



What is a TRUE 5200 bottom?

by Don Danenberg



A well-used, 10-year old 'shortcut' 5200 bottom showing open seams. The owner was billed for 24-tubes of 5200, obviously not enough. Also, no barrier coat primer.

I have lately been asked questions about boats that have been purchased or restored with 5200 bottoms, and why they might not be operating as I had described nearly 20-years ago? After some research I find that many, even professional shops that charge \$30 to \$50 more per hour than I do, have been short-cutting my formula for a longer lasting bottom construction.

In March, 1997, in issue #76, *Classic Boating* magazine published an article called "Better Wearing Bottoms." This was my description of how I had been planking runabout bottoms since the mid-1980s.

The whole idea is "Enhanced Traditional" construction, basically following the scantlings and fastener schedule of factory construction, but using modern sealers, bedding compounds and barrier coat paints that each separately, and hopefully in total, enhance the lifespan of the entire construction.

From the early 1970s to the mid 1980s, I had been working on 40-ft to 120-ft offshore sailboats, working under certified shipwrights, not just simple

boatwrights such as myself. This work was done in professional boatyards in such places as Newport, RI; Norfolk, VA; West Palm Beach, FL; and Nassau, Bahamas. I was taught procedures and materials that were meant to last the test of time. These were offshore boats, operating hundreds or thousands of miles at sea.

My intention was to bring these procedures and material practices to the world of mahogany runabouts so they would also benefit from this knowledge of a longer lasting product.

I knew that the runabouts were never intended to *swell up*, especially every season (that's why they came with lift rings), but also knew from training that cold-molded laminating glues would be an eventual problem in traditional plank-on-frame construction. Encapsulation would work on the thin ($\frac{1}{16}$ " to $\frac{1}{8}$ ") laminations of true cold-molded construction, but there would still be too much movement (seasonal temperature differences alone) in any thicker laminations.



This 'shortcut' 5200 bottom shows almost no rubber filling seams; also stainless screws? Do not expect longevity here.

WOOD SEALER

In 1991, I began the complete reconstruction of a 1937, 24-ft Gar Wood utility that my father had purchased in Ohio for storage fees. The wood was badly rotten and weak, a true pattern boat. The disassembly showed, like an autopsy, just *what* failed and *why*.

The fellow who purchased the boat, and the reconstruction, brought with him a popular local product from California, Smith's CPES (Clear Penetrating Epoxy Sealer). While this product was primarily used in architectural applications, they reported success in marine applications as well.



This 10-year old 'shortcut' 5200 bottom had never been put in the water. 24-tubes of rubber were billed and *no* CPES or barrier coat primer. Note how plank shrinkage cracked seams and left bung putty proud.

I ran tests on this and other common sealants by cutting many identically-sized pieces of mahogany and weighing each, in grams, on a triple-beam scale. I then applied CPES (2- and 3-application samples, also different timing between applications), a popular brand epoxy laminating glue (similar numbers of applications as above), and 3M-5200, with and without CPES (multiple coat samples as above). After cure, these were all weighed in grams again.

Along with bare control pieces, these sample tickets were then submerged in water for 30 days and weighed again. After 30 days drying, they were all weighed again.

I found that CPES gained less weight, when soaked, than bare wood, and more weight than epoxy glue coatings; but ended up the lightest weight when dried.

This told me that it would slow down moisture movement over bare wood, but would breath that moisture back out, definitely not encapsulating the wood, which has shown to create other problems.

I contacted Steve Smith, the chemist who developed CPES, and he verified my observations with tests he had already done in his lab.



Sections from a failed 3M-4200 bottom. The "professional" restorer used a woefully inadequate amount of 4200 (20 tubes), which set too early (note trowel tooth marks) and he also skipped the use of intermediate frames, which would have pulled the layers together.

This two-part (thus *epoxy*) penetrating sealer was nothing at all like the petrochemical, hard epoxy laminating glues used in modern cold-molded construction with thin veneers.

CPES is made from wood resins, a by-product of the paper industry, the Lignin removed from wood to make paper of the remaining cellulose. It is extremely

thin and soaks deeply into any abnormal porosity in the wood. Its short chain molecular structure absorbs better and bonds better with wood than any petrochemical resins, like hard epoxy glues.

It remains flexible after set to move with the wood. It allows trapped moisture to breath back out.

It improves the adhesion of any following product, whether sealer, glue, bedding compound, or paint coatings, because it glues together the wood fibers at the surface, like the Lignin originally did. It seeks and fills any "abnormal porosity" like rot damage or even rot tendrils.

If the wood is not sealed with CPES, but some other sealer or varnish, I DO NOT consider it a TRUE 5200 bottom.

FASTENERS

Stainless steel was invented in 1913. The 300 series (302-316) includes 18-20% chromium and 8-12% nickel (316 has 2-3% molybdenum, which makes it slightly less susceptible to crevice corrosion). In the presence of oxygen, the chromium and nickel form a surface coating that protects the 70% of the material that is mild steel. If you bury them in the hull, covered with putty and paint, they are cut off from oxygen and will soon corrode like mild steel. Only silicon bronze is long lasting here. The only apparent reason some use stainless steel is that, coming from Taiwan, they are *cheap!*

It doesn't matter if they are advertised as "marine grade." That only applies in the presence of oxygen. Please see this website link: <http://www.stevedmarineconsulting.com/ezine/index.php?p=18>



Complete removal of incorrect paint coatings to allow applications of CPES, barrier coat primer, and bottom paint.

3M-5200 POLYURETHANE RUBBER ADHESIVE SEALANT

This one-part, moisture cure, tenacious adhesive, was developed by 3M (Minnesota Mining and Manufacturing) and made available to the public in 1966 for the direct purpose of adhesively bedding wooden components in marine construction. They knew then it should be a flexible product to deal with traditional plank-on-frame construction.

In communications with the two 3M scientists who invented and developed the 5200 product, I was told that one of their first, largest customers was Chris-Craft, who used it to replace the two-part Thiokol they were currently using in the plywood Cavalier and Sea-Skiff divisions. It was apparently tried in the main division of planked boats but added far too much in construction costs to be cost-effective. Higher-end boat builders, like Trumpy Yacht Company, used it as their standard construction procedure after 1966.

The biggest problem I've seen here is inadequate amounts being used. Where I recommend 40 to 60 tubes for just the bottom plank installation, these troubled guys reported they had been billed for 24 tubes. This is simply not enough product to fill all voids. Okay, so you saved a few hundred bucks, but compromised the entire operation?

Another just-as-bad option would be changing from 5200 to something else purported to be as good.

3M5200 and 3M4200

The MSDS sheets for 5200 show a 700/ft/lb/sq/in shear strength to failure. The wood would fracture first.

The MSDS sheets for 4200 show a 350/ft/lb/sq/in shear strength to failure. The wood would STILL fracture first.

The problem here is that 5200 takes up to 7 days for full cure. That's plenty of time to get thousands of screw-holes drilled and set in the bottom, pulling things together, like thousands of clamps, before it sets.

4200 sets in 4 hours, nowhere near enough time to get thousands of screw-holes drilled and set before it sets up!

Another problem I've seen in troubled bottoms is the restorer's decision to *not* include the intermediate frames, claiming they are not necessary because the rubber is there. The problem with this is that the intermediate frame screws *are* necessary to pull the planking layers into contact before the rubber sets.

If there is NOT an adequate amount of 3M-5200 used in the construction, or a substitute product is used, I DO NOT consider it a TRUE 5200 bottom.



Some tiny gaps are too small to force 5200 into. Three quarts of CPES caused the wood to swell, then set in that condition. Note the raised rubber.

BARRIER COAT PRIMER

One of the biggest problems I've seen with short-cut 5200 bottoms is either a total lack of, or inadequate amounts of, Interlux 2000E Barrier Coat Primer. This two-part (thus epoxy) paint is a water barrier coat meant to keep the water from soaking into the bottom planks. It does this with minute platelets in its makeup that vastly slow the movement of water. Unlike hard epoxy laminating glues, it is flexible enough to move with the bottom.

It is a very important part of the true 5200 bottom. It helps stabilize the bottom construction, keeping adequate moisture in the wood during extremely dry winter storage, and keeping excess moisture out of the wood during summer use. Its use is meant to stop excessive expansion/contraction that cracks open paint coatings, elongates screw holes, and buckles or cracks planks and frames.

This product's instructions call for a 10-mil thickness, usually 4-6 rolled-on coats (no sanding between coats) or two gallons for the average 20-footer. If your restorer tells you that 2 coats is enough, he is wrong.

FINAL THOUGHTS

While we all love the varnished mahogany runabouts such as Chris-Craft, Gar Wood, Hacker, Century, etc., we cannot just romanticize them as being the high state-of-the-art of boatbuilding, built by master crafts-

men. These were, in fact, built with an early form of mass production. Low-wage furniture workers and seasonal farmers were employed to complete the construction processes, often only doing the same procedure at their station day after day.

Most of these boats came new with a one-year warranty, before 1935. After that, we find Chris-Craft offered a 6-month warranty and Century Boat Company a 3-month warranty.

Chris-Craft owners' manuals warned not to allow the boat to stay in the water "when not in use" because they could absorb enough water to weigh them down and not meet "advertised speeds."

Chris Smith explained to me that Chris-Craft's marketing strategy was a six-year turnaround, where their average customer bought a new boat, roughly every 6-years. (Think of how long cars lasted back then). Hulls with true 5200 bottoms will last the test of time. ↓



Any remaining tiny gaps, too small to force rubber into, are filled with barrier coat primer by brushing perpendicular to the seams with a stiff brush. Four to five barrier coats follow, then 2 bottom paint.



A TRUE 5200 bottom, well used by three owners, 21-years after construction and refresher bottom paint twice.