut into the sealant using a utility knife.

3. Measure the thickness of sealant cured at this time. Every 24 hours, verify the amount of cured sealant until the sealant is cured through and no uncured material is visible at the center of the bead.

4. Record total number of days for cure in the logbook. The number of days required for the sealant to cure will vary depending of the thickness of the sealant and the local



Through Cure Test

C. ONE-PART QUALITY CHECK – LOGBOOK

TEST #1
Tack-Free Time

TEST #2
Through Cure

DATE	SEALANT THICKNESS	BATCH #	START TIME	END TIME	TACK FREE TIME [MIN]	24-HOUR CURE [IN. OR MM]	DAYS TO FULL CURE	TEMPERATURE & RELATIVE HUMIDITY [RH]	OPERATOR SIGNATURE

VIII. TWO-PART SILICONE SEALANT – QUALITY ASSURANCE PROGRAM

TREMCO PROGLAZE II

Today, more than ever, professional glaziers are using plural component silicone sealants to improve in-shop production and fabrication schemes.

A. OVERVIEW

The equipment used in delivering Tremco Proglaze II has three basic functions:

1. Dispensing the sealant components (base and catalyst) from their respective containers, through the metering system and mix elements, via the gun to the substrate.
2. Effective metering of the base and catalyst components at the specified ratio.
3. Thorough mixing of the base and catalyst components to promote proper cure and performance characteristics of the sealant per the manufacture's specifications.

It is important that the pump is properly mixing and dispensing both components (base and curative). Verifying any inconsistencies in the metal finish, which may adversely affect adhesion, is also important.

Tremco Technical Services recommends the following tests be conducted to verify product performance:

1. At the beginning of each day and/or every time the pump is started prior to the installation of the silicone sealant if not intermittently throughout the day's production:
    - **a.** Butterfly test and snap time checked
    - **b.** Color check (cure through to be done afterward)
    - **c.** Snake test (referenced on Page 21)
    - **d.** An adhesion test on project substrate (in plant adhesion—tab adhesion)
    - **e.** A Shore A test sample
2. At the beginning, middle and end of each Proglaze II component container record the following:
    - **a.** Sealant flow rate of the equipment
    - **b.** An adhesion test on project substrate at the beginning of each newly loaded base and curative container(s)

All test results must be recorded in the logbook, indicating the date, time, and silicone batch number and cross-referenced to the unit produced and its location on the building.

It is the end user's ultimate responsibility to maintain proper record keeping when using Proglaze II. The equipment suppliers in addition to Tremco Technical Services are prepared to service this market.

Note:

- Proglaze II is typically used in plant.
- Proglaze II can be used in either 2-sided or 4-sided structural glazing jobs.
- Proglaze II is mixed and delivered by means of a Tremco approved meter/mix pumping system.
- Contact the pump manufacturer for proper operating procedures.

B. TEST #1 - BUTTERFLY TEST

To verify a proper mix of base and curing agent, this test will be performed at each start up of the dispensing equipment.

The object of the butterfly test is to verify homogeneous mix and detect the presence of any streaking or unmixed material. It should be performed just before a snap time test sample is taken.

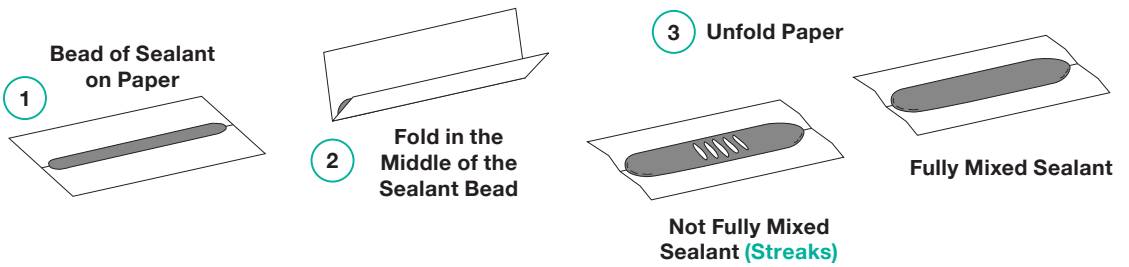
The butterfly test is to be performed as follows:

1. After the pump has been started, dispense 1/4 of a gallon (approximately 1 litre) of mixed base and curing agent into a container to flush lines (it should take 2-3 minutes to do so). At the start, the color of the material will appear predominantly white because the lines have been base purged at the previous shut down.
2. On a sheet of paper or paper towel, apply a 6 to 8" (15 to 20 cm) long bead of sealant (approximately 3/8" [9 mm] diameter) from the gun nozzle.
3. After sealant is applied, fold the paper in half. Apply ample pressure to flatten out the bead of sealant.
4. Open the paper towel and lay it flat, and visually inspect the sealant.
5. The sealant must appear completely uniform in color (the base is white and the curative is black). There should be no white or gray streaks of any kind in the sealant.
    a. If there is no evidence of streaking and the sealant is uniform in color, a thorough mix has been achieved, then proceed with the Snap Test.
    b. **DO NOT PROCEED** with further testing and sample preparation if there is evidence of streaking or inconsistency in color because this indicates that a thorough mix has not been achieved. Instead, dispense additional sealant and repeat steps 1 through 5.
    c. If there is still evidence of streaking or an inconsistent color exists, some adjustments/ repairs should be performed on the dispensing equipment (static mixer area). Such efforts should continue until a thorough mix is achieved.
6. All test results (negative or positive) must be recorded and dated in the "Logbook".

The butterfly test can also be performed with 2 pieces of clear glass. Apply a bead of sealant onto one of the glass pieces and press the second glass piece on top of it. Visually inspect for mix. Initially, a white marbling will occur, indicating incomplete mix. Eventually, the compressed sealant will become uniform in color, verifying full sealant mix.

The butterfly test cannot be used by itself to confirm that the material is properly mixed but should be used in conjunction with all the other tests described in this section to verify proper mixing of the sealant components and confirm in-place performance.

PROGLAZE II



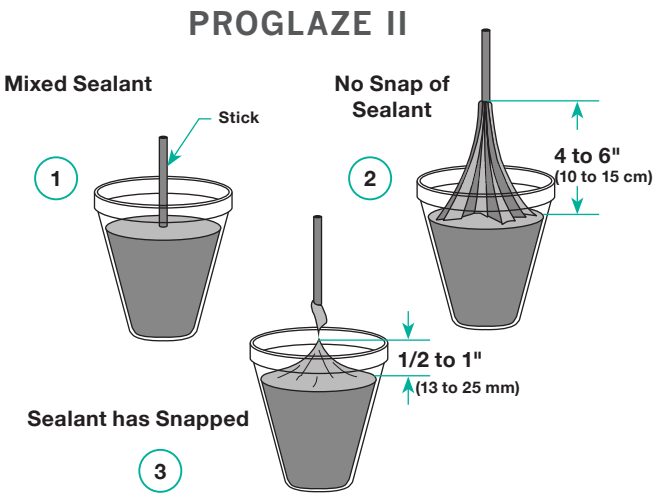
Butterfly Test Procedure

C. TEST #2 - SNAP TIME TEST

The snap time test is performed only after proper mixing of base and curing agent is verified (refer to butterfly test section for more information).

This snap time test is performed to determine the cure rate of the sealant once mixed and is to be performed as follows:

1. Dispense mixed sealant into a container (3/4 full). A disposable cup is suitable for this test. Record time of sample preparation.
2. The snap time of the mixed sealant is checked by withdrawing the stick from the container of sealant.
3. Insert a wooden tongue depressor or Popsicle stick into the sealant in the middle of the container so that it is well-embedded. Immediately withdraw the stick, pulling straight up, in a period of one full second. Initially, the sealant will form a continuous string from the stick to the surface of the sealant in the cup. In its initial cure state, the sealant will not break when the stick is lifted 4 to 6" (10 to 15 cm) above the surface of the sealant.
4. Wait 10 to 15 minutes and repeat step 3 every 5 minutes.
5. As material approaches its designed snap time, the distance required for the material to break when lifting the stick from the sealant surface will get smaller and smaller.
6. Snap time is achieved when the sealant breaks after lifting the stick 1/2 to 1" (13 to 25 mm) above the surface of the sealant in the container. The snapped sealant will act like a broken rubber band, i.e., both ends will snap in opposite directions.
7. Record the snap time. The designed snap time should be between 25 to 35 minutes when performed at 77 °F (25 °C). This snap time value may vary depending on the local temperature and humidity conditions at the time of testing.
8. Care should be taken to avoid further mixing or sheering of the sealant during the snap time testing; this will affect the snap time result.
9. Snap time result may vary and be affected by the local temperature and humidity conditions and the shelf life of both base and catalyst. As an example, testing at higher temperatures reduces snap time while testing at lower temperature increases the snap time.



Note:

- After the mixed sealant has been tooled in place, it should not be disturbed once the sealant snap time has been reached; its adhesion to both substrates may be affected.
- If any major discrepancy in the snap time value is noted, advise Tremco immediately.

Snap Time Test Procedure

D. TEST #3 - COLOR CHECK

After the butterfly test and then snap time are conducted, a sample of cured sealant should be compared with the material currently being dispensed. Color of a previously cured sample (control sample) should match that of the dispensed material. This control sample is generally produced at the commencement of the project prior to the installation of the structural silicone sealant.

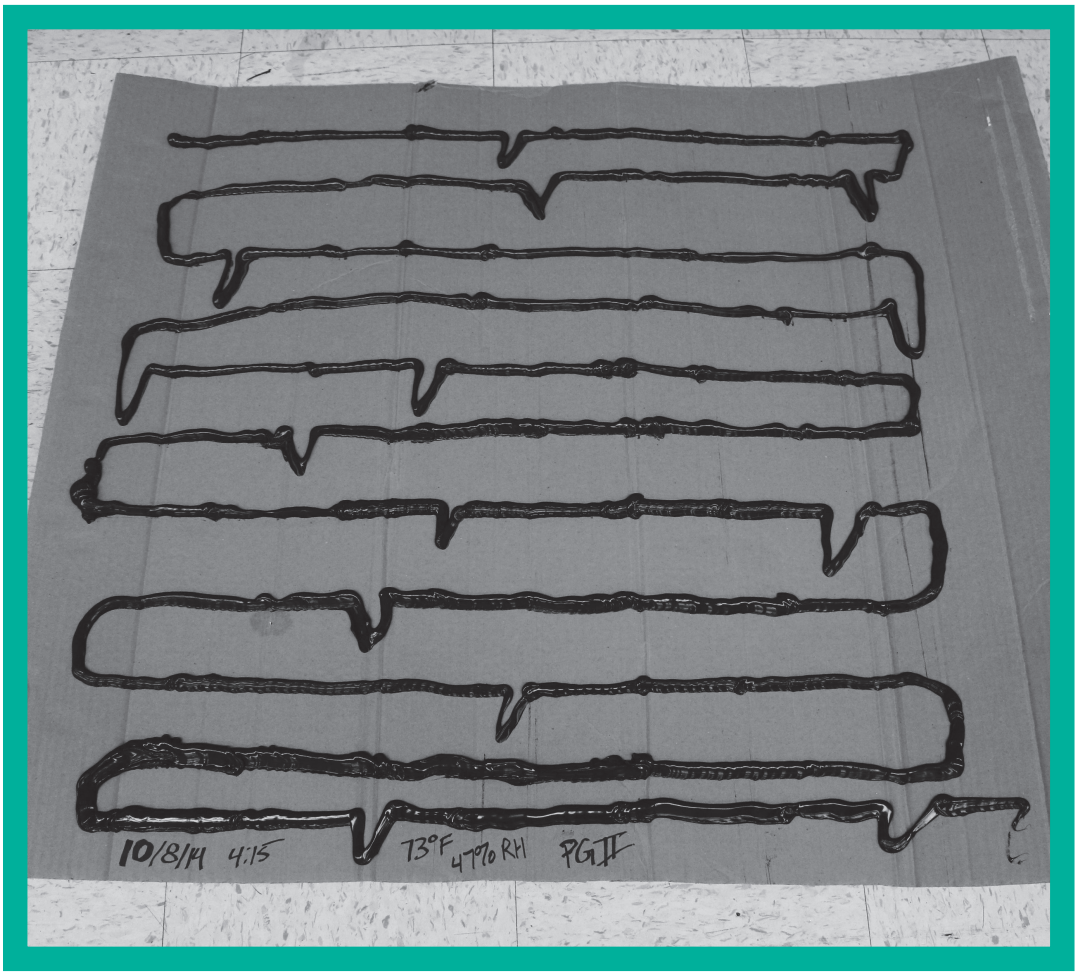
If the snap time is in specification and the butterfly test shows no streaking, and the color check is consistent with the control sample, then you have confirmation that the material is being dispensed and properly mixed.

E. TEST #4 - SNAKE TEST

1. Dispense a continuous bead of sealant (snake bead).

2. Mark meter change locations and pump directional changes.

3. Allow to cure 24 hours. Check Shore A at all of the above locations and record. Variations can occur so record softer Shore A readings at changeover locations listed above. Uniform Shore A is less than 5 points from norm at soft spot locations. The goal is uniform Shore A after 72 hours.



F. TEST #5 - ADHESION TEST

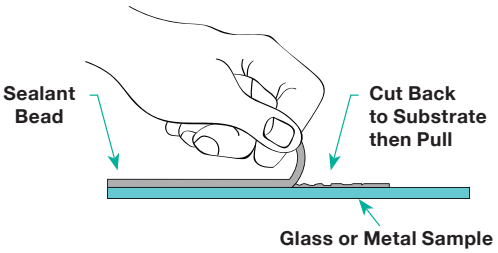
The adhesion test is to be performed at the start and end of each production run or day. It will verify that the sealant adhesion has not changed from the beginning to the end of a production run, assuring consistent performance.

The adhesion test is to be performed as follows:

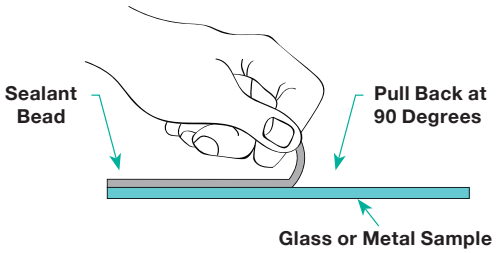
1. Clean both finished metal and glass substrates with the recommended cleaning procedures.
2. Apply a bead of the silicone sealant to the substrates being used, approximately 1/2" (13 mm) wide, 3/8" (9 mm) high by 4" (102 mm) long. Tool the bead to 1/4" (6 mm) thickness.
3. Allow the sealant to cure for 24 hours at 77 °F (25 °C) or higher.
4. Upon completion of the cure, undercut about 1" (25 mm) of the test bead at the substrate interface with a razor blade and pull this tab of sealant at 90° to the substrate. The sealant should tear cohesively with no loss of adhesion.
5. Record the results of adhesion in the project logbook.

Note: If pull test results in adhesive failure (sealant pulling away neatly from the substrate), notify Tremco immediately for direction.

Adhesion Test Procedure



Cohesive Failure Within Sealant Bead
(Recommended)



Adhesive Failure at Bond Line
(Not Recommended)

G. TEST #6 - FLOW RATE CHECK [FOR NON-DIGITAL METERING EQUIPMENT]

This will be done a minimum once a week to ensure a proper volume of sealant continues to be delivered by the gun. Reference the manufacturer's operating manual for system specific flow rate procedures.

1. Weigh a paper cup.
2. Using this cup, pump material from the gun into the cup for 30 seconds.
3. Weigh the cup containing the material; then subtract the weight of cup. Record on a flow rate check sheet (see Page 23) the date, time, weight of sealant delivered, pump pressure and ratio cylinder pressures.
4. The flow rate check sheet should be reviewed after each test. While some variation from test to test is to be expected, a large deviation from typical results is cause for concern and should be reported to Tremco Technical Services. The inability to maintain specified cylinder pressures is an indication that service may be required on the pump.

Note: Using digital equipment, follow equipment manufacturer guidelines.

Pump #:_____

Date:_____

Location:_____

FLOW RATE CHECK

		PUMP PRESSURE (PSI/KPA)		RATIO CYLINDER PRESSURE (PSI/KPA)				
DATE	TIME	BASE	CATALYST	CATALYST (IN)	CATALYST (OUT)	BASE (IN)	BASE (OUT)	WEIGHT OF SEALANTS (WT. OF CUP AND SEALANT – WT. OF CUP)

QUALITY ASSURANCE - LOGBOOK

	BATCH #	QUALITY ASSURANCE TEST						
DATE & START TIME	BASE/ CATALYST	BUTTERFLY	SNAP TIME	COLOR CHECK	ADHESION	*GLAZED UNIT LOCATION	OPERATOR SIGNATURE	COMMENTS

*__NOTE:__ In the GLAZED UNIT LOCATION column, indicate the unit # and its location on the elevation drawing.

H. TEST #7 - SHORE A TEST [OPTIONAL BASED ON WARRANTY REQUIREMENTS]

A Shore A sample should be prepared when a fresh container of either base or curative is installed on the pump, as well as at the half-way point and near the bottom of each container.

1. Apply an amount of sealant to a piece of heavy cardboard that can be struck off with a block that has a notch 1-1/2" x 3/8" (38 mm x 9 mm). Strike off the sealant so as to form a slab of sealant 1/4 to 3/8" (6 mm to 9 mm) thick x 2 to 3" (51 to 76 mm) long.
2. Record the date and time on each sample.
3. Take a Shore A reading after 24 hours.
4. Take another Shore A reading after 7 days.
5. Cut the section and check to make sure that a complete cure is taking place. Shore A reading should be recorded.
6. The Shore A reading should be taken by the hand held instantaneous reading method. Contact Tremco Technical Services for specific instructions.

SHORE A READING

PUMP # _____

Project: _____

DATE	TIME	24-HOUR READING	7-DAY READING	CROSS SEC. READING

I. ON-RATIO VERIFICATION TECHNIQUES

Dispensing of Proglaze II at the correct ratio as specified, is critical not only to the initial cure of the sealant but also to its long-term performance characteristics.

Recognizing the critical nature of this requirement, plural component equipment manufacturers have strived to engineer equipment such that a network of system checks provide indication of malfunction or the need for maintenance. In addition, the sealant manufacturers have further reviewed these systems to provide other methods of analytical verification of optimum equipment performance in order to validate that the product dispensed is within recommended ratio levels.

Volumetric and/or weight ratios are normally specified by the sealant manufacturer. In most cases, the sealant manufacturer has an established relationship with the equipment supplier who, in turn, has developed sealant specific pump systems which ensure proper sealant dispensing, metering and mixing given the unique characteristics of that sealant. Variables, which may affect pump specification, include sealant component viscosities, flow characteristics, volumetric ratio and mixing ease. When ordering equipment for a specific plural component sealant or when switching from one sealant supplier to another, it is critical that the user work closely with the equipment manufacturer and sealant supplier to validate that proper equipment configuration exists.

In any case, when a question of equipment or sealant performance arises, we recommend that the user consult with both parties to identify the issue and then implement an effective solution.

We recommend that the information derived from the above quality control test procedures be documented on the charts listed above. A copy of this project logbook document should be filed by the customer and made available upon request.

IX. GUIDE FOR REGLAZING

The design professional, when designing structural glazing systems, should address glass replacement needs and accessibility.

Glass replacement must allow for proper glass support, bite, edge clearances and tensile bead sealant dimensions. Tremco Technical Services must be involved in this investigation and in subsequent replacement/reglazing procedures. The reglazing procedures will incorporate temporary retainers for holding the glass in place while the replacement sealant cures.

There are basically two types of replacement failures:

1. Glass Failures

2. Sealant Failures

- **a.** Adhesive
- **b.** Cohesive

After a thorough investigation to determine the cause of failure to the satisfaction of all parties involved, reglazing should commence immediately.

A. GLASS FAILURES

For the replacement of glass due to failures such as broken glass or a failed I.G. unit, proceed as follows:

1. Remove existing glass by cutting the tensile bead and weatherseal. The sealant adhering to metal (tensile bead) and glass (weatherseal) may be removed with an utility knife or a razor blade. A small portion of the sealant is to remain adhered to the metal (approximately 1/16" [1.6 mm]). **Caution:** All loose sealant or shavings must be removed.

2. Before setting new glass, wipe the remaining tensile bead with IPA (Isopropyl Alcohol) using the 2-rag wipe method. Reinstall all compatible spacers and setting blocks.

3. Set the glass and install temporary retainers as required. The opening is now ready to be resealed.

4. Mask the joint, install the new silicone sealant, and tool; then remove the masking.

5. Allow the replacement sealant to cure following Tremco's recommendations; then remove retainers sealing the retainer voids with the silicone sealant.

Note: The replacement silicone sealant shall be approved by Tremco prior to the beginning of the work.

B. SEALANT FAILURES

Tremco shall be notified of any sealant failures in a structural glazing project. A thorough review of the total glazing system is required to determine the reasons/causes for the failure. Once Tremco has investigated the matter, a Tremco Technical Services Representative will establish specific reglazing procedures to be followed.

Some general questions to be addressed prior to the repairs of the job:

1. What cleaners/primers are to be used?

2. How long should the replacement silicone cure before removing the retainers?

3. Is there room for attachment of the temporary retainers?

4. Is the replacement sealant bead (tensile bead) adequate for load requirements?

5. Are replacement spacers and setting blocks compatible?

6. Is the replacement silicone the same as original?

6. Did Tremco provide adhesion and compatibility testing for substrates for this project?

Resolving these and other questions as they arise will lead to successful replacement and continued service.

X. APPENDIX

A. STRUCTURAL GLAZING TESTING INITIATION FORM

Project Name and Location:_____

Sales Rep:_____ Customer Name:_____

Wind Load:_____ Company Name:_____

Company Address:_____

Circle all that apply.

Structural Glazing Type: **1 sided** **2 sided** **3 sided** **4 sided** **Sloped glazing**

Structural Sealants to test: **Spectrem 2, Proglaze SSG, Proglaze II**

Check all that apply.

Submitted Metal for Testing:

Metal Finish: ❑ Anodized ❑ Alodine ❑ Paint:

Manufacturer:_____

Paint Color:_____

Paint Code:_____

If more than 1 paint is required please include information in additional comments section*

Check all that apply.

Glass: Manufacturer_____

Type: ❑ Monolithic ❑ Laminated ❑ Insulated

Coatings: Manufacturer:_____

Coating Name:_____

Coating Color:_____

Check all that apply.

Accessories: **Rubber Type:**

Spacers Manufacturers:_____ ❑ Silicone ❑ EPDM ❑ SCR ❑ Other

Gasket Manufacturers:_____ ❑ Silicone ❑ EPDM ❑ SCR ❑ Other

Setting Block Manufacturers:_____ ❑ Silicone ❑ EPDM ❑ SCR ❑ Other

Check all that apply.

Test Procedures:

❑ Tab adhesion (ASTM 1193 Appendix) ❑ ASTM C794 Adhesion-in-Peel

❑ ASTM C1248 Stain Testing (Optional)

❑ ASTM C1087 Compatibility For: ❑ Accessories ❑ Glass Coatings

Check all that apply.

Primers:

❑ TREMprime Silicone Metal Primer ❑ TREMprime Silicone Porous Primer

Sample Sizes and Requirements:

- Tab adhesion – metal requirements: one sample of 4”x6” (10 cm x 15 cm) project specific metal per sealant
- ASTM C794 – metal requirements: square flat metal, 4 samples of 4”x6” (10 cm x 15 cm) project specific metal per sealant
- ASTM C1087 – accessories: three 3” sample of each; glass: three 12” x 12” (30 cm x 30 cm) samples

Send Samples to:

Charlotte Guerrero
Tremco Inc.
3777 Green Road
Beachwood, OH 44122

Additional Comments:_____

X. APPENDIX

B. DEGLAZE TEST LOG

Sealant Adhesion and Cure Quality Control Log (Deglaze Test)	
Company Name & Location:	
Project Name & Location:	
Dispensing Pump Type & Location:	
Frame Description:	**Cleaning Solvent:**
Primer:	**Primer Lot Number:**
Base Lot Number:	**Curing Agent Lot Number:**
Glass Description:	**Frame Number:**
Sealant Application Date:	**Deglaze Test Date:**

Results and Observations:

Measured SG Bite (Glass):

Measured SG Bite (Frame):

Measured Glueline Thickness:

Joint Fill:

Sealant Mix:

Air Entrapment or Bubbles:

Sealant Adhesion to Frame:

Sealant Adhesion to Glass or Panel:

Sealant Cure Uniformity:

Other Observations:

X. APPENDIX

C. TECHNICAL SERVICE BULLETIN NO. S-08-47

LAB TESTING REQUIREMENTS

In order to effectively execute project testing requests in a timely manner, we are establishing the following sample size requirements. Estimated test completion times, which include report generation, are also included. Testing will commence upon receipt of all pertinent project samples and completed laboratory test form.

1. Tab Adhesion: A bead of sealant is applied to the clean substrate, primed and unprimed. After curing for 14 days, a dry pull is done and the substrate is immersed in water for 7 days. A wet pull is done and findings are reported. A 4" x 6" x ¼" (10 cm x 15 cm x 6 mm) sample for each sealant is recommended; however, a sample that is representative of the job is acceptable. For structural glazing applications, a sample that is representative of the job is required. Estimated completion time – **4 weeks.**

2. ASTM C794 Adhesion-in-Peel testing: Four pieces of wire mesh are embedded in the sealant on the substrate, primed and unprimed. The samples are allowed to cure at room temperature for 7 days, placed in the 158 °F (70 °C) oven for 7 days, back at room temperature for 7 days, and immersed in water for 7 days. The samples are then pulled on the Instron to get the average peel (pli) strength and the % Cohesive or Adhesive Failure. Four 4" x 6" (10 cm x 15 cm) flat samples for each sealant are required. Estimated completion time – **5 weeks.**

3. ASTM C1087 Compatibility testing: A 1 to 2" (25 to 51 mm) piece of accessory is place on a piece of glass and half is covered with the test sealant and the other half with a reference sealant. They are allowed to cure at room temperature for 7 days and then placed in the UV box for 21 days. The findings are then reported – Staining of sealant, adhesion to glass, adhesion to accessory, and any other observations. Three 3" (8 cm) long gaskets or accessories are required for each sealant. Estimated completion time – **5 weeks.**

4. [OPTIONAL] ASTM C1248 Stain testing: Twelve H-beads are made and filled with sealant and allowed to cure for 21 days at room temperature. Three assemblies of 4 H-beads under compression are created. One assembly is placed at room temperature, one in the UV box, and one in the 158 °F (70 °C) oven for 14 days. Two H-beads from each assembly are removed and broken with a mallet to check for staining. The remaining H-beads are removed and broken after an additional 14 days. A 12" x 12" x 1" (30 cm x 30 cm x 25 mm) sample for each sealant is required. Estimated completion time – **2 months.**

When completed, the test reports will be issued to the pertinent sales representative. The representatives are to issue the cover page summary to the customer.

Charlotte Guerrero
Technical Services
Tremco Commercial Sealants & Waterproofing Division

Please contact Tremco Technical Services at 866-209-2404 with any questions regarding this bulletin.