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## CLOSE THAT GAP

by Bob Cusumano

Whenever there is a gap between construction materials, it is common to install sealant in the joint. However, proper procedure involves much more effort than simply smearing or gunning in an elastic material. Whether the main purpose of the caulking is weatherproofing or improving aesthetic appearance, careful consideration of joint design, the physical properties of the sealant to be used, and the operating environment of the joint all play a significant role in its performance and durability.

There are many sealant types available and the selection of a particular material should be based on its physical properties as well as its cost. Sealants are often classified by the amount of expansion and contraction that they can endure. Low cost sealants such as oil based caulks, and polybutene and isopolybutene materials have very limited joint movement capability of approximately 5%. These caulking materials should only be used for static joints with limited exterior exposure. Sealant materials that can accommodate joint movement of approximately 12.5% include latexes and butyls. Silicones, polyurethanes, and polysulfides offer elongation and contraction capabilities, but at an even higher price. Other factors that determine a sealant materials performance include adhesion, hardness, abrasion resistance, ease of installation, effective temperature range, resistance to weathering,

Regardless of the type of sealant used, it cannot perform properly in a geometrically improper joint. The joint must be large enough to accommodate a sufficient amount of material so that expansion and contraction can be achieved when the joint moves. Some rules of thumb for sizing joints are as follows:

1. The minimum width and depth of joints in weatherproofing situations should be  $\frac{1}{4}$  inch.
2. For small joints up to approximately  $\frac{1}{2}$  inch wide, the depth of the joint should be approximately equal to its width.
3. For medium sized joints that are between  $\frac{1}{2}$  inch and 1 inch wide, the depth should be no more than  $\frac{1}{2}$  inch.
4. For large joints over 1 inch wide, the depth of the joint should be approximately 50% of the width.

The above rules are based on performance studies that indicate that when sealant joints are too deep, the stress created will increase, likely resulting in failure of the sealant. The joint depth is often controlled by placing a compressible material called a backer rod into the joint. Backer rod is typically a foam-like material and is purchased in long lengths of various diameters and is inserted into the joint just before the sealant is applied.

Another important reason for using backer rod is to prevent a condition known as “three point adhesion”. When you install caulking, it should be adhered to the two sides of the joint, but not to the rear. If the sealant is attached to both the sides and the rear of the joint, then its ability to elongate is compromised and sealant failure often occurs. The backer rod either provides a surface that the sealant will not adhere to or will be so flexible that even though the sealant adheres to it, it does allow the sealant to move properly. Bond breaker tape may also be used to prevent three point adhesion when the depth of the joint does not need to be controlled.

The most common form of sealant failure is adhesive failure when the material disbonds from one of the surfaces to which it is attached (photo 1).

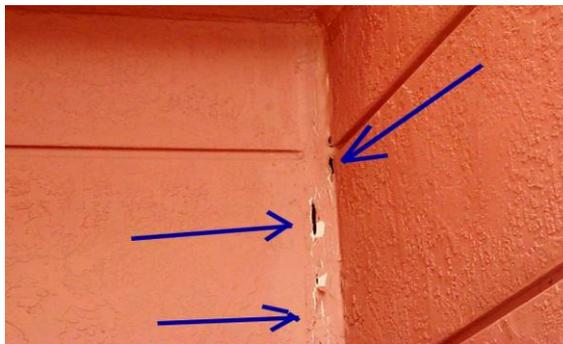


Photo 1

For this reason, joint preparation is of utmost importance. Joints should be cleaned by grinding, sanding, or wire brushing to expose a sound surface free of contamination. Solvent cleaning may be required to remove surface contaminants. All loose materials, including previously applied coats of paint, which would impair the adhesion of the sealant, must be removed. The sealant shown in photo 2 failed when the paint to which it was applied delaminated. On certain materials, the sealant manufacturer will require the joints to be primed prior to installing the sealant material.



## Photo 2

Proper sealant installation requires that the sealant bead be pushed into the joint opening to fully wet-out and adhere to the sides of the joint. Masking tape should be placed at the sides of the joint, if needed, to avoid contact outside of the joint. The sealant joint opening should be filled to a full and proper configuration. Vertical joints should be lapped over horizontal joints. After the sealant is placed, and before skinning or curing begins, it requires immediate tooling. This is normally accomplished with metal spatulas. The tooling process should create a smooth, uniform finish with no air pockets and good contact for optimum joint sealant adhesion within each side of the joint opening. Excess sealant should be removed from adjacent surfaces and any masking tape should be removed after the sealant is installed. The sealant manufacturer as well as ASTM Standard C-1193 will provide guidelines for proper specific joint sealant installations.

When you are bidding on caulking and sealant work, it is very important that the size of the joint be constructed as specified. Let's say that you are to caulk 40 expansion joints on a new 20 foot high warehouse. Therefore, there is 800 linear feet of joint to caulk. A detail on the plans indicates that the joints are to be 1/2 inch by 1/2 inch. Table C of the PDCA Estimating Guide Volume 2 indicates that you can caulk 6.2 linear feet of this joint size with a 10.3 oz. cartridge of material. Therefore, the number of cartridges that would be needed is 800 LF divided by 6.2 LF/cartridge for a total of 129 without considering waste.

When the walls are erected, you go to the job site to measure the joints and realize that you must install a caulking bead that measures 1 inch by 1/2 inch instead of the 1/2 inch by 1/2 inch bead you figured in your bid. According to Table C, you can now only caulk 3.1 linear feet of joint per cartridge, so the number of cartridges actually required is  $800 \text{ LF} / 2.8 \text{ LF/cartridge} = 258$  cartridges (again, without waste). You will need an extra 129 cartridges of caulking due to this increase in joint size! Obviously there will also be an increase in the cost of labor and the cost of the backer rod.

Successful sealant installations will provide many years of excellent service, but they don't happen by accident. Proper joint design, careful selection of the type of sealant to be used, and meticulous adherence to installation details are all required.