

Warranty Issues and Sealant Service Life

Sealants are installed around the world to protect from water intrusion, the elements, chemicals, thermal movement, seismic movement, fire and much more. As a result, sealant manufacturers are developing comprehensive warranties, promising advances in sealant and waterproofing technologies that will enable products to set new performance standards, dramatically reduce construction schedules, and provide greater than ever flexibility in project design and implementation.

What exactly does a sealant manufacturer warranty? Typically, that their products are free from defects and that they will perform as tested. Sealant manufacturers consider most sealant failures to be an applicator error and thus will not receive the protection of a manufacturer's warranty. Generally, sealants fail as a result of:

- Poor Surface Preparation
- Lack of or Wrong Primer
- Excessive Bondline Stress
- Moisture During or after Application
- Installed Improperly
- Poor Tooling
- Poor Joint Profile
- Weak Substrate
- Deterioration
- Movement During Cure
- Excessive Movement
- Vandalism
- Wrong Sealant Installed

There are many more reasons "why" sealants fail, and the majority, (as listed above) is not covered under a sealant manufacturer's warranty.

There is no debating that the **contractor** is responsible for bringing a trained sealant crew to the site and being sure that the trained crew follows proper installation procedures. That the **contractor** must verify—that field conditions are acceptable for performance and installation of the work. Beginning the sealant installation constitutes acceptance of the conditions as satisfactory for the specified sealant materials. It is the **contractor** that is responsible for the design selection and installation of the sealants, as well as the performance of the sealant system. If the contractor fails in installing the sealant exactly as indicated by manufacturer's published literature, then the failure is considered a construction defect, and not a material fault.

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If a type of sealant is used in an application beyond manufacturer's stated properties then there will *be no warranty against failure*. Receiving a manufacturer's warranty requires the proper application of sealants and choosing the right material with the correct physical and chemical properties. This includes, but limited to:

- Proper Joint Design
- Consideration of the substrates to be sealed
- Performance needed
- Proper installation of the joint sealant

When a sealant manufacture responds to a reported sealant failure of claim of warranty many factors are reviewed and assessed. The specifics of the joint design and configuration must match up with the sealant's movement capabilities in real field conditions. (Beyond a warranty, the practicality of placement and aesthetics also requires consideration.) If the joinery experiences sustained movement greater than sealants physical properties, a warranty will be invalid. Modulus of elasticity, stress, tear strength, and fatigue resistance are all factors— that influences the sealant performance in a joint. To illustrate, the photo on the right is a specified urethane with a 25% ± promise of movement. The joint has experienced sustained movement greater than 25%, thus the warranty received by the owner is of no value.



It should be noted that the specification ASTM C 920 covers several classifications of sealants for various applications. It should be recognized by the purchaser or design professional that not all sealants meeting this specification are suitable for all applications and all substrates and thus may not be warrantable. It is essential, therefore, that the applicable type, grade, class, and use be specified so that the proper classification of sealant is provided for the intended use.

The proper selection and use of a sealant is fundamental to its intended use, ultimate performance, service life, and durability. A sealant joint subjected to movement and other similar performance criteria should be designed for the particular application to avoid compromising its performance capability resulting in failure. If the sealant is not designed for a particular application, failure is more

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than a distinct probability and no manufacturer's warranty is available. The majority of responsibility falls to the applicator to guarantee.

Equally important is the proper selection and use of other materials and products associated with sealant use. These include substrate cleaner, surface conditioner or primer, type of sealant backing material, bond-breaker, and joint filler, among others. The ability of a sealant installation to remain watertight is critically dependent on proper preparation, building continuity, and durability of the substrates to which the sealant will adhere, and compatibility of the sealant with the materials it will



contact, including the substrates. Implying “compatibility” of sealants upon other materials does not automatically interpret good performance. Sealant can come into contact with other waterproofing materials and paints that it may be compatible with, but pull in tension upon these materials enough to cause failure. In the photo (above) there appears to be a sealant failure, but in fact is a paint failure. The iron was pre-painted followed by the installation of silicone sealant which was deemed compatible. It was the paint that lost adhesion when the joint interface with the window below began to experience thermal-cycling.

A sealant must be compatible with the materials and surfaces with which it will be in contact. Occasionally, materials that are in close proximity, but not in contact with the sealant, which can have an effect on the installed sealant. Incompatibility with other materials can cause, as a minimum, a discoloration of the sealant or, at its extreme, sealant deterioration or adhesion loss. Compatibility must never be assumed but always established, since there are no “always compatible” combinations of a sealant with other materials. A sealant should be tested for compatibility with other sealants which it may contact and with materials and finishes it contacts or is in close proximity. Materials and finishes, with time and exposure to sunlight, can cause a sealant to change color or lose adhesion. Other sealant characteristics that could also be affected by incompatibility include the

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ability of a sealant to cure fully, its ultimate strength development, and its aesthetic qualities.

The proper application and installation of the various materials and products, following the established joint design criterion, avoids premature deterioration of the sealant joint. For a sealant joint that is difficult or expensive to access a sealant should be selected that will have excellent environmental weathering characteristics to minimize maintenance.

Common Problems That Will Nullify a Sealant Warranty

Adhesion failure in some cases may be the result of the wrong sealant chosen for the job. The chosen sealant may be too high in modulus not allowing for the anticipated movement of the structure. The rigidity of the sealant results in undue stress on the bond line at high elongation. In very-high-movement applications (more than 25% expansion and contraction), whether the sealant will fail adhesively or the sealant will pull itself apart (cohesively) or the sealant will pull the substrate apart (with weak tension properties), such results may be that the installed sealant was forced to extend beyond its intrinsic properties. The greater the distance the sealant is stretched, the greater are the forces on the bond line. Thus, forces at the bond line may be greater than the sealant should be expected to tolerate. For instance, going from 25% extension to 35% extension for polyurethane will almost double the stress at the bond line.

Adhesion was more than adequate at 25% extension, the maximum intended movement, but inadequate for the additional stress of 35% movement.

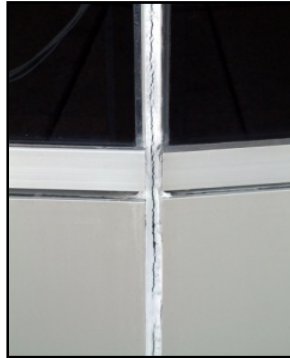
Sealants are often the least thought about and contribute the lowest percentage to a project's overall cost; however, they can become the biggest problem if a structure starts to leak.

There is both a science and an art to completion of proper joints from design to sealant placement

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Sealants cannot make up for poor structural or joint design. They require:

- Proper joint design
- Proper product
- Proper application



General Joint Design that is Warrantable:

Joint Spacing

- Must allow access for sealing joint and, if necessary, backer rod placement
- Allow sufficient bonding surface to be present

For weatherproofing, a minimum depth of 1/4" (6 mm) sealant/substrate bond, and (in most cases) minimum width of 1/4" (6 mm) opening is necessary to ensure that sealant applied from a caulking gun will flow into the sealant joints properly.

For moving joints, one also needs to consider:

- Wider joints (minimum of 1/4" width): as wider joints can accommodate more movement than narrow joints.
- Use backer rod or bond breaker tape to eliminate a situation of "three-sided adhesion"
- Use 2:1 width to depth ratio to accommodate more movement than a thick joint (i.e. 1.5:1 or 1:1 ratio). Consider "hourglass" shape.
- For joint size larger than 1", depth should be kept to about 3/8" to 1/2" (9 mm to 12 mm)
- The number and spacing of joints is critical to performance

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Placing the sealant

- Mix 2-part sealants properly (no entrained air)
- Tape outside edge of joints if necessary
- Gun sealant into joint at constant pressure and flow
- Prevent overlapping sealant
- Dry tool sealant to press material against joint walls or bonding surface
- Check work frequently and keep samples
- Maintain a job log (e.g. lot no., weather conditions, application procedure)

Materials

- Will the selected material handle the anticipated joint movement requirements?
- Will the sealant adhere to substrate properly? - This is probably the most critical element in the selection process.
- Will product endure anticipated weathering exposures?
- Is product compatible with adjacent materials?
- Does the joint size allow for sufficient placement of selected materials?
- Will the product perform under the stated conditions of use?
- Is there history of application success?
- Does the sealant supplier have the necessary in-house resources to support your application in case of problems?



Surface Preparation

- Most common failure is adhesive
- Must remove all weak material on bonding surface of porous substrates
- Surfaces must be clean, dry, free of dew or frost
- Use best practices as recommended by industry experts
- Porous: abrasive, high pressure water (allow to dry after), grinding, wire brush
- Non-porous: 2 rag method



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Poor cleaning is another primary cause of adhesive failure and loss of material warranty from a workmanship point of view. This has many aspects aside from the simple and often true statement that the worker just did not do a good job.

If a worker does not remove dust, the sealant will stick to the dust and the joint will fail. While cleaning sounds simple, removing dust from powdery surfaces can be very difficult. Some surfaces are so poor (such as poor concrete mixes) that the dust literally cannot be removed. In fact, some surfaces simply have no integrity.

Proper cleaning of joints is undoubtedly the most tedious step in the entire sealing process, but its importance cannot be overstated; no sealant will adhere to a dirty joint wall. Joint cleaning is somewhat less critical with preformed shapes, but it is still required.

Loose paint, scale, or rust on metal surfaces, laitance on the face of concrete joints, and general construction dirt must be removed before the joint can be sealed. Sound metal surfaces such as new aluminum can be cleaned with a non-oily solvent and a soft rag.



Scale, rust, and laitance are best removed by sandblasting. A clean wire brush can also be used for this purpose. In resealing work, old sealant can be cut out with a knife, and the remaining traces of old sealant can be removed from the joint faces by sandblasting or wire brushing. After sandblasting or wire brushing, the joint faces should be dusted clean with a soft brush or rag, or by vacuum. Compressed air should not be used to blow out the joints because oil from the air compressor is often sprayed onto the surface. The degree of cleanliness required by mastic sealants is almost in direct proportion to the amount of recovery in the sealant. Silicone and urethane sealants require very clean joints; whereas, at the other

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end of the spectrum, acrylic latex caulks and solvent-based acrylics require much less cleaning.

Aluminum mullions and sash, as furnished to the job site, present a special cleaning problem. Aluminum sections are often given a special lacquer finish at the factory. This lacquer coating should be removed so that the sealant can adhere directly to the aluminum. A strong solvent, such as toluene or xylene, on a clean rag can remove the lacquer.

Oily contaminants come in a variety of types. Aluminum and most other metals almost always carry oil contamination (oil from the extruder or some other source). This can generally be removed with little, if any, problem if proper attention is given to the details.

Priming

- Improves the bond in many situations
- Is not a substitute for good preparation
- Many products perform w/out primers
- Most commonly used on horizontal and submerged applications
- Must be done properly to work (primers are not error free: may cause "ponding", waiting time, adhesion failure, etc.)



Practical guidelines for safe and effective application of most primers begin with these simple steps (*always follow the manufacturer's safe handling and application requirements*). If not followed, the sealant manufacture will invalidate the warranty.

- Joint surfaces should be clean and dry. Apply masking tape (if aesthetics require) to the surfaces next to the joint to keep excess primer and sealant off areas where they are not intended.
- Pour some primer into a small, clean container, and be sure to replace and tighten the cap or lid on the primer, do not pour more than a 10-minute supply into the container.

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- Depending on the substrate and job conditions, two different methods can be used to apply the primer. The preferred application is to apply to a clean, dry, lint-free cloth into the primer and gently wipe a thin film onto the surface. For “hard-to-get-to” areas and rough surfaces such as EIFS, apply the primer in a thin film with a clean brush.
Caution: Over-priming can cause adhesion loss between the sealant and the primer. Some primers may even waterproof porous surfaces, causing uneven panel wetting in rain.
- For silicone primers, if too much primer has been applied, a powdery, chalky, dusty film will form on the surface. Excess primer should be removed by dusting the joint with a clean, dry, lint-free cloth or a non-metallic bristle brush.
- Allow the primer to dry until all the solvent evaporates. This typically takes 5 to 30 minutes, depending upon the temperature and humidity.
- Inspect the surface for dryness. Remove excess primer as described in item 4 above.

The surface is now ready for application of the backer rod and sealant. Sealant must be applied the same day the surfaces are primed. Any surfaces primed but not sealed on the same day must be re-cleaned and re-primed before applying sealant.

Backing materials: Why use backer rod?

- Attain proper wetting of substrate when sealant is tooled
- Control sealant depth
- Prevent 3-sided adhesion
- Recommended Materials are:
 - Closed cell backer rod: primarily a foam material with a surface skin
 - Open cell backer rod: primarily a foam material without a skin
 - Backing tape: primarily a self-adhesive polyethylene or Teflon material

Not recommended:

- Any rigid materials
- Silicone sealant as bond-breaker and joint fill



Keys to success:

- Backer Rods must be 25% larger than joint width so it remains during joint movement
- Don't poke holes in any backing materials, this can cause air bubbles in sealant
- Must be compressed against side walls to prevent leakage through joint and to get proper bond line dimensions
- Function ceases once sealant is applied and tooled

Structural Glazing Applications

Structural glazing involves attaching glass, metal, or other panel materials to a building's metal frame in place of using gaskets and other mechanical attachments. High-performance sealants must be able to withstand wind load and other stresses, and help to transfer these forces to the structure of the building.

For effective structural joint design, the following parameters should be considered:

- "Structural bite" - defined as the minimum contact surface of sealant required on both the panel and frame to account for such environmental factors.
- "Deadload" - the weight that a panel places on a sealant
- "Glueline Thickness" - used to facilitate the installation of a sealant; helps to reduce stress on a structural joint that might result from a differential thermal movement.

Weatherproofing Applications

- Weatherproofing helps keep rain and other weather elements from entering a building.
- To apply properly, the following parameters must be considered:
- "Joint Movement" - may occur as a result of: changes in temperature, seismic movement, elastic frame shortening, creep, live loads, concrete shrinkage, moisture-induced movements, and design errors.
- "Movement Capability" - The +/- percent value that indicates the amount of movement the sealant can take in "extension (+)" and/or "compression (-)" from its original cured joint width.

Moisture at time on sealant installation can lead to loss of Warranty

The presence of moisture can cause premature adhesion failure, especially on porous substrates and can lead to costly sealant replacement well before the end of the sealant joint's anticipated service life. In the building construction industry, sealant adhesion failures within five years of initial installation can, and often do, lead to extensive water damage to moisture sensitive wall system components and interior finishes. Although there is an abundance of sealants manufactured with expected service lives of 25 years or more, a high percentage of installed joint sealants fail prematurely due to poor durability of the adhesive bond.

Many premature weatherseal failures are a result of moisture concentrated at the sealant bond line (sealant to substrate interface). Sealants designed for use as an exterior seal against the elements are sometimes mistakenly applied to damp substrates because the substrate surface may appear dry while underlying moisture is present. Residual moisture is frequently present in porous substrates during construction, but it is rare that tests are performed prior to sealant



Saturated Precast Panels

application to assure that the substrates have dried sufficiently. In addition, porous substrates will sometimes become saturated within the sealant joinery when exposed to extended periods of rainfall or if leaks through windows, claddings, etc., deposit water into the wall system behind the sealant joint, creating a saturated condition.

Elevated moisture in porous substrates is particularly detrimental to adhesive bond development. Monitoring substrate conditions, at the time of sealant application, may help applicators avoid sealing to damp substrates and thus, avoid potential sealant failures.

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General contractors need also to be involved with the sealant applicator to ensure that sealants are not installed during more climatic and wet conditions. Since sealant substrates may, in some instances, become saturated for extended periods of time or become immersed in water, it would be advisable to contact the sealant manufacture for information regarding the affect of elevated moisture levels at the time of installation.

Since job site conditions of all kinds can affect the performance of joint sealants it is imperative that before the installation of the sealant begins that the joinery is examine with the Installer present, for compliance with requirements for joint configuration, installation tolerances and other conditions affecting joint sealant performance. Installation of joint sealant should not proceed until ALL unsatisfactory conditions have been corrected. Most commercial caulking contracts makes the caulking contractor RESPONSIBLE for ALL existing conditions at the moment of beginning the sealant work. Ignorance of other building envelope specifications is no excuse and all unsatisfactory and defective work encountered may be at the sealant contractors expense.

General contractors under a difficult and fast-track building schedule to install sealants in conditions not applicable to a successful installation can result in sealant failure and loss of warranty.

Shooting the Sealant – Sealant Application Procedure

- It is critical that the sealant fills the entire joint or cavity and firmly contact all surfaces intended to receive sealant. If the joint is improperly filled, good adhesion will not be achieved, and sealant performance will be weakened.
- To obtain full adhesion, sealants require a clean, dry, frost-free surface. Although silicone sealants have excellent wide temperature gunnability, the practical application temperature can be dictated by frost formation on the joint edges, which can begin to occur below 40°F. To assist in the drying of a frost-containing joint, a water-soluble solvent such as MEK or IPA should be used.

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Sealant should be applied as follows:

- If required, masking tape should be used to keep excess sealant from contacting adjacent areas where it is not intended to ensure an aesthetically pleasing job.
- Apply the sealant in a continuous operation using a caulking gun or pump. A positive pressure, adequate to fill the entire joint width, should be used. This can be accomplished by “pushing” the sealant against the backing material forcing the sealant to the joint walls. Care must be taken to ensure complete fill of the sealant cavity. Excess material can be removed by back tooling with a spatula or tuck pointer (of proper size) or tooling against the masking tape and pulling the tape immediately after.

Poor or insufficient **TOOLING** can lead to loss of a manufacturer’s warranty. Tooling requires skilled hands and knowledgeable eyes, and must be done with some care never exceeding less the 1/4” inch minimum depth at the concave (center in profile) for most silicone sealants and 3/8” to 1/2” inch for most polyurethane sealants. However, should the sealant bead be too thin at its center in profile, the sealant under compression will buckle like a slender column and appear as a ripple in the overall aesthetics of the joint appearance. This condition cannot be warranted.

In addition to having the proper shape in profile, the elastic sealants must be bonded to only two sides of the joint in order to perform properly. The bottom surface of the sealant must be free to deform under compression and extension forces to the joint dimensions. There cannot be “three-sided adhesion creating additional forces beyond the material’s designed performance within the joint cavity. Three-sided adhesion can be explained quite simply by the analogy of a rubber band, adhered at the edges and free to stretch in the middle. The longer



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the rubber band, the greater is the absolute movement. So it is with sealant, properly installed, adhering to two opposing pieces of materials forming a dynamic butt joint.

When tooling these simple guidelines are recommended:

- Tool the sealant with light pressure before a skin begins to form (typically 10 to 20 minutes). Tooling forces the sealant against the back-up material and the joint surfaces, improving adhesion and reducing the risk of weak points and blisters caused by entrapped air. Do not use liquid tooling aids such as water, soap or alcohols; i.e., isopropyl alcohol (IPA). These materials may interfere with sealant cure and adhesion and create aesthetic issues.
- Remove masking tape (if used) before the sealant skins over (within about 15 minutes of tooling).
- Use only dry tooling techniques to strike a flush joint and make certain the sealant has fully “wet” the joint walls.
- Always tool in both directions. For best sealant performance tool a concave surface with a correctly tapered spatula or tuck pointer for recessed joints. A concave sealant bead (hourglass in profile) is best for reducing internal stresses from joint movement.
- Tooling achieves a visually satisfactory finish. Sealants in rough or exposed aggregate panels are best applied and finished with a slight recess. Recessed sealant is best applied with a straight tuck pointer (to size) with the corners slightly rounded.
- After tooling, be sure the minimum depth of sealant is in accordance with the sealant manufacturer’s recommendations.

When installing sealant to the joint:

Push the bead, don’t pull it. A first pass with the tool may be advisable; just to knock down any excess and level out any “valleys” in the sealant bead. This first pass will also help the installer to determine if enough sealant has been delivered to the joinery. The bead can be pushed up or down, right or left, or at any angle.

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What determines a push versus a pull is that a bead of sealant is pushed when it is building up in front of the nozzle; if the sealant is stringing out behind the nozzle, it is being pulled. Pulling may be very obvious, in that gaps can sometimes be seen as the sealant is installed. Pulling may not be obvious, but just as disastrous, if a slight pulling of a well-fitted nozzle leaves a good-looking surface and one that will tool well (sealant is stretched from edge to edge of the joint) but copious quantities of air are trapped beneath the good-looking surface. A good general rule is that pulling will always trap air, even if the appearance of the bead is perfect. Pushing, on the other hand, almost always minimizes air containment. If a hidden flaw is found in the sealant bead the sealant manufacturer will invalidate his warranty.

Once air is entrained in a non-slump product, it never comes out. It may stay at the sealant substrate interface and thus give no adhesion at that point, or it may move more to the center of the bead during the tooling step. Here it causes a weak spot, much like the bubbling backer rod, and causes the same kind of problem. It is considered an applicator error. Clever techniques and special nozzles are part of the art and science of proper sealant installation. As with most jobs, proper knowledge and equipment are the prerequisites to quality work.

Since the temptation to pull is always present, it is very important that the worker be educated to push the bead properly. If the worker knows why a special technique should be used, there is a greater chance that he will use it.

Once sealant has been installed in the joint opening cavity properly it must be tooled to obtain proper sealant adhesion to a substrate. It is essential that the sealant is tooled into direct contact with the substrate and that the sealant wet the substrate surface. If any of these conditions are not met, poor or no adhesion will usually result. A sealant should be installed in a manner that will completely fill the cavity formed in the joint opening by the substrates and sealant backing or bond breaker. Some sealant applicators can accomplish this by pushing the sealant bead ahead of the nozzle of the gun, others with the nozzle bridging the joint opening, although there is increased risk of incomplete filling with this approach. When sealant is installed in an opening with a porous substrate, the

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sealant must enter the pores of the material if good adhesion is to be obtained. A non-sag sealant may resist flow into the pores unless an external force is applied. Proper filling of the cavity with sealant accomplishes this in part, followed by proper sealant tooling. Tooling should be accomplished as soon as possible after the sealant application and must be completed before skinning or curing of the sealant begins. Typically, a project site mockup trial installation would assist in determining the type of tooling procedure to use.

In Horizontal Applications, often sealants can have good adhesion and cure properly. But, catastrophic damage to the sealant from foot traffic, vandalism, discoloration due to spills, are often seen by an owner as a warrantable item, especially when these appear relatively quickly within a few months after installation. Trying to educate an owner that these problems are not a product or installation issue and are normally handled by ongoing periodic maintenance is swiftly ignored. Difficulty escalates when a urethane manufacturer is willing to offer a 5 year warrantee on the sealant installed in sidewalk joinery and then the sealant is completely destroyed in two months at a popular mall visited by over 10,000 people a day. It is often the position of the owner that the sealant applicator has a responsibility to meet their obligation of the five-year warranty. The caulking contractor may be understood to have recommended the installed sealant material, with full knowledge of the existing conditions and the extent of pedestrian traffic.



The urethane sealant industry is normally very cautious with warranties for sealants used in traffic applications, as the longevity of the sealant installation has more to do with the degree of abuse than it does with 'aging' of the materials. Degradation due to physical damage from traffic, cleaning procedures and vandalism are always a concern and are specifically not covered under sealant warranties.

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Urethane sealants in general as specified for sidewalk installations offer limited abrasion resistance since they must also possess elastomeric qualities allowing for thermal movement of the concrete in expansion and contraction. Therefore, urethane sealants are considered a “maintenance installation” and require upkeep for which the owner is ultimately responsible.

Typically, in commercial construction, reference literature, Technical Data Sheets, and outline spec components, along with proposed applicator warranties are all delivered to the project design team for approval. The applicator does not act as a consultant or specifier and therefore expresses no prejudice of product or products to be used.



Submittals for materials along with a *limited warranty* are reviewed and approved by the owner before work is started. This is not enough to ensure sealant performance in a facility that may attract 10,000 people a day, or 20,000 heels forcing themselves upon the sealant.



When dealing with any problematic sealant installation, it is doubly important to understand the root causes of the issues faced so a repair recommendation can accommodate the underlying dynamics that are identified. This level of detail is not commonly found in manufacturer’s standard

technical literature for most materials.

Sealants shown to be suffering from mechanical damage caused by individuals, tools or other outside agents of course is not covered under any approved warranty document provided by the sealant manufacturer. Sealant warranties are *limited* and specifically exclude degradation due to physical damage from traffic, cleaning procedures and vandalism. Especially in a horizontal application, sealants require inspections and maintenance. Not doing so can result in additional sealant joint failure and deterioration of the substrates, as with all sealant applications.

Because of the frequent failures of urethanes in horizontal, some contractors have begun using medium modulus **silicone sealants in horizontal applications**. Has this produced better results? While the silicones maintain

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adhesion equally with urethanes when installed correctly in sidewalks with firm support under the sealant, overall the results in high trafficked areas are very similar.

In a popular sports arena in Everett Washington, silicone sealant was substituted instead of the specified urethane sealant for the precast seating statia. In a two year period the horizontal sealants received the same types of failures as experienced with urethane sealants in similar applications.



In several aisles leading into the auditorium the joinery is located down the middle of the walkway exposing the silicone sealant to the added downward force and weight of direct heel contact. This has resulted in complete failure to the silicone sealant. The damage observed consists of adhesion loss and numerous punctures through the sealant bead.



The facilities director has responded with covering the joinery with a thin gauge metal flashing attached with safety tape over the edges to hold it in place.



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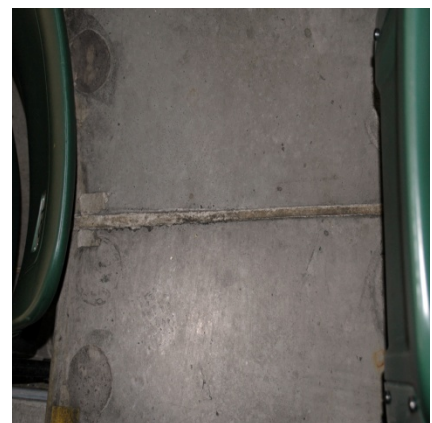
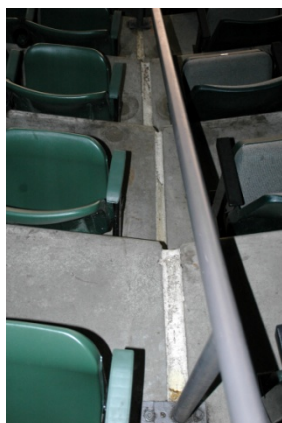
Examples of force visited upon the silicone sealant in the precast stadia produced punctures through the sealant and adhesive separation.



Examples of wider stadia joinery over 2 inches and in some locations the width of the joinery measures 3 inches. Excessive and repeated force upon the sealant has caused loss of adhesion.



There were examples of joinery in the stadia precast that has held up and performing well when protected by a hand rail. It appears that the joinery no larger than 1 inch performed best against the foot-traffic.



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The sealant industry continues to offer extended warranties for their sealants, ensuring quality and confidence in their installations. Most sealant materials offered by the major sealant manufacturers perform very well and hold up to manufacturer's published data. Still, it must be noted as is brought forward in this writing, that it is the applicator of sealants that carries the majority of responsibility for warranting the installation of high performance sealants. The sealant industry (as a whole) has not yet come forward with the much needed training and education in the field for those who are actually installing sealants. The art of sealant installation is seldom shared through any set standards.

The success or failure of the sealant often depends on the attention to detail by the installer himself, not the manufacture. The skill and education of the installer in the field is extremely important.

This acquired skill and education is extremely important, for the sealant applicator must not only know the performance characteristics of the sealant material, i.e. compatibility, durability structural and non-structural applications, but also become familiar with a wide variety of substrates and how to prepare them to successfully insure good performance.

Today, sealant is a minor item when the cost of a building is considered. It has none of the glamour or impact of structural concrete, structural steel, heating, air conditioning, design, solar loads, and many of the other considerations that go into a building's design and construction. Thus, the importance of sealants is often overlooked, and the subject rarely appears in the curricula of architectural and engineering schools.

The importance of good seals is noted when walls discolor, important papers are soiled, machines get wet and fail, or floors and rugs are ruined because of water intrusion. With the increasing popularity of the curtain wall, damage to anchors, pins, and fixtures holding the curtain wall to the supporting wall or frame has become an issue.

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Sealant contractors and sealant suppliers are brought to court along with the architect and general contractor when problems of high financial impact occur. Thus, the attention being paid to good sealant practices is growing.

If the design is good and the sealant lives up to its promises, then the responsibility for a good seal falls to the applicator. A successful and warrantable sealant installation requires the right materials and proper installation. The best protection to sealant installations is the eventual certification of sealant applicators, or the credentials to indicate that the worker has mastered the basic skills.

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