



Structural Glazing Appraisal Program

Pecora Corporation

Technical Bulletin No. 56

What is Structural Glazing?

Structural Glazing is a system of bonding glass to a building's structural framing members utilizing a high-strength, high-performance silicone sealant specifically designed and tested for structural glazing. In structural glazing applications dynamic wind loads are transferred from the glass by the structural silicone sealant, to the perimeter structural support.

Why Structural Glazing?

Structural silicone glazing has become the fastest growing form of curtainwall construction in use today. The system allows for broader architectural flexibility in achieving dramatic design accents for new and old buildings specifically:

- It increases the thermal efficiency of buildings because the exterior exposure of metal framing is either reduced or eliminated.
- It reduces or eliminates water and air infiltration.
- It reduces the potential for thermal breakage of glass.

What is the purpose of this Structural Glazing Appraisal Program?

Acceptance by the construction industry and architectural community of this innovative form of glazing has placed significant new responsibilities on all parties involved in the process. Each of these participants must complete specific tasks in their areas of expertise with the highest degree of proficiency in order to ensure a successful structural glazing installation. The Structural Glazing Appraisal Program addresses all of these concerns with particular emphasis on the structural silicone sealant. The sealant manufacturer

must keep pace with technical advances to ensure that the best quality structural glazing methods are available in implementing these glazing techniques.

Pecora feels these guidelines are necessary. There is no room in structural glazing for guess work or "second best". Following the essential elements of structural glazing as stated in this bulletin will contribute to a sound structurally-glazed curtainwall project. Failure to do so may result in job failures with considerable liability involved for all parties concerned.

THE PARTICIPANTS

The Architect/Engineer

The Architect/Engineer establishes all design parameters, such as wind loads, unit sizes and performance criteria, and verifies that all shop drawings are submitted in accordance with structural design requirements. He or she may require that drawing review and substrate testing results by the sealant supplier/manufacturer be submitted in writing for further review prior to the start of glazing.

The General Contractor

The General Contractor has the overall responsibility for the project construction and is specifically charged with overseeing compliance with all specifications.

The Curtainwall Designer/Supplier

The Curtainwall Designer/Supplier furnishes the curtainwall system that meets the structural requirements established by the Architectural/Engineer. This includes providing a compatible substrate with sufficient design clearance to allow the proper amount and placement of the structural silicone sealant and a consistent application of the required metal finish, i.e.,

anodizing or architectural coating. It is absolutely vital that all finishes provide a substrate to which structural silicone sealants will adhere on a long-term basis.

The Glass Supplier

The Glass Supplier takes wind load, glass area and dimensions into account to confirm that the glass type and thickness are adequate for the installation.

The Structural Silicone Sealant Supplier/Manufacturer

The Structural Silicone Sealant Supplier/Manufacturer has responsibility for:

- Recommending the proper sealant for the job.
- Reviewing shop drawings to confirm the required widths of the sealant bead.
- Reviewing joint shape and location.
- Testing all substrates with contact or are in proximity to the sealant.
- Recommending proper surface preparation and sealant installation procedures and working in concert with the glazier.

The Glazier

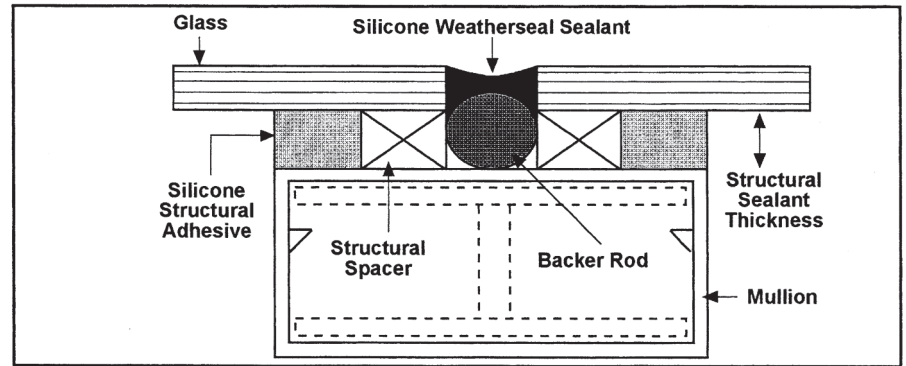
The Glazier, who is THE key member of the process for field-glazed projects, has the responsibility for:

- Conducting preliminary field adhesion tests of the structural silicone sealant to confirm the laboratory evaluations.
- Performing proper surface preparation.

The Program:

As a major member of the building team, Pecora offers this complimentary Structural Glazing Appraisal Program, which is intended to reduce the risks for all team members. Compliance with the program is a requirement of all projects using Pecora structural silicone sealants.

TYPICAL STRUCTURAL GLAZING DESIGN



The drawing above illustrates the most commonly used detail in structural glazing. It would apply to both 2- and 4-sided support systems. If insulating glass utilizing a two-part sealant is used, the weather seal must be a non-acetoxy silicone sealant. The structural seal is isolated from the insulating glass edge by spacer gaskets.

- Installing back-up materials, spacer shims, setting blocks and gaskets.
- Applying the structural silicone sealant.
- Conducting post-application testing of silicone sealant adhesion.

2-Sided vs. 4-Sided Glazing

Two-sided structural silicone glazing provides mechanical support for the window head and sill. Only the vertical joints are structurally adhered to the supporting structure. The dead load of the glass weight is supported mechanically. The live load is carried on two sides by structural silicone sealant, and is carried at the head and sill by mechanical fastening.

No distinction should be made between two or four-sided support when the design of the structural silicone bead is undertaken. The function of the structural seal is critical in either system. Two-sided systems require the same degree of care in design and application as four-sided systems.

Safety Factor

As applied to structural glazing, "safety factor" is the ratio of a sealant's ultimate tensile strength to the normally used design stress of 20 psi. Safety factors of 5:1 and 6:1 have proven adequate since the inception of structural glazing and are the most commonly specified.

Considering the number of variables possible in a structural glazed system, as well as the potential liability, the higher the safety factor the more tolerant of errors the system becomes.

Basic Guidelines for Structural Glazing Details:

- Structural sealant thickness must not be less than 1/4 inch (6mm).
- Structural bite must not be less than sealant thickness.
- Structural bite (inches) =

$$\frac{0.5 \times \text{smallest leg of window (ft)} \times \text{windload (psf)}}{\text{Sealant design strength (20psi)} \times (12\text{in/ft})} =$$

- Always round up when using the above equation. For instance, a 4-foot x 8-foot lite under 40 pounds per square foot windload requires 0.3333 in. (8.47 mm) of silicone. This is then rounded up to 3/8 in. (9mm). Never round down.
- The structural sealant joint must be able to be filled using standard caulking practices.
- The structural joint must not move during the cure.

Shop Drawing Review

Pecora will perform a review of all shop drawings and details pertinent to sealant application to confirm the required contact widths of the bead. Each request for review must be accompanied by the following data:

- Project name and location.
- Name and address of architect.
- Dimensions of the lite (Width x Length).
- Sealant contact width and joint width dimensions.
- Design wind load specified by the architect expressed in pounds per square foot (PSF).
- Glass type and manufacturer.
- Metal framing type, finish and manufacturer.
- Spacer and setting block type and manufacturer.

Laboratory Testing

Pecora will perform laboratory adhesion and compatibility testing of all substrates that either directly contact or come in close contact with the structural silicone sealant. Samples of each substrate must be submitted in the quantities requested on page 3. **The samples should be from an actual production run for this project.**

- **Metal** - six pieces minimum, 4" x 6" with specified finished identified,
- **Glass** - six pieces minimum, 4" x 6" with manufacturer and type identified,
- **Gaskets, Spacers and Setting Blocks** - one piece each minimum, 12" long with manufacturer and type identified,
- **Insulated Glass** - one piece with edge sealant intact, or one sample, 12" long, of insulated-glass edge sealant with manufacturer and type identified.

Note: *If insulated glass is used, it should be a high-quality, dual-seal unit with a silicone secondary seal which has been certified by an approved agency such as IGCC. Compatibility of the structural silicone sealant with the insulating glass edge seal must be verified.*

Compatibility of Materials

Evaluation of sealant compatibility with pre-formed rubber parts, such as spacers, setting blocks and gaskets, and/or with the materials used in fabrication of these parts is considered a vital step in process. The reason for this is that these parts or materials must not cause a color change in the sealant. Color change indicates a chemical reaction between the performed rubber parts and the structural silicone sealant. This reaction may, in the long run, cause a complete loss of bond between the silicone sealant and the glass and/or metal substrates especially when they are exposed to ultraviolet light. Our experience shows that some organic rubbers, such as Neoprene and EPDM, when exposed to UV can cause color change and adhesion loss of the sealant, and they, therefore, are judged not compatible, and should not be used in structural glazing systems.

Surface Preparation

No sealant will maintain long-term adhesion to any substrate if the surface is not prepared and cleaned properly before the sealant is applied. The use of proper materials, as well as following prescribed surface preparation and cleaning procedures, are essential for sealant adhesion.

All loose material, such as dirt, dust, frost or other contaminants must be removed from all surfaces to achieve good adhesion of the structural silicone sealant. Non-porous substrates such as glass and aluminum must be thoroughly cleaned.

Pour or squirt solvent onto a cloth. Do not dip the cloth into the container of solvent. Wipe vigorously to remove surface contaminants. Move the cloth to a wiped area and rewipe until no dirt or oily material is evident on the cloth. Immediately wipe the solvent-cleaned area with a second clean, dry cloth. The solvent must be removed with the dry cloth before it evaporates or the cleaning will be ineffective.

Do not spread the contaminants being removed by the solvent over the face of the area being cleaned. Any residue left may discolor or stain the face of the panels. Clean only as much as can be sealed in one hour. If cleaned areas are again exposed to rain or contaminants, the surface must be cleaned again. Change rags frequently as they become dirty. Use only clean solvent. Should it become contaminated in some way, change to a fresh supply, as cleaning with dirty solvent can result in serious sealant adhesion problems.

Only after the substrates have been properly cleaned in this manner may primer, if required, or the silicone sealant be applied.

Note: *Solvents usually are flammable and toxic. Follow carefully the solvent manufacturer's label instructions and precautions. Refer to applicable Safety Data Sheets.*

Primers

Various substrates or finishes might require the use of a primer. The type of substrate and/or finish will determine whether and which primer might be necessary in a particular application. Primers, when used properly, enhance sealant adhesion to surfaces to which adhesion may be difficult. Only apply primers to substrates identified by Pecora in each application.

- Mask joint edges to ensure that primer is not misapplied to adjacent surfaces.
- Brush or wipe (depending on primer used) a thin film of primer to the joint surface. Do not puddle primer in glazing pockets.
- Allow primer to dry before applying the sealant. Drying time is dependent upon ambient conditions, but waiting time should be no more than 5 to 15 minutes in most cases.
- NEVER apply or allow primers to come into contact with glass surfaces.
- Priming is NEVER a substitute for proper cleaning and surface preparation.

Note: *Primers usually are flammable and toxic. Follow carefully the primer manufacturer's label instructions and precautions. Refer to applicable Safety Data Sheets.*

Sealant Application:

- Use pressure-sensitive tape to mask the exterior face of the joint. Start from the top down and overlap the runs.
- Cover areas below caulking area to catch any excess sealant removed during the tooling operation.
- Use a standard cartridge caulking gun. If using air-powered guns, do not exceed 45 PSI.
- Carefully apply the sealant from the bottom of the joint upward making sure that the entire cavity is filled. Air pockets and voids are not acceptable and should be removed with tooling.
- Tool the joint immediately after application before the sealant begins to form a skin. Tooling should be neat while forcing sealant to completely wet the sides of the joint. Dry tool or use a solvent; never tool with soap or detergent solutions.
- If the glass is installed in a vertical position, temporary stops must be used to mechanically fasten the glass to the frame while the sealant is curing.

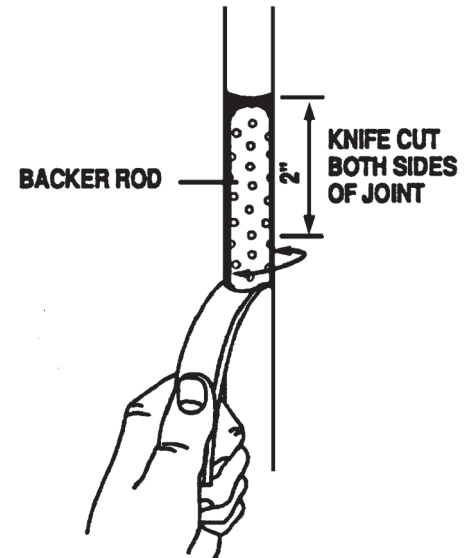
Post Application Considerations
Field Testing - as a final check of ultimate sealant adhesion, the following described field-adhesion test should be conducted by the Glazier:

1. Depending on the sealant used, let cure for 14 to 21 days and then conduct a hand peel test.
2. Make a knife cut horizontally from one side of the joint to the other.

3. Make two vertical cuts approximately two inches long at the sides of the joint meeting the horizontal cut at the top of the two-inch cuts.
4. Grasp the two-inch 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.
5. If adhesion is good, sealant should tear cohesively or be difficult to adhesively remove from the substrate.
6. Sealant may be replaced by applying additional sealant in the same manner it was originally installed.

• Maintenance Program

All structurally sealed joints should be inspected annually by a reliable agency approved by the design professional and the building owner. During these inspections, special attention should be given to those installations involving structurally glazed insulated glass. Any unit exhibiting evidence of condensation within the confined air space and the glass lites should be replaced as soon as possible. Failure to replace such defective units may eventually impact on the structural integrity of the system and possibly cause extensive damage to the structure, as well as danger to the building occupants and others.



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