CHOOSING High-Performance Caulks

A guide to the endless array of products on the caulk aisle

by Don Jackson

Read the label on a tube of caulk and it's likely to promise the world: "50 years," "lifetime durability," "guaranteed." Superlatives abound, exclamation points are in order. "Exceptional adhesion," "permanent flexibility," "all purpose."

Flip the tube over and read the small print, however, and you'll find that the warranty is practically worthless because it only covers replacement cost for the caulk itself. The stakes are a lot higher than that if you're relying on caulk to seal out the weather on a new home or remodel.

Faced with a shelf displaying ten different products, each claiming "superior performance" and "adheres to most surfaces," how do you choose?

Researching this article was a chance to retest my old prejudices and preferences, and see how the new formulations compared with the products I used seven years ago when I was still in the trades. I went through almost 50 tubes of sample caulks on a variety of substrates. I concentrated mainly on the high-performance caulks — the ones designed for moving joints and that meet the ASTM C-920 standard (see "Caulks vs., Sealants," opposite). In the end, my own simple testing did far more to inform me than all of the hours spent talking to technical experts. I formed definite opinions that would influence my buying if I had to caulk a joint tomorrow.

Silicones come in two types: neutral cure (the three on the left) and acid cure (the righthand three). Performance varies between the two types, but manufacturers don't always make the distinction clear.

Caulk Not a Cure-All

Before you buy a tube of high-performance caulk, ask yourself *why* you're buying it. Is the caulk your main line of defense for keeping out the weather, or do you have some backup protection underneath? Caulking is not a substitute for proper flashing and weatherproofing. For example, no amount of caulking will make a vinyl siding job waterproof — that's the work of the building paper underneath. Before you buy into the hype and expect a caulk to provide a "permanently flexible, watertight seal" that will "last a lifetime," stop and think about those warranties.

Caulk Basics

All caulks are formulated starting with a base polymer, sometimes called the "backbone polymer." To this polymer are added assorted ingredients, including fillers, plasticizers, solvents, adhesion promoters, UV absorbers, pigments, and curing agents, among others. The proportions and types of additives are varied depending on the properties the sealant needs and the various substrates it needs to stick to.

The backbone polymer gives a certain identifiable character to the caulk; the additives change the performance in various ways, depending on the manufacturer's intent. One polyurethane formulation may have increased hardness for use as a pavement control joint,

where it will get walked over by high-heel spikes; another one may have increased flexibility but may be softer, making it better for vertical joints where a lot of movement is expected. But both products will exhibit essential polyurethane qualities.

There are four polymer types used to manufacture most high-performance caulks: silicones, polyurethanes, latex acrylics, and the solvent-based "block copolymers" — synthetic rubbers, of which Shell's Kraton is the most popular.

Making Sense of Silicones

Next time you're walking downtown, look up at one of those sleek glass-clad skyscrapers and consider this: Those huge glass panels may be resting in their frames restrained only by beads of silicone sealant. It's a scary thought, especially on a windy day. But it's a testament to the strength of the so-called structural silicones developed for high-rise curtain wall construction — applications that go far beyond the demands of residential construction. Yet the silicones that are available to builders and homeowners have trickled down from the commercial market, and share many of the characteristics of those super-silicones. It's no wonder that silicones are often touted by caulk companies as "top of the line" and that many builders look for "100% silicone" on the label when they want the best.

But descend from the world of high-rise structural glazing, and "best" becomes relative. Silicones don't always live up to expectation in the messy world of home building and remodeling.

No paintable silicone. For one thing, silicones won't hold paint — a huge strike against them. Tech support reps for silicone sellers like to say this is because the paint is not as flexible as the silicone, so it breaks down and falls off (in other words, blaming it on the paint). Common sense and experience suggest that the paint just doesn't stick. In fact, silicone giant GE seems to be giving up the quest for a paintable silicone: For paintability, they've added acrylic latexes

Caulks vs. Sealants: What's in a Name?

It's getting harder to find a good, old-fashioned "caulk" on the store shelves anymore — seems they've all gone off and become "sealants." The term sealant implies higher performance — a material that not only sticks well to a variety of substrates but that withstands the weather and is flexible enough to stretch and compress with building movement without losing adhesion or tearing. Silicones and urethanes are invariably called sealants. Among the latex brands, the terminology is mixed: Lower-performing compounds are more likely to be called caulks (for example, "painter's caulk"), while 100% acrylic products might be dubbed either a caulk or a sealant. Dap's 230 acrylic is labeled an "advanced latex sealant" while M-D's Maxx 5000 is touted as "an advanced professional sealant" and "our best acrylic caulk."

This inflationary language is more than just marketing hype — it has to do with terminology adopted by the ASTM (American Society for Testing and Materials) C-24 committee, the standard writer for the sealant industry. ASTM C-834 is the "Standard Specification for Latex Sealants," a minimum standard for older generation latex caulks; ASTM C-920 is the much more rigorous "Standard Specification for Elastomeric Joint Sealants." If a caulk meets the requirements of either (or both) of these standards, the manufacturer is likely to use the name "sealant" on the label.

Caulk code: ASTM C-834 is the standard for latex caulks; ASTM C-920 is the spec for sealants for moving joints. TT-S-00230C is a federal standard similar to, and being replaced by, C-920.

The C-920 standard was originally created for polysulfides, polyurethanes, and silicones — rugged sealants that met the demands of high-rise curtain wall construction. To pass C-920, caulk samples on glass, aluminum, and concrete are exposed to a battery of tests, including being heated in ovens, frozen, immersed in water for a week, and put through numerous cycles of compression and elongation, without showing adhesive or cohesive failure. As acrylics have improved, they are also proving able to meet this standard — almost. C-920 allows for no more than 10% shrinkage by weight after heat aging, but most acrylics shrink 20% or more. That's why top acrylic caulks generally claim to meet only the "performance requirements" of C-920. The same is true for Kraton-type caulks, which can meet all the C-920 criteria except for shrinkage (they may shrink anywhere from 30% to 40%).

Despite the rough treatment in the lab, the ASTM tests are not as brutal as the conditions the caulks will be exposed to in service. These are minimum standards. To be on the safe side, use C-834 latex caulks on the interior only; for exterior caulking of joints where movement is expected, choose a caulk that meets C-920 Class 25 (+/-25% movement); for nonmoving joints, a C-920 Class 12.5 caulk is a good choice.

to their new consumer product line. There are still some paintable silicones on the market, but they're probably not worth the trouble.

Acid cure vs. neutral cure. Silicones also seem to be choosy about what they'll stick to. One issue is that silicones come in two types: acid cure and neutral cure. Acid-curing silicones, which produce acetic acid as the rubber cures, can corrode metal and etch some plastics. Unfortunately, the manufacturers don't often make the distinction clear. If the tube lists chemical ingredients, look for the word "acetoxy." If you use a silicone and your eyes and nose get assaulted by the Vinegar from Hell, you'll know you've got an acid-cure.

Generally, acid-cure silicones work best on nonporous surfaces like glass, glazed tile, and unfinished aluminum. With most other metals, including anodized aluminum, you should avoid acid-cure silicones (unless you're willing to locate and apply the right primer).

The neutral-cure silicones I tested stuck well to both aluminum and galvanized steel, while one acid-cure peeled right off of the galvanized.

The neutral cures also adhered moderately well to wood while the acid cures stripped easily. In general, none of the silicones I tested adhered to wood as well as the other types of caulk, with the exception of GE's Silpruf.

Dirt and staining. Silicone caulks pick up dirt by electrostatic attraction. They are also known to stain stones like marble, limestone, and light-colored granites, as well as light-colored concrete. Silicones have the reputation of not sticking to concrete and masonry. The samples I applied to porous concrete and brick bore this out.

Workability. Silicones are messy to work with. Unfortunately, it is usually recommended that they be dry-tooled. In other words, you shouldn't use water or a soapy solution on your finger or whatever it is you like to tool with.

On the plus side, silicones have an amazing application temperature range — from -35°F to 140°F, making them a good cold-weather choice. Their service temperature range is even greater — from -80°F up to 400°F in some cases. Silicones are the sealant of choice for sealing around metal chimneys; high-temperature formulations are available with service temperatures up to 500°F.

Applications. If you can get a silicone bead to stick where you want it, you've probably got the best seal you can get. No other sealant has the long-term UV and weather resistance, nor the strength. This is a two-edged sword, however. If you've ever had to separate a sink that was bedded in silicone from the countertop beneath, you know what I mean. When you use silicone that way, think "permanent." Also, once you've used silicone on a surface, you're committed to silicones. No other sealant will stick to the oily residue left behind, assuming you can clean the bead off. Until recently, there was no known solvent for silicone. Now a company called Amtex (800/562-6839) makes what it claims is a nontoxic solvent for cleaning either cured or uncured silicone. The stuff's not cheap — around $27 a quart — but it may be worth trying if all else fails.

Polyurethane excels as a rugged outdoor caulk. It's particularly useful in masonry joints and for joining dissimilar materials.

Silicones are popular in kitchen and bath applications because of their water resistance and superior adhesion to nonporous surfaces. Also, being inorganic, silicone doesn't support mildew growth, though the additives might.

Because of their UV resistance, silicones are great for special glazing applications, especially glass-to-aluminum joints (keep in mind that you may need a primer with other metals). And given their excellent flexibility, silicones are the sealant of choice for EIFS manufacturers, many of whom specify Dow Corning 790, which is available in 13 colors. Primers are often required.

Although "window and door" silicones are now being marketed, be careful: If you use silicone around a window or door installation that's later going to get painted, you might make an enemy of the painter.

Polyurethanes

Polyurethanes are favorites of masons. They stick well to most kinds of masonry without a primer and don't have the staining problems associated with silicones. In fact, polyurethanes stick reliably to just about everything. This makes them an ideal choice for joints between dissimilar materials — wood to masonry, metal to wood, and so forth. In the adhesion tests I ran, the polyurethanes showed better adhesion in every case than any of the other caulks. In most cases I could hardly get my fingernails under the bead to pull it up.

Polyurethanes have typically been hard to come by for builders and remodelers who buy through retail lumberyards. This is changing, however, as more and more caulk companies add urethanes to their product lines. ChemRex's PL line of polyurethanes is even available in Home Depot. One of my favorite products, Sikaflex, is available by credit card in any quantity directly from Sika.

Polyurethanes can be applied down to 20°F, depending on the product. They are relatively stiff out of the tube, and can be tooled nicely with a plastic spoon. Sika allows wet tooling with a soapy solution, though many polyurethane manufacturers recommend against it. Since polyurethanes cure by exposure to moisture, wet tooling can facilitate cure in dry climates. Polyurethanes have a typical shelf life of one year, after which they get so stiff in the tube they can't be gunned. Geocel's polyurethanes cure by exposure to oxygen instead of moisture, and have a two-year shelf life.

Polyurethanes are not naturally UV resistant, but are formulated with UV absorbers to give excellent resistance. They will not corrode metal, and are ideal for general caulking on metal roofs. Like silicones, polyurethanes shrink very little during curing. They come in a limited number of colors, but can be painted after cure.

Polyurethanes are good for control joints in masonry, traffic and expansion joints in slabs, general-purpose caulking around flashing, and any other exterior joint where movement is expected.

Latex Acrylics

Acrylics have been the rising stars of the caulk market during the last decade. Just as acrylic paints are now matching or beating the performance of the best oil-based paints (and winning over skeptics along the way), acrylic caulks are starting to move in where previously only silicones or polyurethanes dared to go. Choosing a bedding caulk for installing door and window units is a no-brainer — you grab a tube of a reasonable quality latex caulk and have at it. Likewise for any interior trim and painting caulking — nothing beats the workability of a latex formulation. Latexes tool with a finger and clean up with water; plus they're nontoxic and produce little odor, making them ideal for indoor work. They stick well to a variety of materials and can be painted.

But are they up to heavier-duty work — a tile shower or exposed outdoor caulking? The answer is yes, as long as you choose the product carefully and give it some protection as it cures.

Flexible chemistry. Older-generation latex caulks have less flexibility — +/-7.5% movement capability. The new high-performance acrylics are formulated with a high percentage of plasticizers, so many are capable of +/-25% movement. This doesn't come close to the ability of silicones and polyurethanes, some of which can withstand 100% elongation and 50% compression (+100%/-50% movement), but it's adequate for most residential demands. The plasticizers in these new-generation acrylics are nonvolatile — that is, they don't evaporate as the caulk ages, so the caulk remains flexible indefinitely. Top-performing acrylics also have good UV resistance and aren't susceptible to adhesion loss from water.

High-quality latex acrylics win the prize for user friendliness, and claim to meet the same performance standards as some silicones and polyurethanes.

So why not toss all those messy silicones and urethanes and move over to acrylics? There are a couple of reasons. For one thing, acrylics are much slower to firm up as they cure than urethanes or silicones, leaving them more vulnerable to the weather. Much of the ASTM testing is done after the caulks have been able to cure for days or even weeks. But on a remodel, an exterior caulk bead goes into service from the moment it's tooled.

To test how these softer acrylics would handle a surprise rainstorm, I ran beads for six different acrylic caulks on a piece of painted sheet metal, along with sample beads of silicone, polyurethane, and Kraton-based products. I let all the beads cure for an hour outside at 70°F, then hit them with spray from a garden hose for five minutes. Of the six acrylics, all were deformed by the spray; in two cases the bond lines were smeared and weakened, and in one case the caulk partially dissolved and ran down. The other three types of caulk were virtually unaffected.

This was no white-smocked, scientific test by any means, but it supported my suspicions that compared with other types of caulk, these soft acrylics might require special care to be able to cure properly in exterior joints where movement is anticipated. (For light caulking of nonmoving joints before painting, however, acrylics are fine as long as the weather is cooperating.) Acrylic caulks also have to be protected from freezing in the package and can't be applied below 40°F. However, once they're in place and cured, many remain flexible at very low temperatures. DAP's Formula 230, for instance, has a service temperature range from -30°F to 180°F.

With care, I would also use a top-of-the-line acrylic to caulk the expansion joints in a tiled shower — another fairly severe environment. Allowed to cure properly, these caulks are up to the task. Tile guru Michael Byrne swears by Color Caulk's Pro Line Class A — an acrylic caulk that meets C 920 and comes in specially mixed colors, and sanded if desired, to match most commercially available grouts. Always use a caulk with mildewcide for kitchen and bath work.

Because of their water content, latex acrylics will shrink as they cure — up to as much as 30% by volume. For a tight waterseal, you may have to go back and add more caulk.

What does siliconized mean? In choosing a high-performance acrylic,

don't be misled by the term "siliconized." All caulks are "siliconized," which refers to the addition of small amounts of adhesion promoters called silanes (a form of silicone). Early on, the term was a marketing ploy that let latexes piggyback on the reputation of silicone. Nowadays, with 100% acrylics coming into their own, the term is just as likely to be used on a medium- or even low-quality latex caulk.

Because there are so many grades of latexes (including polyvinyl acetates, vinyl acrylics, and 100% acrylics), you will have to choose carefully to find a top performer. Look for an acrylic with the ASTM C 920 Class 25 designation, which indicates +/-25% movement capability. Don't confuse this with the marketing claim of "25% *total* movement," which indicates +/-12.5% movement.

Kratons, or Block Copolymers

Kratons are the new kid on the caulk block. These are typically the "superclear" caulks — products such as Sashco's Lexel, Geocel's Pro Flex, and OSI's Quad. The strength of these caulks is their versatility. They stick to just about everything (they'll melt rigid foam, however), and can be applied to damp substrates and in temperatures down to 10°F or lower. And there's no doubt about their clarity, if it's a clear caulk you need. (I hate to take sides in the caulk wars, but I found Quad to be the clearest of all.) These caulks skin very quickly, but can typically be wet-tooled with soapy water.

For me, the biggest drawback to the Kraton products is their heavy solvent odor. Despite some marketing claims to the contrary, these are not caulks to be used indoors — unless you've got at least a week for ventilation before occupancy. One tech support person told me that sensitive individuals can smell the solvents for months. A second drawback is shrinkage: After the solvents flash off, the bead is as much as 35% smaller. The caulk will meld to itself, however, so if shrinkage is a problem you can add more sealant.

New solvent-based "block copolymer" synthetic rubbers are the backbone of these caulks. The products are known for good performance and versatility, but the fumes can be strong and persistent.

Kratons can be painted, and they're easy to color — a fact that OSI has used to advantage in its Quad line, which is available in more than 100 colors to match standard shades of vinyl and aluminum siding.

I could probably live without Kraton products if I had never heard of them, but I might keep a tube of Geocel's Pro Flex in the truck, for one reason: It claims to stick to oily surfaces — a unique claim in the caulk market, as far as I know. This could come in handy if you have to get caulk to stick to a concrete foundation that has traces of form release oil on it. I'm not ready to bet the ranch that it will work, but it's worth a try.

Get Your Hands Sticky

So who can you believe when it comes to caulk claims? Ultimately, you have to get your hands on the product and try it, then go back and see how it performs over time. Your own house may be your best test site. If you've got a question about how a caulk will work in a given application, call tech support by all means, but don't ignore your own field test with the actual substrate materials; it's the only way you can be sure.

Don Jackson *is JLC's managing editor.*

Caulk Manufacturers

Bostik, 211 Boston St., Middleton, MA 01949; 800/726-7845

Chemrex, 889 Valley Park Dr., Shakopee, MN 55379; 800/828-0253

Color Caulk, 723 W. Mill St., San Bernardino, CA 92410; 800/552-6225

DAP, 855 N. Third St., Tipp City, OH 45371; 800/543-3840

Dow Corning, Midland, MI 48686; 800/248-2481

Franklin Intl., 2020 Bruck St., Columbus, OH 43207; 614/443-0241

GE Silicones, 260 Hudson River Rd., Waterford, NY 12188; 800/255-8886

Geocel Corp., P.O. Box 398, Elkhart, IN 46515; 800/348-7615

Gibson-Homans, 1755 Enterprise Pkwy., Twinsburg, OH 44087; 800/433-7293

Gloucester Co., 235 Cottage St. Franklin, MA 02038; 800/343-4963

Macco Adhesives, 925 Euclid Ave., Cleveland, OH 44115; 800/634-0015

Macklanburg-Duncan, 4041 N. Santa Fe, Oklahoma City, OK 73118; 800/654-0007

Mameco Intl., 4475 E. 175th St., Cleveland, OH 44128; 800/321-6412

OSI Sealants Inc., 7405 Production Dr., Mentor, OH 44060; 800/321-3578

Red Devil, 2400 Vauxhall Rd., Union, NJ 07083-1933; 800/423-3845

Sashco Sealants, 10300 E. 107th Pl., Brighton, CO 80601; 800/767-5656

Sika Corp., 4800 Blue Pkwy., Kansas City, MO 64130; 800/548-0496

TACC Intl., Air Station Industrial Park, Rockland, MA 02370; 800/503-6991

Top Industrial Inc., 16149 Leadwell St., Van Nuys, CA 91406; 800/473-1617

Tremco, 3735 Green Rd., Beachwood, OH 44122; 800/321-7906

UGL, P.O.Box 70, Scranton, PA 18501; 800/845-5227

White Lightning, 770 Tipton Indust. Dr., Lawrenceville, GA 30045; 800/869-4483