INTRODUCTION

This Arriscraft•NOTE discusses the important criteria to consider when selecting sealant and backer rod materials for use with masonry veneer applications.

A good quality backer rod and joint sealant should be used to seal the exterior of movement joints against moisture and air penetration. The sealant material should be selected by the designer to be highly compressible, resistant to weathering and ultraviolet radiation, and compatible with the veneer materials, including any adjacent materials such as flashing membranes or metal elements. The appropriate backer rod material should be selected for compatibility with the sealant.

The sealant must be able to span the joint width and accommodate the anticipated movements. As a rule of thumb, sealants used in movement joints should have a width-to-depth ratio of 2:1 in order to ensure adequate protection against moisture and air penetration (Figure 1).

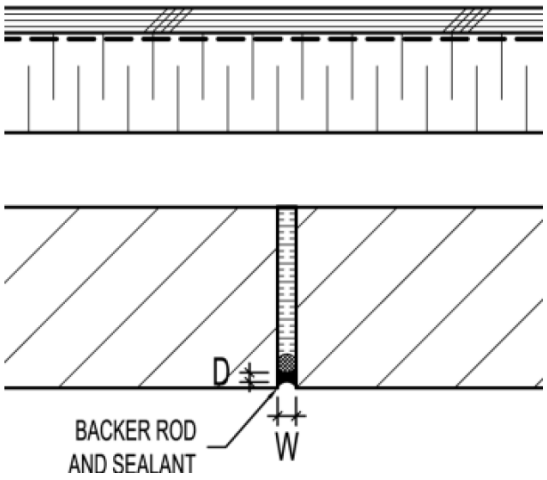

Figure 1

Sealant Materials

Sealant materials used for expansion joints can generally be separated into two distinct categories: *organic* and *inorganic.* The difference in the two categories lies in their chemical makeup and the backbone polymers used as the building block for an elastomer sealant.

Organic sealants consist of polymers made of organic Carbon and Oxygen molecules. Organic sealants can be further divided into several types such as butyl rubbers, polysulfides, and polyurethanes.

Butyl rubber sealants have good water resistance and low moisture vapor permeability, however they also offer relatively low movement capability, sensitivity to temperature, hardening, and high stain potential.

Polysulfides provide better movement capabilities than butyls, resist weathering and aging better, and provide good adhesion to nonporous surfaces such as glazing. When applied to porous surfaces a primer is typically required to provide proper adhesion.

Polyurethane sealants provide a watertight bond with most materials, often without the use of a primer, and possess a high elasticity to allow for movement of up to 50% of the joint width. Urethanes, like all organic sealants, tend to deteriorate more quickly than silicones with time and exposure to UV, resulting in drying, cracking and loss of elasticity.

Inorganic sealants consist of silicone polymers as the main building block for the resulting sealant elastomer. These polymers contain Silicon and Oxygen molecules. Inorganic sealants used in expansion joints for masonry construction are typically silicone sealants.

Silicone sealants provide a durable, long lasting joint seal that withstands the effects of sunlight, inclement weather, temperature extremes, and dynamic movement conditions. These benefits are derived from the material's chemical makeup. The superior weathering characteristics are a result of their UV resistance and low shrinkage. They remain flexible and durable over a wide range of service temperatures. Silicone sealants may or may not require the use of a primer to ensure adequate bond to adjacent surfaces.

Another item to consider is staining as a result of the silicone. Testing should be considered with quarried stones and many masonry units, as plasticizer and oil migration from silicone sealants have been known to stain adjacent surfaces. Some 'non-staining' formulations are now available.

Silicones are available in either acetoxy (acid-cure) or neutral-cure formulations. Acetoxy (short for acetyl-oxy) silicones release acetic acid while curing, whereas neutral-cure silicones release methanol. Acetic acid can prove detrimental to substrates such as metals, concrete and many types of masonry units, including calcium silicate masonry units.

Classification of Sealants

Both organic and inorganic sealants contain several classifications to further differentiate their performance and applicability. Sealant materials for veneer applications are tested and classified in accordance with ASTM C920, *Standard Specification for Elastomeric Joint Sealants*.

ASTM C920 designates sealants by Type, Grade, Class, and Use. These classifications detail how and where sealants should be applied.

Type: Type ***S*** sealants are *single-component* and require no jobsite mixing prior to installing. Single-component sealants cure when they react with moisture from the air. They are limited to a maximum depth of ½", while maintaining the 2:1 width-to-depth ratio discussed above. If the sealed joint is to be covered with a membrane or coating shortly after installation, it will not be able to cure.

Type ***M*** sealants are *multi-component* and require the mixing of materials together to allow chemically induced curing. One of the materials is a curing agent or catalyst. This allows them to be coated almost immediately after installation if desired. Multi-component

sealants cure faster than single-component sealants and allow for more variety in colour choice as dyes or pigments may be added during the mixing process.

Grade: Grade ***P*** sealants are *pourable*, or self-leveling. This property makes them well-suited for use in horizontal applications.

Grade ***NS*** (*nonsag)*, or gunnable, sealants are ideal for vertical applications as the sealant will not move out of place once set.

Class: A sealant's Class defines its movement potential. The Class is listed as a number which indicates the percentage of movement (either contraction or expansion) the sealant can handle relative to the original joint width. A smaller Class number is associated with a sealant that is used for non- or minimal-movement type joints. Class 100/50 indicates a sealant capable of handling movements of 100% expansion and 50% contraction.

Use (related to exposure): The Use classification defines the applications that the sealant may be used in. Sealants with a Use factor of ***T*** are suitable for joints subjected to vehicular or pedestrian *traffic*, while Use factor ***NT*** sealants are classed as *non-traffic*. Non-traffic sealants are primarily used in walls, or around windows. Use factor ***I***, or *immersible* sealants, are designed for use in areas subject to water immersion.

Use (related to material): Use classifications also define what adjacent materials the product is suitable to be used with. ***M***, ***G***, and ***A*** Uses refer to *mortar*, *glass*, and *aluminum*, respectively. Sealants with Use factors of ***O*** are for use with all *other* materials than those previously listed.

Sealants can be (and often are) classified by more than one Use. For example, a sealant may be listed as Use NT, M, G, and A.

Masonry veneer, thin adhered veneer, and clipped or anchored veneer applications require appropriate selection of a sealant to ensure that any movement joints or other gaps in the wall remain weather-resistant. Silicone sealants, with their ability to accommodate high movement are the ideal choice for exterior applications with unit masonry and thin clad systems. Sealants should ideally conform to ASTM C920, Type S, Grade NS, Class 25 or 50, and Use M classifications.

Two such products that perform ably as expansion joint sealants are LATICRETE® MVIS Silicone Sealant™ and *Dow Corning*® 790 Silicone Building Sealant. Both products are high performance, single-component, neutral-cure, 100% silicone sealants. These products conform to the aforementioned properties under ASTM C920, making them well-suited for use with both full-bed and thin-adhered veneer expansion joint applications.

Sealant manufacturers should always be consulted for the applicability of their sealants for expansion joint applications.

Backer Rods

The inclusion of a good quality backer rod is important to proper joint design. The role of a backer rod is to:

- Act as a bond breaker, forcing the sealant into two-point adhesion. It should be noted that sealant may fail prematurely when put into three-point adhesion as this subjects the sealant to shear stress in addition to tension/compression;
- Achieve the required 2:1 width-to-depth ratio of the sealant; and
- Provide a firm surface against which tooling can be done. Proper tooling optimizes the joint's weather resistance and ensures better adhesion of the sealant. The backer rod allows the sealant to be tooled into an hourglass shape, providing maximum flexibility.

Backer rod materials are classified in accordance with ASTM C1330, *Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants*, into three types: type C - closed cell material, typo O – open cell material and type B – bi-cellular material.

Closed-cell backer rods possess very good water resistance properties and provide better insulation properties than other backer rod types. Single-component sealants that cure by reacting with moisture in the air should not be used with closed-cell backer rods. Closed-cell backer rods will not allow air in from the back of the sealant bead, retarding the curing process. Closed-cell rods are manufactured by injecting gas into an extruded plastic tube. Any punctures in the rod will lead to outgassing and result in a loss of the backer rod's rigidity and round shape. This may inhibit the flexibility of the sealant. Closed-cell backer rods are not recommended in applications where they may be compressed by more than 25% of their diameter.

Open-cell backer rods tend to be more flexible than closed-cell rods and may be compressed up to 75% of their diameter. This may mean that fewer sizes of backer rods will be required throughout a singular project. Open-cell rods do tend to absorb moisture which reduces their water resistance.

Bi-cellular backer rods: Bi-cellular backer rod materials take advantage of the positive properties of both open- and closed-cell backer rods. They are soft and pliable like open-cell rods, but contain a moisture-resistant outer plastic coating similar to a closed-cell rod. They do not contain any gases so unlike a closed-cell backer rod they will not outgas if punctured.

The appropriate type of backer rod will depend largely on the specified sealant. Compatibility characteristics between sealants and backer rods should be tested by ASTM C1087, *Standard Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems*.

It should be noted that bond breaker tapes are also available for use with joint sealants. These tapes serve the first function of a backer rod by limiting the sealant to two-point adhesion. However, because they lack the form of a backer rod and are unable to assist in the tooling and shaping of the sealant, use of bond breaker tapes is only advised in applications where it is impractical to use a backer rod.

When using the recommended LATICRETE® MVIS Silicone Sealant™ or *Dow Corning*® 790 Silicone Building Sealant, open-cell backer rods are recommended.

Summary

This Arriscraft•NOTE describes the different types of joint sealant and backer rods and discusses their appropriate design and use in veneer applications.

Sealants are used to resist moisture and air penetration in gaps or openings of veneer walls. Backer rods are used in conjunction with the sealant to ensure proper form and tooling of the joint.

The information and suggestions contained herein are based upon the available data and information published by the listed references and the experience of Arriscraft architectural and engineering staff. More detailed information may be found by referring to any of the related references listed below.

The information contained herein must be used in conjunction with good technical judgment and a competent understanding of masonry construction. Final decisions on the use of the information contained in this Arriscraft•NOTE are not within the purview of Arriscraft and must rest with the project designer or owner, or both. It remains the sole responsibility of the designer to properly design the project, ensure all architectural and engineering principles are properly applied throughout, and ensure that any suggestions made by Arriscraft are appropriate in the instance and are properly incorporated through the project.

Related References

1. Gibb, J.F., Hidden, but Essential – A Technical Review of Backer Rods, The Construction Specifier, March 1980.
2. Brick Industry Association, Technical Notes on Brick Construction 18A, Accommodating Expansion of Brickwork, November 2006.
3. American Society for Testing and Materials, ASTM C920-14, Standard Specification for Elastomeric Joint Sealants.
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Marble Institute of America, Technical Bulletin Volume V, Issue II, Joint Sealants: Products & Application for the Natural Stone Industry, May 2010

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