Appendix: Sealants (Caulks)

Introduction

Sealants are found in many locations on the exterior of a building, but have a single function: to allow building components to move without allowing the entry of air and water. Sealants are also used in non-working joints, where there is no movement but it is still important to keep out the weather. A glazing joint between glass and metal, or a construction joint in a cast concrete slab are examples of non-working joints. The discussion below will be limited to working joints, since they are the ones where failure is most likely and most undesirable. The most common movement in working joints is expansion and contraction of building materials in response to temperature changes.

In this manual’s checklists, the word “caulk” is used since it is more familiar to many people. “Sealant” is a more precise term, and covers a wider range of materials. The term “caulk” sometimes refers to oil-based materials that are lower in performance than silicones and urethanes, but in this manual caulk and sealant are used as synonyms.

Joint Types

Joints can be divided into three categories: Control Joints, Construction Joints, and Isolation Joints.

The purpose of a control joint is to divide a large area (brick, concrete, etc.) into smaller areas to make cracking less likely or to encourage any cracking to occur in the selected location. Control joints are usually non-working joints, except in the case of a brick wall where they act to accommodate expansion and contraction due to heating and cooling.

A construction joint is a joint in concrete where one placement of concrete ends and the next placement was begun after the previous work set up (“cured”). These are strictly non-working joints.

An isolation joint prevents movement in one part of a building from affecting other parts of the building. The most common isolation joint is the "expansion joint." Every building has major expansion joints that divide the building into segments; these joints go through the structure such as a wall or a roof and are continuous through the entire building.

If a wall without an expansion joint is built on top of a floor with an expansion joint, the wall will crack. Where human beings fail to put expansion and control joints, the forces of nature will put their own. The natural "joints" (cracks) damage building components and allow water and air to enter.

The control joints in a brick wall are also called expansion joints by some people; they both do the same thing. A control joint will go the depth of the face brick; a
true building expansion joint will go through the back-up structure behind the brick as well.

Other isolation joints occur between building components, such as between a brick wall and a metal window frame. The brick wall and the window frame will expand and contract at different rates in response to temperature changes.

**Sealant Types**

A preformed seal, like a gasket, may be used in a very large joint such as a true building expansion joint. The discussion below will cover only bulk sealants (caulks) that are applied to a joint with a caulking gun.

In working joints on a modern building exterior you will find "high performance elastomeric sealants", which are the higher quality grade of caulks that have good adhesion to keep joints weathertight and good movement capability to take expansion and contraction. The oil-based caulks and acrylic-latex caulks that homeowners use are examples of lower-performance sealants.

In order for the higher performance sealants to work properly they must have a foam "backer rod" or "caulk saver" behind them and a width-to-depth ratio of 2 to 1. This allows the sealant to expand and contract properly. The backer rod is a soft material that is wedged into the joint and held by friction; it is soft enough to compress and expand as the joint moves. Sometimes on a major building joint a precompressed expanding foam filler is used, which is a suitable joint material that will function well in response to tension and compression.

**Sealant Chemistry**

The most common exterior caulks are made from the following chemicals: acrylic, polysulfide, urethane (or "polyurethane" to be more exact), and silicone. In order to report on the condition of exterior joints it is not essential to know the different chemicals and their properties.

Silicones are the longest-lasting and most expensive of the high-grade caulks; they tend to be smooth, shiny, and will pick up a light coating of dirt. Other sealants will not adhere to silicones! In order to repair a silicone sealant joint, you must either clean away all the silicone (a contractor will grind the surface of brick, stone, or concrete) or use a compatible silicone. The sealant manufacturer or distributor will help you confirm compatibility. Silicones should not be used where the joint is submerged in water for long periods of time.

Urethanes are the other major group of exterior high-grade caulks. They may be similar to silicones in appearance, but are usually less smooth and shiny. They have less static electricity and thus attract less dirt. Silicones will adhere to urethanes, but urethanes will not adhere to silicones. Urethanes are often used in pavements, walks, and curbs, as well as in the horizontal joint that occurs at a relieving angle (shelf angle) in a brick wall. Urethanes are more resistant than silicones to water immersion but less resistant to ultraviolet light. Joints around window frames, door frames, and louvers could be either silicone or urethane.

A sealant that is mixed from 2 containers, called a "2-component sealant", can undergo incomplete mixing at the time of application or can undergo "reversion" or separation of the components. The sealant will appear mottled, oily, foamy, or sagging in either case. There may be oily stains adjacent to the sealant.
Acrylic and polysulfide caulks are found on some buildings but are not included in SCA standard specifications. Caulks other than silicone or urethane will be found on the interior of a school building.

**Installation**

The surface preparation, priming, and sealing of a joint is a complex procedure performed by a caulking contractor. The first step in surface preparation is removing the existing sealant and backer rod. Cleaning away the residue of the old sealant is important. Depending on the sealant to be used and the surface to be sealed, the final preparation step is a solvent wipe. Solvents can be both flammable and toxic and should be handled by trained personnel. In some cases, a primer is painted on the surface to improve adhesion (this will be stated in the instructions that come with the tubes of sealant).

Application of the sealant requires a minimum temperature, absence of rain, and a surface free of frost and moisture. The material should be gunned into the joint without air bubbles, and tooled without the use of slicking agents. Tooling is the use of a convex-surfaed tool which slides along the bead of sealant to make a slight concave shape to the sealant. This forces the sealant against the sides of the joint and improves the performance, adhesion, and appearance of the joint.

**Glazing**

For a discussion of sealants used in glazing, see Chapter 5, "Windows."

**End of Appendix**
Glossary of Sealant Terms

APPLICATION LIFE: The period of time during which a sealant, after being mixed with a catalyst or exposed to the atmosphere, remains suitable for application. Also referred to as work life.

BACK BED: A bead of sealant or glazing tape applied between the glass or panel and the stationary stop of sash or frame; usually the first bead of sealant or tape applied when setting glass or panels.

BACK-UP MATERIAL: A material placed into a joint prior to sealant application, primarily used to control the depth of the sealant.

BEAD: A strip of sealant applied in a joint; such as caulking bead, glazing bead. Also a molding or stop used to hold panels or glass in position.

BOND BREAKER: A release type of material (such as polyethylene film sheet with adhesive on one side) used to prevent adhesion of the sealant to the back-up material or back of the joint.

BULK COMPOUND: Sealants in containers or cartridges capable of being extruded in place.

BUTTERING: Application of compound or sealant to the flat surface of a member before placing it into position; such as the buttering of a removable stop before securing the stop in place.

CAP BEAD: A sealant applied as the top seal after the glass or panel and stop bead are attached.

CAULKING: Process of sealing a joint. Usually refers to the use of linseed oil compounds rather than the more recently developed elastomeric sealing materials.

CHANNEL: Three-sided, U-shaped member in sash or frame to receive glass or panel inserts.

CHEMICAL CURE: A change in the properties of a material due to polymerization or vulcanization, which may be effected by heat, catalysts, exposure to the atmosphere, or combinations of these.

CONCRETE CURING COMPOUND: A liquid applied to fresh concrete surfaces to form an impervious membrane to seal against loss of moisture and retain water for hydration of the cement. (Also referred to as concrete-sealing or membrane forming compound).

CONCRETE MOLD OR FORM RELEASE AGENT: A material used to prevent sticking of concrete to forms. May be based on silicone release agents or non-
drying oils.

**ELASTIC GLAZING COMPOUND**: A compound formulated from selected processed oils (and/or liquid polyisobutylene) and pigments to remain plastic and resilient over longer periods of time than conventional putty.

**FLOOR HARDENER**: A chemical solution which, when applied to new or existing concrete floors, reduces dusting and hardens the surface of the concrete.

**GASKET**: A preformed shape of rubber or rubber-like composition used to fill and seal joints or openings, either alone or in conjunction with a supplemental application of a sealant.

**GLASS CENTERING SHIM OR SPACER SHIM**: A small rubber block placed on the edges of glass or panel inserts to keep the insert centered in the sash or frame.

**GLAZING**: Application of sealant in the process of installing glass in prepared openings in windows, door panels, screens and partitions.

**HEEL BEAD**: A sealant applied at the base of a channel, after setting the glass or panel and before the removable stop is installed.

**JOINT**: A space between adjacent surfaces of members to be sealed.

**LAITANCE**: A thin coating which sometimes forms on the surface of concrete.

**NON-SAG (SEALANT)**: A sealant formulation having a consistency that will permit application in vertical joints without appreciable sagging or slumping at temperatures between $40^\circ F$ and $100^\circ F$ ($4^\circ C$ and $38^\circ C$).

**PRIMER**: A special coating designed to enhance the adhesion of sealant systems to certain surfaces.

**PROTECTIVE COATING**: A film to protect the surface from destructive agents or environments (abrasion, chemical action, solvents, corrosion and weathering). Such coatings may be either temporary or permanent. Temporary protective coatings include methacrylate lacquers; permanent types include coating to prevent galvanic corrosion.

**RABBET**: A two-sided, L-shaped member used for face-glazed window sash.

**RESILIENT TAPE**: A preshaped, rubbery sealing material furnished in varying thicknesses and widths, in roll form. May be plain or reinforced with twine, rubber or other materials. Non-oily varieties are suitable for use with curing sealants.

**SEALANT**: An elastomeric material with adhesive qualities that joins components
of a similar or dissimilar nature to provide an effective barrier against the passage of the elements.

SELF-LEVELING (SEALANT): A sealant formulation having a consistency that will permit it to achieve a smooth level surface when applied in a horizontal joint at temperatures between 40°F and 100°F (4°C to 38°C).

SETTING BLOCK OR SHIM: A small supporting block placed under the bottom edges of glass or panel inserts.

SHORE HARDNESS: A value of hardness obtained with a Shore hardness tester (durometer), measuring the resistance of a rubber surface to penetration of a blunt point pressed onto the surface.

SPACER: A small block placed on each side of glass or panel inserts to center them in the channel and maintain uniform width of sealant bead.

STAINING: A change in color or appearance of masonry adjacent to sealant.

STOP(STOP BEAD): A removable member at the front of a channel, which serves to hold the glass or panel insert in the sash or frame.

TOE BEAD: A sealant applied at the base of the fixed stop before or after the glass or panel is installed (opposite to heel bead).

TOOL: To shape and finish the surface of a sealant in a joint with a specially designed blade.

TOPPING BEAD: See CAP BEAD.

UNITED INCHES: The sum, in inches, of one width plus one height; usually of glass.

WATER REPELLANT: A solution of silicone or other resins in an appropriate vehicle which, when applied to dry masonry surfaces, renders them water repellant for a period of time.

WORK LIFE: The period of time during which a sealant, after being mixed with a catalyst or exposed to the atmosphere, remains suitable for application. Also referred to as application life.