Technical Bulletin

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CAULKS & SEALANTS

Caulks and sealants play an essential role in building envelope performance and coating system durability. They are used to seal joints, gaps, and penetrations to help prevent water intrusion, air infiltration, and premature coating failure. Although they are often viewed as separate from paint systems, many caulks and sealants, particularly water-based latex and acrylic products, are formulated similarly to architectural coatings.

Like paints, these materials contain binders, pigments, fillers, and additives that influence properties such as flexibility, adhesion, weather resistance, and workability. In many cases, they also share similar drying and curing mechanisms. For example, latex and acrylic caulks cure primarily through water evaporation followed by polymer film formation, which is the same coalescence process used by many water-based paints. Because of this, environmental conditions such as temperature, humidity, and surface preparation can significantly influence their performance.

Understanding the differences between caulks and sealants, the applicable ASTM standards that govern their performance, and the proper installation practices required for durable joint sealing is essential for achieving long-term building protection.

Functional Differences and Intended Uses

Although the terms *caulk* and *sealant* are often used interchangeably in the field, there are functional differences between the two categories. In general, caulks are used for smaller joints where minimal movement is expected, while sealants are designed for joints that experience movement due to thermal expansion, structural movement, or vibration.

Caulks are commonly used for finishing work and small gaps in construction. They typically have lower movement capability and are frequently paintable. Many are water-based latex or acrylic formulations that are easy to apply and clean up with water. In general, caulks are primarily intended for interior applications or for protected areas where joint movement and weather exposure are limited. Typical applications include sealing trim and molding joints, filling small gaps around windows and doors, sealing drywall joints prior to painting, and completing interior finishing work.

Sealants, by contrast, are designed to accommodate larger joint movement and generally exhibit higher flexibility and elongation. Many are elastomeric materials capable of stretching and compressing repeatedly without losing adhesion. Sealants may or may not be paintable depending on their chemistry. They are generally intended for exterior applications where weather exposure and joint movement are more demanding, although many are also suitable for interior use. They are often used in expansion and control joints, window perimeter joints, façade joints, and other locations where building movement is expected. In practice, many products marketed as “premium caulks” are actually sealants with moderate movement capability.

Common Types of Caulks and Sealants

A variety of chemistries are used in caulks and sealants depending on the required durability, flexibility, and compatibility with building substrates.

- Latex caulks are among the most common materials used in interior finishing work. These water-based products are easy to apply, simple to clean up, and generally paintable. However, they typically have lower flexibility compared with elastomeric sealants and are therefore best suited for small interior joints.
- Acrylic or acrylic-latex sealants offer improved durability compared with basic latex caulks and are frequently used for exterior trim and siding joints. They remain paintable and provide moderate movement capability.
- Siliconized acrylic sealants are acrylic products modified with small amounts of silicone to improve flexibility and water resistance. These materials remain paintable while offering better weather resistance, making them widely used in architectural construction.
- Silicone sealants are moisture-cure elastomeric materials that offer excellent flexibility, weather resistance, and movement capability. They are commonly used in glass systems, curtain walls, and exterior joints. However, many silicone sealants are not paintable, which limits their use in some architectural applications.
- Polyurethane sealants are highly durable materials known for their excellent adhesion and abrasion resistance. They provide good movement capability and are often used in concrete, masonry, and expansion joints.
- Hybrid or modified polymer sealants—often referred to as STPE or SMP sealants—combine properties of polyurethane and silicone technologies. These products offer good adhesion, flexibility, and weather resistance and are often paintable, which has made them increasingly popular in construction applications.

Applicable ASTM Standards

Caulks and sealants used in building construction are typically evaluated according to several ASTM performance standards. One of the most widely recognized is ASTM C920, Standard Specification for Elastomeric Joint Sealants. This specification classifies sealants based on movement capability, type (single-component or multi-component), grade (self-leveling or non-sag), and intended use. Movement capability is expressed in classes such as ± 12.5%, ± 25%, and ± 50%.

ASTM C920 Classification	Joint Movement Capability
Class 12.5	± 12.5%
Class 25	± 25%
Class 50	± 50%

Another commonly referenced specification is ASTM C834, which applies to latex sealants such as acrylic latex and siliconized acrylic caulks. These materials are typically intended for interior or exterior joints where limited movement is expected.

Joint Design and Bead Geometry

Proper joint design and sealant bead geometry are essential for long-term performance. Sealants must be able to stretch and compress with joint movement without losing adhesion to the surrounding substrates. One widely accepted guideline is that the width-to-depth ratio of the sealant bead should be approximately 2:1 for most joints (Figure 1a).

Excessively deep sealant beads restrict flexibility and can lead to cohesive failure within the sealant. Proper bead geometry helps ensure that the sealant can accommodate movement without placing excessive stress on the adhesion surfaces.

The shape of the sealant bead also influences performance. A concave bead is generally preferred because it allows the sealant to stretch more effectively while reducing stress at the bond line and promoting water shedding (Figure 1a). A flush bead may be used where aesthetics are important, although it may experience slightly higher stress during movement. Convex beads are generally discouraged because their shape increases stress on the adhesion points and may lead to premature failure.

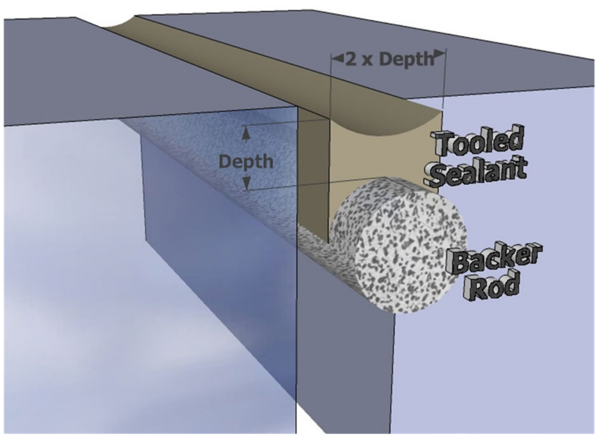

Figure 1a

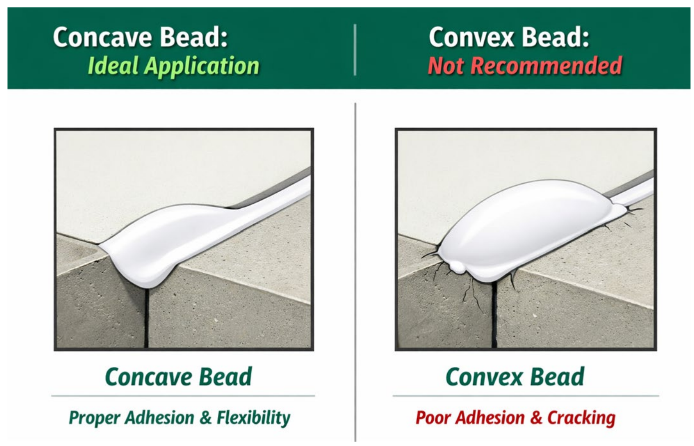

Figure 1b

Backer rod is commonly installed behind sealants to control bead depth and improve joint performance. Typically made from closed-cell polyethylene foam, backer rod serves several important functions. It helps establish the correct bead geometry, prevents sealant from bonding to the back of the joint, improves flexibility, and reduces sealant consumption. Preventing adhesion to the back of the joint is especially important because it eliminates three-sided adhesion, allowing the sealant to stretch properly during movement.

Joint Width	Recommended Backer Rod Diameter	Notes
1/4 in	3/8 in rod	Allows proper compression
3/8 in	1/2 in rod	Most common scenario
1/2 in	5/8 in rod	Ensures snug fit
5/8 in	3/4 in rod	Maintains sealant depth
3/4 in	1 in rod	Larger joints need stiffer rods
1 in	1 1/4 in rod	Prevents rod from floating or shifting

Figure 2

The correct backer rod size is typically selected so that the rod is slightly larger than the joint width, allowing it to compress by about 25% when installed (Figure 2). This slight compression ensures the rod fits snugly without being forced, provides proper support for the sealant, and helps maintain the correct sealant depth and joint profile. Choosing a rod that is too small can lead to movement, floating, or inconsistent sealant thickness, while an oversized rod can stretch or damage the joint. Selecting a backer rod with the appropriate compression is essential for long-term joint performance and durability.

Surface Preparation

Sealant adhesion is highly dependent on proper surface preparation. Substrates should be clean, dry, and free of contaminants such as dust, dirt, oil, grease, or previous sealant residues. Cleaning methods may include solvent wiping, detergent washing, or light abrasion depending on the substrate and sealant type. Smooth or non-porous surfaces may require abrasion to improve adhesion.

Porous substrates such as concrete and masonry may also require primers recommended by the sealant manufacturer. Inadequate surface preparation is one of the most common causes of sealant failure.

Application Conditions and Curing Behavior

Many water-based caulks and sealants behave similarly to water-based paints. These products cure primarily through water evaporation followed by polymer film formation, which means environmental conditions strongly influence their drying and curing characteristics.

Factors such as temperature, relative humidity, air circulation, and substrate moisture content all affect curing speed. In general, these materials should be applied when temperatures are above 50°F and when rain is not imminent. High humidity conditions can slow water evaporation and delay curing, while cool temperatures may extend drying times.

If water-based sealants are applied in cool or humid conditions, the curing process may be significantly delayed. This can lead to problems such as poor adhesion, surface cracking, shrinkage, or coating failure if paint is applied before the sealant has fully cured.

Common Sealant Failures

Sealant failures can occur for several reasons, often related to improper material selection, poor surface preparation, or incorrect installation practices. Adhesion failure occurs when the sealant pulls away from the substrate. This is commonly caused by contamination, inadequate surface preparation, or lack of primer where required. Cohesive failure occurs when the sealant tears within its own body rather than separating from the substrate. This may be caused by excessive joint movement, improper sealant selection, or incorrect bead geometry (Figure 2).

Figure 2

Another common problem is three-sided adhesion, which occurs when sealant bonds to the back of the joint as well as both sides. This restricts movement and often leads to tearing during joint expansion and contraction. The use of backer rod or bond breaker tape helps prevent this issue.

Lower-quality latex caulks may also experience cracking or shrinkage, especially when applied in thick beads or when rapid drying occurs.

Painting Over Sealants

Many acrylic and siliconized acrylic sealants are designed to be paintable. However, they should be allowed to cure sufficiently before applying paint. If coatings are applied too soon, sealant shrinkage may cause cracking in the paint film, adhesion problems may occur, or staining and discoloration may develop. Following manufacturer curing recommendations is essential for achieving proper performance.

Key Takeaways

Caulks and sealants play a critical role in protecting building assemblies from water intrusion and air leakage. Although they may appear to be minor components of a construction project, improper sealant selection, poor surface preparation, or incorrect installation practices can lead to significant performance issues.

Understanding the differences between caulks and sealants, selecting products that meet appropriate ASTM standards, and following proper joint design and installation practices are essential for achieving durable results. Because many modern sealants, particularly acrylic and latex products, share formulation characteristics and curing mechanisms with water-based paints, they must be applied under suitable environmental conditions and over properly prepared substrates.

When properly specified and installed, caulks and sealants contribute significantly to the durability, appearance, and long-term performance of building envelope systems.

2020 E. Orangethorpe Avenue • Fullerton, CA 92831
(714) 680-3800 | www.vistapaint.com
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