
1. SELECTING THE SILICONE SEALANT

The intended function of sealant determines the specific product that will be appropriate for use in the application. A brief overview of selection guidelines is found in this section. If further assistance with silicone sealant selection is required, then contact Tremco's Technical Services or consult Tremco's Sealant Selection Guide; this guide is available at www.tremcosealants.com. Provided below is a list of items to consider while selecting a silicone sealant.

Movement Capability

Many joints into which sealants are installed must be considered dynamically moving entities, and the sealant must be able to accommodate the magnitude of dynamic movement that the joint will experience. The sealant's ability to accommodate the joint movement is provided as ratings for the extension and compression capabilities. The movement capability of a silicone sealant is published on the product data sheet and reported under the "Applicable Standards" Section as the "class" distinction within ASTM C920 - *Standard Specification for Elastomeric Joint Sealants*.

Modulus

The modulus property of a sealant is a relative value measured as a ratio of stress to strain during joint extension. To define this property simply, modulus describes the amount of force, load, or stress required to extend a sealant to a predetermined strain or elongation. Low-modulus sealants exhibit stress at the location of the sealant-substrate bond line when the sealant is exposed to joint movement. Generally, low-modulus sealants demonstrate greater movement capabilities when compared to their higher-modulus counterparts. Low-modulus sealants are a more forgiving selection for high movement joints, joints that have opposing substrates with dissimilar coefficients of thermal expansion, and joints that have interfaces that can be pulled apart by movement stresses maintained by higher-modulus sealant materials. Low-modulus silicone sealants are the preferred selection for joints that interface with EIFS.

Medium-modulus and high-modulus sealants can provide durability in joints where a less significant amount of joint movement is expected and when the substrate is rigid enough to accept higher levels of stress. Some of these medium- and high-modulus sealants have been formulated to be strong enough to perform as a structural component in a specific type of glazing called structural glazing.

Single-Component or Multi-Component

This portion of selection pertains to equipment available to dispense the sealant, speed of sealant cure-through, and preference of the applicator. A multi-component sealant is usually packaged in bulk containers and requires mixing as well as specialized dispensing equipment, while single-component sealants are ready for immediate dispensing from packaging types that have smaller volumes, such as cartridges or sausages.

Non-Sag or Pourable

A non-sag material is required in applications marked with joints in vertically-oriented substrates and can be used in skyward-facing horizontal joints. Pourable sealants cannot be used in vertically-oriented joints and may be preferred in skyward-facing horizontal joints as they promote ease of use by reducing the intensity of tooling that the applicator must perform after the sealant is initially applied. The "gun-grade" and "non-sag" sealant terms are synonymous. The self-leveling" sealant term is descriptive for "pourable sealant".

Paintability

Where sealant joints are to be painted, silicone sealants are not typically recommended as the only type of commonly used paints or coatings that will develop adhesion to them are also composed of silicone based chemical structures.

Contact Tremco Technical Services if you have any questions regarding the sealant selection process.

2. TESTING

Tremco recommends project-specific testing be completed prior to starting production at any jobsite. Upon request, Tremco's Technical Services laboratory performs in-house testing of sealant for adhesion, compatibility, and potential

staining on submitted project substrate materials. Project-specific recommendations regarding surface preparation, primer use, and silicone sealant product recommendations are made after the completion of Tremco's project-specific testing process. Contact Tremco's Technical Services for details on how to initiate, complete, and interpret laboratory testing procedures, requirements, and results. Consult Tremco's Technical Services [bulletin](#) for more detailed information pertaining to each test performed within Tremco's Technical Services laboratory.

In some instances, [in-field testing](#) may be adequate for qualifying a sealant for use in a specific application. Contact a local Tremco Sales Representative for assistance with testing at the job site.

3. STORAGE

Prior to use, all silicone sealants must be stored in a cool, dry location. The optimal storage temperature range is 60-80 °F (15-27 °C). Once the packaging of a single-component sealant is opened, the material will begin to cure. Preserving the sealant from developing undesired cure of the material can be achieved by promptly closing the sealant's container immediately after completion of use.

The curing mechanism of single-component silicone sealants is initiated with the introduction of airborne water vapor to the exposed sealant. The seals of Tremco sealant containers are effective as isolating the sealant from the atmosphere, and the water vapor that it contains, for extended periods of time.

Storage of packaged silicone sealants in locations that experience significant temperature fluctuations and/or cyclic temperature changes may be problematic as these conditions are known to accelerate the migration of air and water vapor into the sealant container, unduly exposing the sealant to conditions that ultimately reduce the effective shelf life of the material or the overall performance of the sealant when applied. Therefore, it is recommended to ensure that the storage of silicone sealants be in a temperature-controlled environment with a stable ambient air temperature.

If the volume of either component of two-component silicone sealant container measures five or more gallons, then it is recommended to utilize the follower plate of the appropriate dispensing equipment as a functional seal that mitigates the diffusion of air to the contents of the container. The container of either component of a two-component silicone should only be opened immediately before it is to be dispensed with suitable sealant delivery equipment. It is recommended that the follower plate be lowered into the sealant container immediately after the container is opened and should remain inserted into this container until the contents have either been completely consumed or are to be removed for disposal.

4. SURFACE PREPARATION

The five key steps for a successful sealant installation can be summarized as: clean, prime (if necessary), pack joint with backing material, gun the sealant, and tool the surface of the sealant. Specific instructions for each of these installation steps are provided in the subsequent sections within this document below.

Two-Cloth Cleaning Method

The two-cloth cleaning method is completed by first wiping the substrate with a clean, white, lint-free cloth that is dampened with an approved cleaning solvent, such as isopropyl alcohol. The cleaning cloth should never be introduced or inserted directly into the solvent vessel or its contents to prevent contamination. Immediately following the solvent-wipe, before the cleaning solvent has flashed off the substrate surface, with a wipe of a second cloth that is dry, clean, white, and lint-free to remove loosened dirt or oil. It is recommended to clean non-porous substrates using this cleaning method immediately before applying a silicone sealant and the substrate must be cleaned again if two or more hours have elapsed between the time that the substrate was cleaned, and the sealant is applied.

Taping of Surfaces Surrounding the Joint

Applying masking tape at the perimeter of a sealant joint is optional and is generally to support aesthetically favorable appearances of the sealant joint and to promote easier clean-up procedures. The masking tape must be removed immediately after the sealant's surface is tooled and before the sealant begins to develop a skinned surface.

Masonry

Concrete and masonry surfaces must be fully cured, stable, clean, dry, and free of contaminants. If film-forming curing aids or form release agents are present on a concrete substrate, they must be completely removed. If non-film-forming curing or form release agents have been used, adhesion testing must be employed to determine if they would be deleterious to adhesion.

The rough surfaces of these substrates can be prepared by sandblasting, mechanically abrading, wire brushing, grinding, or any combination of these preparation methods. These abrasive surface preparation procedures will introduce dust and other particles to the application area that must be treated as contaminants and thoroughly removed by blowing the affected substrate with oil-free compressed air or by brushing the contaminants away from the application area with a soft bristle brush.

Recommendation on the use of the primer is determined via project-specific testing. Specifics on priming substrates of this type can be found in section 5 of this document, "Priming". These substrates are porous in nature; TREMprime Silicone Porous Primer is to be used if a primer is required for the sealant to develop adequate adhesion.

Glass, Porcelain, Tile, etc.

These surfaces must be clean, dry, and free of any contaminants. Clean the substrate using the two-cloth cleaning method described above. Preventing oily fingerprints from being introduced onto these substrates is an important precaution to maintain cleanliness and create an ideal surface for the sealant to develop adhesion to.

Recommendation on the use of the primer is determined via project-specific testing. Specifics on priming substrates of this type can be found in section 5 of this document, "Priming". These substrates are porous in nature; TREMprime Silicone Porous Primer is to be used if a primer is required for the sealant to develop adequate adhesion.

Wood

Tremco's silicone sealants will typically develop adhesion to dry, fresh wood that is clean and free of any contaminants. Many species of wood, such as teak, contain oils that dry out very slowly. Oil bearing woods are usually not suitable substrates for silicone sealants to develop adhesion with unless sufficient time has been allotted for the oils to vacate the substrate. Applications of silicone sealant onto wood that will be painted or stained at a later time must utilize adequate masking techniques to ensure that silicone sealant does not get onto surfaces that will be painted or stained.

When applying silicone sealants to painted wood surfaces and adhesion will develop with the paint, it is important to note that the bond between the sealant and the paint is of no more value than the bond between the paint and the wood. Recognize the need for additional prudence because stresses of movement introduced to the sealant joint will be transferred to the paint material at the bond line. Use of a low-modulus sealant would be preferable to a medium-or high-modulus sealant to minimize such transfer of movement stress. Tremco recommends that any paint on the surface of the wood and the bonding area be removed mechanically, so bare wood is the exposed surface for the silicone sealant to bond to. Where paint is not fully removed from wood and well-bonded residual paint is left after scraping or abrading, a low-modulus sealant is the preferred selection. Silicone sealants have historically been found to readily develop adhesion with a wide variety of different types of paint, but it is always recommended to confirm this with the implementation of project-specific testing with the materials present at the application site.

Metals

The bonding surface of the silicone sealant must be clean, dry, and free of any contaminants. Metal substrates must be cleaned using the two-cloth cleaning method described previously within this document. Preventing oily fingerprints from being introduced onto these substrates is an important precaution to maintain cleanliness and create an ideal surface for the sealant to develop adhesion to.

Metals that have the potential to corrode via oxidation pose a threat to the long-term adhesion of a sealant as oxidation can creep beneath the sealant bond line over time to cause failure. It is for that reason that factory-applied primers are recommended on steel substrates.

Recommendation on the use of the primer is determined via project-specific testing. Specifics on priming substrates of this type can be found in section 5 of this document, "Priming". These substrates are porous in nature; TREMprime Silicone Porous Primer is to be used if a primer is required for the sealant to develop adequate adhesion.

Plastics

Plastic surfaces must be clean, dry, and free of contaminants prior to the application of silicone sealant. These substrates must be cleaned using the two-cloth cleaning method described previously within this document. Preventing oily fingerprints from being introduced onto these substrates is an important precaution to maintain cleanliness and create an ideal surface for the sealant to develop adhesion to.

Recommendation on the use of the primer is determined via project-specific testing. Specifics on priming substrates of this type can be found in section 5 of this document, "Priming". These substrates are porous in nature; TREMprime Silicone Porous Primer is to be used if a primer is required for the sealant to develop adequate adhesion.

Insulated Concrete Forms

Nudura Insulated Concrete Forms (ICF) or insulated concrete forms must be dry, clean, free of dust, mold, or any other substances that might prevent placement and bonding of sealant. After UV exposure it is recommended to rasp and clean substrate to the standards above. Contact Tremco and/or Nudura technical services for additional information.

5. PRIMING

Porous Substrates

Tremco commercial silicone sealants will typically develop adhesion without the need of a primer to most common porous construction materials. When priming is determined to be necessary, by conclusions derived from results from testing with project-specific materials, then TREMprime Silicone Porous Primer is recommended. This is a single-component primer that is used to enhance the adhesion of silicone sealants to porous surfaces, such as concrete, limestone, or brick. TREMprime Silicone Porous Primer also provides a barrier to moisture at the bonding area when the substrate becomes wet and begins to wick moisture throughout its body.

TREMprime Silicone Porous Primer is to be applied generously with a soft bristle brush; implement care to ensure that not bristles are inadvertently deposited from the brush onto the substrate at the location of application. The dry time for this primer is approximately 30 to 40 min at 70 °F (21 °C). This primer must be completely dry before the sealant may be applied. Applying a sealant to a surface that is still wet with freshly applied primer will become a detriment to the sealant's ability to cure appropriately, develop adhesion to the substrate, and/or achieve its expected physical properties.

Silicone sealants can be applied onto a primed substrate for up to eight hours after primer has been applied. If sealant has not been applied to the primed substrate after eight hours has elapsed, the surface must be cleaned and primed with TREMprime Silicone Porous Primer again.

Non-Porous Substrates

Tremco commercial silicone sealants will typically develop adhesion without the need of primers to most common non-porous construction materials. When priming is determined to be necessary, by conclusions derived from results acquired with testing of project-specific materials, then Tremco Silicone Metal Primer is recommended. This is a single-component primer used to enhance adhesion of silicone sealants on non-porous surfaces, such as glass, metal, or plastics. When Tremco Silicone Metal Primer is applied to the bonding surface, the time required for the silicone sealant to reach complete adhesion to the substrate is often reduced, when compared to applications of the sealant onto identical unprimed substrates.

Tremco Silicone Metal Primer is approved for use in ASTM C1401 compliant structural glazing applications when all procedures found in Tremco Structural Glazing Manual are also followed. When the glazing application of silicone sealants is intended to serve a structural role within the glazing system, it is required to confirm the adhesion characteristics of the tensile bead within Tremco's technical services laboratory and also complete a structural glazing shop drawing review with the assistance of Tremco's technical services. Contact Tremco's technical services for specific information pertaining to the procedures required for all projects featuring structurally glazed conditions.

To apply Tremco Silicone Metal Primer, the primer must be applied directly to a clean, lint-free, white cloth. The cloth used for this primer's application should never be inserted directly into the container of Tremco Silicone Metal Primer, as this significantly increases the potential for the primer to become contaminated. Before the primer can be applied to the substrate, it is recommended to remove all excess primer from cloth, so the cloth is merely dampened with the primer. This will help prevent the over-application of primer to the substrate. Apply Tremco Silicone Metal Primer from the dampened cloth directly onto the substrate as a thin layer. When applied correctly, this primer dries after approximately 15 min at conditions of 70 °F (21 °C).

The primer must be completely dry before applying the sealant. Applying sealant to a surface that is still wet with freshly applied primer will become a detriment to the sealant's ability to cure appropriately, develop adhesion to the substrate, and/or achieve its expected physical properties.

Silicone sealants can be applied onto a primed surface for up to six hours after primer has been applied. If the sealant has not been applied to the primed substrate within six hours, then the surface must be cleaned using the two-cloth cleaning method and primed with Tremco Silicone Metal Primer again.

6. APPLICATION

Backing Materials

Backing materials, such as backer rods, are included in appropriately designed sealant joints to control the depth of the sealant bead, to promote an hour-glass sealant bead geometry, and to prevent three-sided adhesion.

The depth of the sealant bead, in applications where the sealant is not being used in a structural glazing application, is to abide by the guidelines provided below. The geometry and dimension of silicone sealants used as a tensile bead in structural

glazing applications is to be provided by Tremco's technical services after the completion of a structural glazing shop drawing review; contact Tremco's technical services for specific information pertaining to the procedures required for all projects featuring structurally glazed conditions.

Expansion Joints: The minimum joint width (W) and sealant contact depth (C) of any silicone sealant application is 1/4" by 1/4" (6.35 mm by 6.35 mm). It is recommended that the sealant joint depth (D), when measured from the face of the sealant bead to the crown of the backer rod, be equal to one-half the sealant joint width (W), known as 2:1 width-to-depth joint ratio. For silicone sealants, the minimum sealant joint depth (D) at crown of backer rod is 1/8" (3 mm) and the maximum sealant joint depth at crown of backer rod is 1/2" (13 mm).

For joints that are wider than 1" (25 mm), contact Tremco's technical services or the Tremco sales representative nearest to the application site for additional support.

Window Perimeter Joints: For fillet beads, or angle beads around windows and doors, the sealant should exhibit a minimum sealant contact depth (C) of 1/4" (6.35 mm) onto each substrate. Proper joint backing or bond breaking must be implemented to allow the sealant to perform when exposed to joint movement.

Structural Glazing: Special consideration must be taken when using a silicone sealant as a tensile bead in structural glazing applications. Therefore, the above sealant dimension guidelines do not apply in these applications. Consult Tremco's technical services for a structural glazing shop drawing review and recommendations.

Applying Sealant

After joint is verified to be clean, dry, and free of contaminants, primer has been applied (if necessary), and the backing material has been properly installed, the application of the silicone sealant may begin.

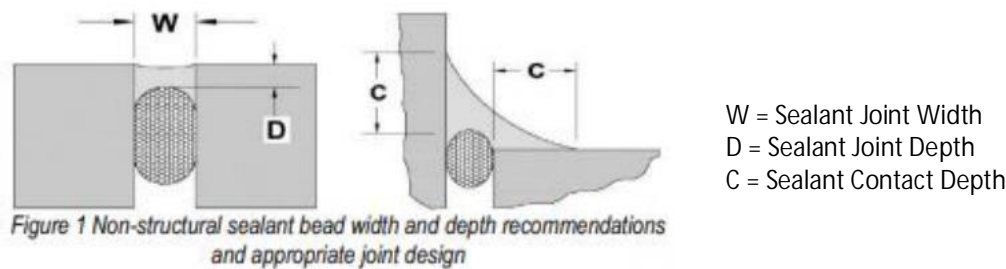
The process of gunning sealant is completed by dispensing sealant from its packaging, through a nozzle, and into the sealant joint.

Joint Designs and Dimensions

Tremco recommends that individuals responsible for designing sealant joints and those who are to apply Tremco silicone sealants become familiar with the versions of the following industry guidelines and best practices that have been published most recently:

- ASTM C1193 - *Standard Guide for Use of Joint Sealants*
- ASTM C1472 - *Standard Guide for Calculating Movement and Other Effects When Establishing Sealant Joint Width*

All silicone joints that are not a structural tensile bead must be designed and installed in accordance with ASTM C1193 and ASTM C1472.



Two Considerations must be acknowledged when gunning the sealant:

1. The joint is filled from the backside to the frontside. It is not recommended to practice to fill the joint from front to back, as this introduces the potential for air to become entrapped within the body of the sealant bead. If air becomes encapsulated within the body of the sealant bead, then the sealant joint may demonstrate a reduced capacity to perform when exposed to dynamic movement.
2. Complete contact between the sealant and joint bonding surface of the substrate is required for the sealant to be expected to perform as intended when the joint was designed. Substrate joint surfaces must be fully "wetted" with sealant, meaning that there must be contact between the silicone sealant and the substrate along with entire depth of the sealant-substrate interface. If the sealant does not fully contact the substrate along the bond line from the face of the sealant joint to the backer rod, then there is assumed potential for the sealant joint to be ineffective at preventing leaks and/or fail prematurely when exposed to a load or stress. Some force exerted during gunning of the sealant may be required to accomplish full "wetting" of the sealant onto the bonding surfaces as tooling, alone, may not be sufficient to force the sealant fully into the joint.

Tooling

Tooling is always required within the installation of a sealant bead to achieve an optimally performing sealant joint. Tooling the sealant joint will assist to create an installation that has full "wetting" of the sealant onto the joint interfaces, to achieve the desired hour-glass shaped cross-sectional joint geometry, and to shape the visible surface of the sealant to a clean and consistent appearance. The sealant joint should be deliberately tooled to shape to actively shed water and prevent the ponding of water on the surface of the joint.

Tooling can only be accomplished prior to the sealant achieving a skinned surface. Once the sealant has begun to form a skinned surface, the joint can no longer be effectively tooled. For information regarding the skin time of any Tremco sealants, consult the data sheet created for the specific sealant or contact Tremco's technical services.

Tooling is the process of applying consistent pressure to the sealant body through the exposed face of the sealant bead by running a rounded tip spatula along exterior surface of the sealant bead. A slightly concave surface at the exterior surface of the sealant bead is one characteristic of a properly tooled sealant bead. Pressure is applied by the applicator with the tooling spatula to the face of the sealant bead of a substantial enough magnitude to ensure the sealant is completely filled into the joint. The use of controlled force while tooling is a practice that is intended to provide additional assurance that the sealant has fully "wetted" the bonding interfaces of the substrates. The applied pressure is also effective in ensuring that the installed sealant has achieved complete contact with the backing material. Care must be observed while tooling the joint to not introduce enough pressure to displace the joint backing material.

Tremco recommends dry tooling be used to tool the surface of the sealant joint. The practice of dry tooling is completed without the use of tooling agents, such as water, soap, or detergent solutions. Sealant joints should be tooled to shed water and eliminate ponding.

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