



United Professional Caulking & Restoration, Inc. Joint Surface Preparation and Sealant Application



This application procedure outlines general requirements for installing most silicone and urethane sealants. By following these procedures closely, you will help ensure good sealant performance. Sealants are applied in many different environments and situations; these procedures are not intended to be a complete and comprehensive quality assurance program.

How well the sealant adheres to the surface will depend upon how much care has been taken before sealant application. Joint preparation begins with an inspection at the site by the sealant contractor to be sure all joint dimensions are the same as those in the specifications. If the width or depth of joints varies from those specified due to positioning of the components, improper component size, flaws in workmanship, weathering or other joint altering conditions, all parties should be notified.

Field adhesion tests are required to ensure good sealant performance and to verify any sealant recommendation.

In preparing for sealant application, the two most important characteristics are its adhesive and cohesive properties

JOINTS, Type and Function

There is movement in structures regardless of size, height, and width. To accommodate or cushion structural movement, there is need for elastic joints at varying strategic locations throughout the exterior of a building. In addition to the problem of potential torsion, seismic, or vibrational stresses, the dimension and location of joints are directly related to the tolerances and thermal movement characteristics of various substrates that make up the structure, potential shrinkage, and design esthetics.

Construction Joints

Construction joints are designed and created as a matter of “breaking up” lengthy expanses of a building’s surface. The precise locations of these joints are predetermined by the architect, engineer, and, in some cases, the contractor. The construction joints can be called upon to function as expansion and/or contraction joints to accommodate the normal or even radical movement of a structure.

Expansion, Contraction and Isolation Joints

Expansion or isolation joints prevent crushing and distortion (including displacement, buckling, and warping) of the structural unit that could be caused by expansion or settlement. They are used primarily to isolate walls from floors or roofs, columns from floors or cladding, and pavement slabs and decks from bridge abutments – thus the name “isolation joints.”

Control Joints

Control joints are designed to control cracking that might occur from the contraction of the structure. They are used frequently to divide large, relatively thin structural units, such as pavements, floors retaining and other walls, into smaller panels.

Movement and Butt Joints

Joints are generally described according to their function and, in the absence of universally accepted terms, often in more than one way. A movement joint (DYNAMIC JOINT), for instance, refers to a joint that will expand and contract with a change in temperature. It is also called a “working joint” or a “dynamic joint.”

Movement joints perform as butt joints or lap joints. Butt joints (more commonly used) are designed if the structural units being formed abut each other. Lap (or shear) joints are used when the units being formed override each other, and any relative movement is one of sliding. The difference in the movement that takes place between structural units at butt joints and lap joints determines, in part, how the sealant will perform.

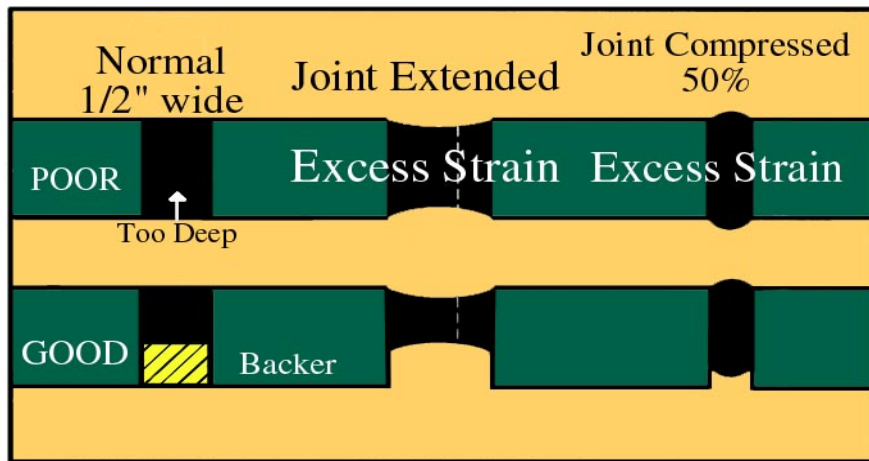
Non-working and Static Joints

A joint designed for minimal stress or no stress is described as a “non-movement” joint. Other names are “non-working joint” and “static joint.”

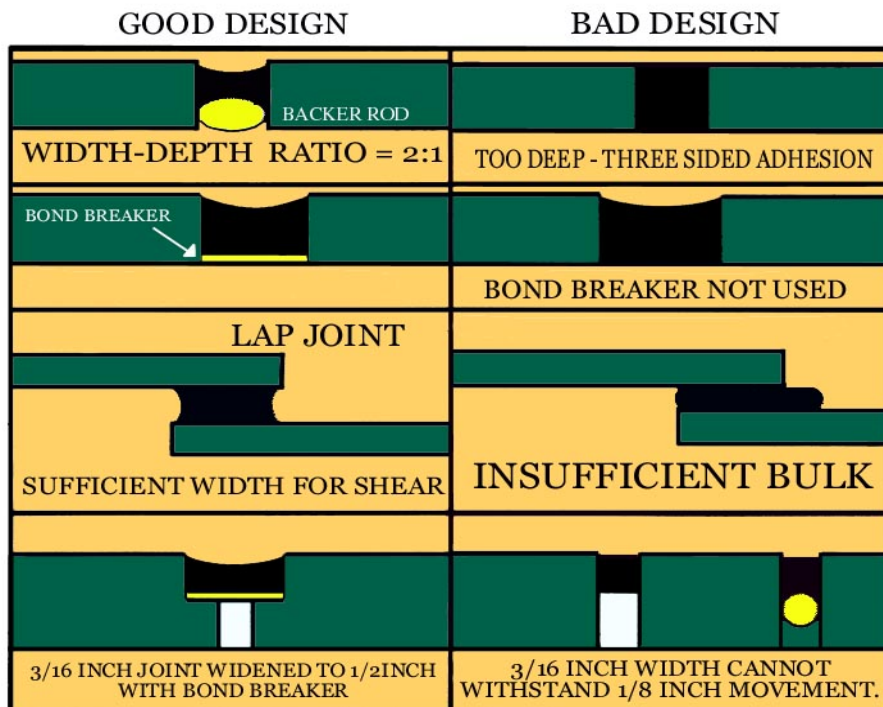
Moving Joint considerations

The location, dimension, and the actual design of the joints will contribute to the proper functioning of the exterior wall as it is exposed to the rigors of daily weather and to climatic changes from season to season. The anticipated movement and changes in a structure must be accommodated by and considered in the selection, characteristics, and caliber of the sealant to be used.

HOW PROPER JOINT DESIGN MINIMIZES STRESSES ON THE SEALANT



EXAMPLES OF DIFFERENT JOINTS



Sealants and Their Function

The prevention of moisture and air penetration begins with joint design that takes all conditions into consideration and joint preparation that is in accordance with recommended procedures. It is the sealant that is specified (and applied) and the workmanship on the job that often determines how long the structure will be protected from the effects of weathering.

The primary function of a joint sealant is to maintain a positive seal between the sides of a joint, which may be subject to movement. Non-structural applications refer to applications where the sealant is not required to structurally support glass or panels, as in the case of structural silicone. Such applications include expansion joints, weatherseals, end dams, screw heads, kerf seals, splice joints, etc. This type of sealant application does not contribute in any way to the structural properties of the building; rather, it helps to control the environment within the structure by resisting the passage of heat, light, sound, rain, snow, wind, odor, chemical and biological contaminants, and dust. At the same time, the sealant must withstand the effects of thermal, moisture, and structural movement, including vibration and creep. It also provides sound insulation. In some cases, the sealant will be required to perform other functions, such as withstanding attack by insects, microorganisms, plants, or pollution.

The successful performance of a building exterior is frequently defined by its ability to keep rain and the elements outside, away from the building's occupants. One of the critical links to ensuring a weatherproof building exterior is the joint sealant.

Selecting the Right Sealant

Generally, selecting the best sealant for any specific project is determined by the nature of the project performance requirements. Primarily, joint sealant should be selected around a few simple guidelines:

1. Minimum contact required [by the sealant manufacture] with all bonding surfaces to ensure adequate surface adhesion.
2. Maximum movement potential necessary for the intended sealant to perform in a structural or non-structural joint.
3. Joint configurations and designs.

Other considerations for key performance features of the intended sealant to be selected include:

1. Application
 - a. Structural (sealant required to structurally support glass or panes).
 - b. Non-Structural (conventional weatherseals)
2. Cure System (chemical, moisture, neutral) and its effect on the surrounding substrates.
3. Durometer, Shore A, pts.
4. Modulus of elasticity.
5. Tooling Time, minutes.
6. All Temperature Gunnability.
7. Life Expectancy, after installed, years?
8. Reversion Resistance.
9. Chalking and Cracking.
10. Staining (will the sealant discolor the surround substrates?).
11. UV-Light Resistance.

Sealants of all types have precautions and limitations. Most are not recommended for:

- a. Joints contaminated with oil, grease, wax, dust, corrosion, tar, asphalt, loose aggregate, frost, dampness, form-release agents or other coatings.
- b. Exposure to harsh chemicals.
- c. Joints less than 1/4" in width or depth.
- d. Certain architectural paints and finishes without laboratory or field testing.
- e. For some, under water usage.

Many high performance sealant manufacturers have technical services available to assist in selecting an appropriate product and provide on-site application instructions or to conduct job-site inspections.

There are five basic steps for proper joint preparation and sealant application.

1. **Clean** – Joint surfaces must be clean, dry, dust free, and frost free.
2. **Prime** – If required, primer is applied to the clean surface(s)
3. **Pack** – Backer rod or bond breaker as required.
4. **Shoot** – Sealant is applied by “pushing the bead” into the joint cavity.
5. **Tool** - **Dry** tooling techniques are used to strike a flush joint and make certain the sealant has the proper configuration and fully contacts the joint walls.

The following sections are intended to provide more detailed information in each of these areas.

Clean – Substrate Cleaning Procedures

This information on cleaning solvents and general cleaning procedures provides the key to good sealant adhesion – **A CLEAN SURFACE.**

You should always check with the supplier of the substrate to ensure that the cleaning procedures and solvents are compatible with the substrate.

Special Note:

Once the exterior cladding is installed, windows are set in place, and the panels placed in their final position, etc., the diminutive sized joinery created around these substrates (intended to receive sealant) may now limit the caulker’s ability to sufficiently clean the materials to be sealed. Once the opening is closed i.e. to a typical ½” inch nominal joint, effectively cleaning the window surrounds or the interfacing materials is now greatly disadvantaged.

For example: In window openings created by precast or masonry, it is both functional and useful to first inspect the openings and remove any contaminants before placing the window in place. Also it is helpful to solvent wipe the window perimeter metal (receiving weather sealant) while still on the floor before installing the casement into the opening. **Once again,** removing contaminants from small joinery are not without problems that could effect sealant adhesion or even *damage* the substrates.

ORGANIC SOLVENT USAGE

Not every contaminant is effectively removed by every solvent, and certain solvents can seriously damage some substrates. *Please follow the solvent manufacturer's safe handling recommendations and local, state and federal regulations regarding solvent usage.*

Non-Porous Substrates

Non-porous surfaces must be cleaned with a solvent before the sealant is applied. The solvent used will depend on the type of dirt or oil to be removed and the substrate to be cleaned. Non-oily dirt and dust can usually be removed either a 50 percent solution of isopropyl alcohol (IPA) and water, a 70 percent solution of IPA and water (rubbing alcohol) or pure IPA. Oily dirt or films generally require a degreasing solvent such as xylene. DOW CORNING® 1593 Cleaner / Primer may be used for removal of both oily and non-oily contamination. Regardless of which solvent is chosen, use the “two-cloth” cleaning method explained later in this section.



Non-porous surfaces of glass and glazing

Porous Substrates

Building materials such as EIFS, cement board panels, concrete, granite, limestone and other stones or cementitious materials that absorb liquid are considered porous substrates.

Dusting alone may be sufficient cleaning for new porous substrates. Depending on the condition of the surface, porous substrates may require abrasion cleaning, solvent cleaning or both. Laitance and surface dirt must be completely removed. Concrete form-release agents, water repellents and other types of surface treatments, protective coatings, and old sealant all affect sealant adhesion. Removal of these treatments, coatings or sealants by abrasion cleaning may be required to obtain acceptable adhesion.

Abrasion cleaning involves grinding, saw cutting, sand or water blasting, mechanical abrading or a combination of these methods. Remaining dust and loose particles should be removed by dusting the surface with a stiff brush, vacuuming, or blowing the joints with *oil-free* compressed air. Once the abraded surface is clean and dry, the sealant can be applied. If the surface is dirty, it must be solvent cleaned with the “two-cloth” method explained later in this section. Some porous materials will trap solvents after cleaning or priming. Allow this solvent to evaporate before sealant is applied.



Please note that the above recommendations for removal of existing sealants, substrate cleaning, joint preparation and installation of new silicone or urethane sealants are not intended and may not be appropriate for remedial work involving existing sealants and/or joints containing PCBs or other potentially hazardous substances. If you know or suspect that the existing sealants and/or joints contain PCBs or other hazardous substances, contact a knowledgeable authority on appropriate removal, handling and disposal procedures.

EIFS Cleaning Procedure

1. Allow the EIFS coating to dry a minimum of 24 hours prior to application of the sealant. Drying time may be greater depending of temperature and humidity. Consult the EIFS manufacturer for recommended drying time.
2. The joints must be clean and dry prior to installation of the sealant. If sealant is to be applied immediately following the drying time of the EIFS coating, simply brush or wipe the joint surfaces to ensure there is no dust or debris. If the fully dried coating is exposed for greater than one day, joint surfaces must either be wire brushed and blown with *oil-free* compressed air or cleaned with a suitable solvent using the “two cloth” cleaning method. Consult the EIFS manufacturer to determine if a specific solvent is compatible with their system. Allow sufficient time for the solvent to evaporate prior to priming or installing sealant.
3. When using DOW CORNING® 1200 Prime Coat for DOW CORNING® Silicones, use a soft bristle brush to the inside of the joint. One brush wipe of the substrate should be sufficient. The primer should dry to form a slight primer residue. If, after the primer has dried, the EIFS appears powdery, chalky or dusty, the surface has been over primed. 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 a minimum of one hour prior to backer rod installation and sealant application.

Masking

It is important to note that silicone primers and sealants cannot be removed with organic solvents. Where aesthetics are important, it is imperative that uncured silicone primers and sealants do not contact non-abradable surfaces where the silicone is not intended. Mask these surfaces or use extreme care to prevent any silicone contact with the surface during priming and sealant application. If DOW CORNING® 1593 Cleaner/Primer is used, masking must be applied before the cleaner / primer is applied. If organic cleaning solvents are used, then masking tape may be applied either before or after solvent cleaning the joint.

“Two-Cloth” Cleaning Method

Clean, soft, absorbent, lint-free cloths must be used. The two-cloth cleaning method consists of a solvent wipe followed by a dry cloth wipe.

1. Thoroughly clean all surfaces of loose debris.
2. Pour or dispense solvent onto the cloth. Do not dip the cloth into the container of solvent, as this will contaminate the cleaning agent.
3. Wipe vigorously to remove contaminants. Check the cloth to see if it has picked up contaminants. Rotate the cloth to a clean area and re-wipe until no additional dirt is picked up.
4. Immediately wipe the cleaned area with a separate clean, dry cloth.
5. Wipe with a thin film of primer (if required) and allow to dry. Allow 5 to 30 minutes, depending upon temperature and humidity. Premature application of sealant could cause sealant cure inhibition.
6. Always check primer for contamination or reaction with moisture in the air. The product will no longer perform.

Using Organic Cleaners

Clean, soft, absorbent, lint-free cloths must be used. The two-cloth cleaning method consists of a solvent wipe followed by a dry cloth wipe.

1. Thoroughly clean all surfaces of loose debris.
2. Pour or dispense an acceptable cleaning-grade solvent onto the cloth. A plastic (solvent-resistant) squeeze bottle works best for organic cleaning solvents. Do not dip the cloth into the container of solvent, as this will contaminate the cleaning agent.
3. Wipe vigorously to remove contaminants. Check the cloth to see if it has picked up contaminants. Rotate the cloth to a clean area and re-wipe until no additional dirt is picked up.
4. Immediately wipe the cleaned area with a separate clean, dry cloth. Organic solvent must be removed with the dry cloth before the solvent evaporates or the cleaning will be less effective. Some surfaces or weather conditions will allow a small amount of residual organic solvent to remain. If this is the case, the surface must be allowed to dry before installing backer rod and sealant.

Winter / Summer Solvent Considerations

IPA and methylethylketone (MEK) are soluble in water and may be more appropriate for winter cleaning as they help in removing condensation and frost. Xylene and toluene are not soluble in water and may be better suited for warm weather cleaning.

Prime – Primer Application

Many sealant manufactures strive to develop primer free adhesives and sealants; however, in some instances good sealant adhesion is obtained only with the use of a primer. The primer attaches itself to the surface, and the sealant then adheres to the primer. Be cautious when applying primer, some primers may stain the surrounding substrate if spilled or misapplied.

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*).

1. 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.
2. 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.
3. 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.
4. 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.
5. Allow the primer to dry until all the solvent evaporates. This typically takes 5 to 30 minutes, depending upon the temperature and humidity.
6. Inspect the surface for dryness. Remove excess primer as described in item 4 above.
7. 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.**

Pack - Packing with Backer Rod & Bond Breaker Tape

Three purposes

There are three purposes for using backer rod:

1. To control proper sealant depth.
2. Prevent three-sided adhesion.
3. Provide a firm surface to tool against forcing the sealant to the joint walls (bond line).
4. Bond breaker tape prevents three-sided adhesion.

DEPTH

To create the proper joint depth, the sealant should be applied half as deep as the joint width but never less than ¼” and not over ½” thick unless otherwise instructed. The depth of the sealant is set by how deep the backer rod is placed.

THREE-SIDED ADHESION

Backer rods and bond breaker tape prevent three-sided adhesion. If the sealant adheres to the sides and the bottom of a joint, failure will occur when the joint moves. Sealant doesn't stick to proper backer rod preventing adhesion to the joint bottom.

FIRM SURFACE

Properly installed backer rod provides a base to tool against forcing the sealant to the joint walls.

When designing moving joints, the following points also need consideration:

- A minimum ¼” joint width is recommended. Wider joints accommodate more movement than narrow joints.
- Three-sided adhesion limits the amount of movement that a joint can accept without inducing a tear. Three-sided adhesion can be eliminated by the addition of a bond breaker tape or backer rod. With three-sided adhesion, no more than ±15% percent movement can be accommodated.
- A thin sealant joint (1/4” ±1/8” depth) will absorb more movement than a thick joint. Sealants are designed to deliver optimum performance when the joints are shaped like an hourglass.
- As a practical matter, as the sealant joint width becomes larger than 1”, the depth should be held at approximately 3/8”. There is no need to increase the depth beyond 3/8”.

Movement During Cure

One-part silicone sealants cure by taking moisture out of ambient air. Multi-component polyurethane's cure chemically. Joint movement during cure can cause unsightly aesthetics due to joint wrinkling. *Premature adhesion loss can also occur because the adhesive characteristics of the sealant are obtained after the sealant has cured.* Adhesion loss due to movement during cure can be minimized by the use of a primer. Primers can decrease the adhesion cure time lag. Minimize wrinkling by following these suggestions:

1. Use open-cell polyurethane backer rod in non-EIFS of vertical applications. Allows for backside curing.
2. Seal when the joint surface is cool and will experience minimum temperature changes, typically in the late afternoon or early evening.
3. Place no more than ¼” of sealant over the backer rod at the center.

These suggestions should help minimize wrinkling, but may not eliminate it, as all sealants are prone to this aesthetic issue.

Shoot – 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.

Sealant should be applied as follows:

1. 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.
2. 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.

Tool

1. 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.
2. Remove masking tape (if used) before the sealant skins over (within about 15 minutes of tooling).
3. Use only **dry** tooling techniques to strike a flush joint and make certain the sealant has fully “wet” the joint walls.
4. Always tool in both directions. For best sealant performance tool a concave surface with a custom ground tapered spatula or tuck pointer. A concave sealant bead (hourglass in profile) is best for reducing internal stresses from joint movement.
5. Always tool in both directions. For best sealant performance tool a concave surface with a custom ground tapered spatula or tuck pointer. A concave sealant bead (hourglass in profile) is best for reducing internal stresses from joint movement.
6. 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 ground.
7. After tooling, be sure the minimum depth of sealant is in accordance with the sealant manufacturer’s recommendations.

The above information is intended to provide general information about the practices and procedures observed by United Professional Caulking & Restoration, Inc. United Professional Caulking & Restoration, Inc. believes the information and data contained herein to be reliable. You should thoroughly test any application and independently conclude satisfactory performance before installing any sealant.