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Joint Sealant Guide

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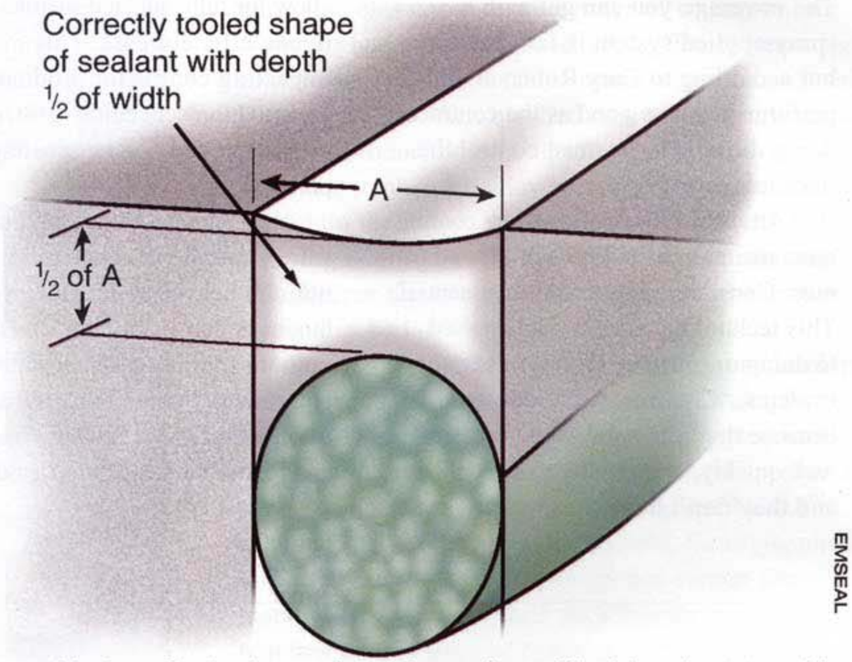
More than Filling the Gap

Options exist when choosing a joint sealant

By Lester Hensley



Proper positioning of a backer rod and the tooling of liquid sealant, to achieve a functional joint.

While they constitute only a small percentage of a construction budget, joint sealants and other waterproofing-related issues are responsible for a majority of post-construction complaints and requests for retrofits.

According to the Construction Industry Research and Information Association (CIRIA), the treatment of movement joint gaps in buildings—from design, technology, and installation standpoints—is underemphasized. "Although they are a minor component of the building envelope, joints with sealants are often responsible for defects and failures—sometimes after only a couple of years."

Additionally, the overall energy efficiency of a building depends on the ability of joint sealants to provide thermal insulation and a barrier against air infiltration. All too often, the joint sealant represents the least insulating component, degrading the effective R-value of the entire wall system.

That's why contractors need to understand that the sealing of structural expansion joints is not just a matter of filling the gaps. Joint sealants function as integral components of the building envelope. Properly specified and installed, expansion joints protect the structure from damaging moisture ingress caused by wind, gravity, capillary force, surface tension, and air pressure differentials.

To solve so many problems, manufacturers have numerous product options for joint sealing. Among the most common are liquid sealants, impregnated foam sealants, and hybrid technology sealants.

Liquid sealants

Liquid sealants are widely used because of the relatively low material cost and the speed of installation. Architects appreciate the wide color range available. Liquid sealants, particularly high-performance silicone sealants, provide moisture impermeability, low modulus, UV resistance, and retain these physical properties with changes in age and temperature.

Liquid sealants are supplied in tubes, pails, sausages, or in other ways convenient for shipping. They are extruded through a nozzle into joint gaps over a pre-placed foam backer rod that serves the sole function of a temporary installation aide. The contractor then tools the sealant against the backer rod to achieve the hourglass cross-sectional shape needed for handling extension and compression movement. Achieving this hourglass shape is critical to the performance of the liquid sealant once it has cured into a solid plastic state. The backer rod makes it easy to attain the required shape but does not provide thermal insulation, waterproofing, resistance to air pressure differentials, or any other benefit.

Liquid building sealants are at their best when used where the basic stresses in the material are shear stresses and not tensile stresses. The preferred condition is the virtual elimination of any tensile stresses at either the bond line or within the elastomer.

One limitation of liquid sealants is the presence of tensile stresses at both the bond line and within the body of the cured sealant during extension movement. The negative effect of these tensile stresses is aggravated by installing the liquid sealant in other than the specifically

The hybrid sealants overcame the fatigue and potential cohesion failure of liquid sealants

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backing. The hybrid sealants overcome the fatigue and potential cohesion failure of liquid sealants. Additionally, when compared to alternatives for structural joint sealing, hybrids provide non-invasive anchoring, eliminating the need to drill or screw into sensitive substrates. This removes the risk of spalling and enables installation into inside corners that are impossible to seal with aluminum rail and rubber strip seals.

Hybrid joint sealants provide a solution for applications including movement joints, large joints over 1-inch where resilience or the need to resist air-pressure and thermal differentials is essential, anywhere a mid-span structural joint is designed, where joints result between abutting buildings, or where additions are made to existing structures.

The new criteria for durability and energy efficiency driven by the adoption of air-barrier codes and principles, as well as by LEED criteria, justify the use of hybrids for joints as small as 3/8 inch. The use of higher R-value hybrids can contribute to the better energy use while increasing the sealant system durability due to the absence of tensile stresses.

With hybrids, the opening and closing movement of a joint gap results in the surface sealant folding and unfolding—rather than stretching and compressing—eliminating substrate bond-line stresses and failure or composition changes caused by pre-cure joint-gap movements.

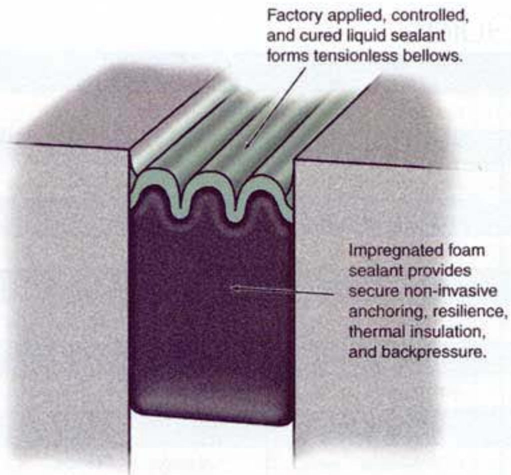
Installation of hybrid technology involves removing the sealant from its hardboard and shrink-wrap packaging that holds it compressed to less than the joint size. The sealant is inserted into the joint opening, recessed to the desired depth, but at least deep enough to accommodate a fillet bead of sealant applied later. A pressure-sensitive mounting adhesive on one face holds the material in place while it slowly expands to fill the joint. A fillet bead of liquid silicone locks the bellows to the substrate. The fillet bead, while field applied, is never in tension as in a conventional liquid sealant and backer rod installation and is simply used to ensure that the bellows is sealed to the substrates. **CS** required geometry. Liquid sealant failure is accelerated by cycles of compressive stress (when the joint is closing) followed by cycles of tensile stress.

Unfortunately, it is difficult to consistently achieve the required geometry. The Sealant Waterproofing and Restoration Institute (SWR Institute) specifies a 7- to 12-step installation process in order for liquid sealants to function properly. Deviations in the depth of the backer rod, for example, can cause the sealant to fail completely. As two-stage sealing using the double caulk and backer rod detail has gained popularity, achieving a clean substrate and installing to the required geometry in the second seal deep inside the wall section is difficult. Further, if installed in close succession, the outer installation will delay or even prevent the inner sealant from properly curing.

Impregnated foam sealants

Another common method of sealing joints is with preformed, impregnated foam sealants. Preformed sealants—in contrast to liquid sealants—are supplied ready for installation in their finished, functional state. They are produced by partially filling the cells of high quality cellular polyurethane foam with non-drying, water-repelling adhesive agents. The combination of this impregnation treatment followed by compression of the fully expanded material to as much as one-fifth of its size, creates a sealant material that, when installed in a joint, is always in compression.

The principal advantage of preformed, precompressed, impregnated foam sealants is that they provide thermal insulation in addition to moisture impermeability. R-values of as much as 3.28 per inch



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Composition of a silicone/impregnated foam hybrid seal.

of depth are typical of impregnated foam sealants.

Preformed impregnated foam sealants, by virtue of their depth, density, and adhesive-infused cellular composition, also resist air pressure differentials often found between interiors and exteriors of buildings using forced air heating and cooling.

Impregnated foam sealants require correct sizing to maintain a suitable level of compression for sealing. Correct sizing is a necessary requirement for all sealing methods. Liquid sealants are equally dependent on correct sizing, because you cannot, for example, install 1-inch backer rod into a 1½-inch joint-gap, tool liquid sealant over it, and expect to achieve the necessary geometry for the sealant to function.

The colors available for standard impregnated foam sealants are black or gray. These are widely used to create shadow-line effects. However, when it is preferred to make the material blend or coordinate with the color of a substrate, this limited selection becomes an issue.

Hybrid sealants

Hybrids have emerged to create more effective products. These new products preserve the best features of the component materials while eliminating any weaknesses that were in the original technologies.

Hybrid sealants combine factory-applied and cured silicone bellows with an impregnated expanded foam sealant

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Lester Hensley is CEO and president of EMSEAL Joint Systems, Westborough, Mass. For questions on joint sealants contact him at LHensley@emseal.com.