# Fasteners for Treated Wood: Practical Solutions for Coastal Environments

**Q:** I know we're not supposed to use regular galvanized fasteners in treated wood, but I'm constantly running into this issue with carpenters. Why exactly is ACQ lumber more corrosive, and are there any alternatives to stainless steel? Stainless can get very pricey when you start speccing framing hardware like joist hangers and post bases.

**A:** *Ted Cushman responds:* You're right, the situation with treated wood and fasteners has gotten complicated in the past few years, especially compared with the good old days when treated wood was treated wood, and nails either were galvanized or they weren't.

That's changed significantly since 2003, when the major wood-treating companies struck a deal with the U.S. Environmental Protection Agency (EPA) to remove potentially toxic arsenic from their wood-preservative formulas. These companies replaced their old wood-treating mixtures with new, proprietary branded recipes that don't use arsenic. Almost immediately, companies that manufacture steel framing connectors or galvanized fasteners began to warn about compatibility problems between the new treating formulas and galvanized steel hardware, nails, and screws. Lab testing indicated that the new copper-based treating formulas might eat through nails and hangers at two to — in some cases — five times the rate expected in the previous conditions. Throw salt moisture into the mix, said experts, and the hardware would likely break down even faster (see "The Science of Corrosion," page 20).

SWAN SECURE

Stainless steel decking nails, such as these 2-inch ring-shank gun nails, are common in many lumberyards these days. Larger hangers and framing clips, however, usually must be special ordered or custom made.

## REAL-WORLD DECISIONS

But lab tests don't necessarily reflect real-world conditions, so builders still have to base their decisions on their own best guess. Unfortunately, when it comes to guesswork, actual coastal exposures involve all the things that are likely to make the real-world performance even worse than laboratory performance. Salt air near the coast is rough on metal hardware, and in southern coastal states, heat is likely to play a role as well. Like most chemical reactions, the rate of galvanic corrosion roughly doubles for every 20°F increase in temperature. Corrosion in the lab also increases significantly if there are higher levels of the treating chemicals in the lumber — meaning that the wood that is most likely to stand up to rot is also the most likely to tear up your galvanized nails and hangers.

In practice, builders need to look carefully at their project's actual exposure and choose accordingly. Exterior applications within five miles of the ocean present the toughest case.

***Stainless is safest.*** Where salt-air corrosion is likely, stainless steel (usually Type 304 or Type 316) is the only metal proven to stand up to direct contact with copper-based wood treatments. Major steel con-

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nector manufacturers Simpson Strong-Tie and USP Structural Connectors both supply at least some of their connectors in stainless steel. Stainless steel nails and screws are also widely available, including gun-driven collated nails. The bad news is that you have to pay a steep upcharge for that durable hardware.

***Isolation membrane.*** Another option is to isolate the hardware from the lumber with an impermeable membrane. While some builders use ordinary black paper, a butyl-based material, such as Grace Vycor Deck Protector, seems to work the best. Butyl stays flexible and won't dry out in extreme temperatures, and because it is self-healing, the fasteners that are driven through it won't leak. This is important because if the hangers and connectors don't touch wet wood, they won't be attacked by the copper-bearing solution. Fasteners will still penetrate into the wood, though, so you'll have to assess whether the membrane will keep that wood dry enough to keep the galvanic process at bay. Even with an isolation membrane, you'll probably want to stick with the hardware and fasteners that have the heaviest protective zinc coating available.

***New treatment formulas.*** A third option is to use one of the treated-wood products that don't contain copper, like Wolmanized L3 Outdoor decking, which is treated with a combination of organic pesticides and water repellents. According to Arch Chemicals, this new material won't damage either galvanized metal or aluminum flashing. At this point, the L3 material is only available in 2x8 or smaller members, so it may not suffice for the undercarriage of a deck or floor system of an elevated coastal home.

KRIS MORY

Exposure is everything: if pressure-treated framing will be exposed to a salt-air environment, stainless steel will be the safest, but priciest, option for fasteners and hardware.

## SETTING PRIORITIES

If you're farther from the water, you may not need to always use stainless steel but may instead be able to rely on hardware with the better galvanized coatings. Ever since wood treaters introduced the proprietary brands, metal connector and fastener suppliers have responded with heavier galvanized coatings. Simpson Strong-Tie and USP, for instance, moved quickly to put G90 instead of G60 galvanizing on their entire product lines (a 50% boost in zinc thickness), and they have since brought out G185 coatings (double the usual thickness and three times as thick as the once-typical G60 standard). The heavier coating, in theory, should stand up to ordinary use in a moderate exposure.

Keep in mind that if pressure-treated wood is dry in service — used where it's not exposed to rain or ground moisture — the risk is largely abated. Galvanic corrosion happens only when the wood is wet. Wood that's out of the weather will stay at 12% moisture content or less, well below the 17% moisture content needed to support fastener corrosion. If that's your situation, you don't need fancy galvanized or stainless steel hardware (though ordinary galvanized products are required in any treated wood by code).

MIKE GUERTIN

When stainless steel hardware is out of the budget, Rhode Island builder Mike Guertin uses a butyl-based flashing material as an isolation membrane to protect galvanized hangers and connectors from the corrosive compounds in the treated framing.

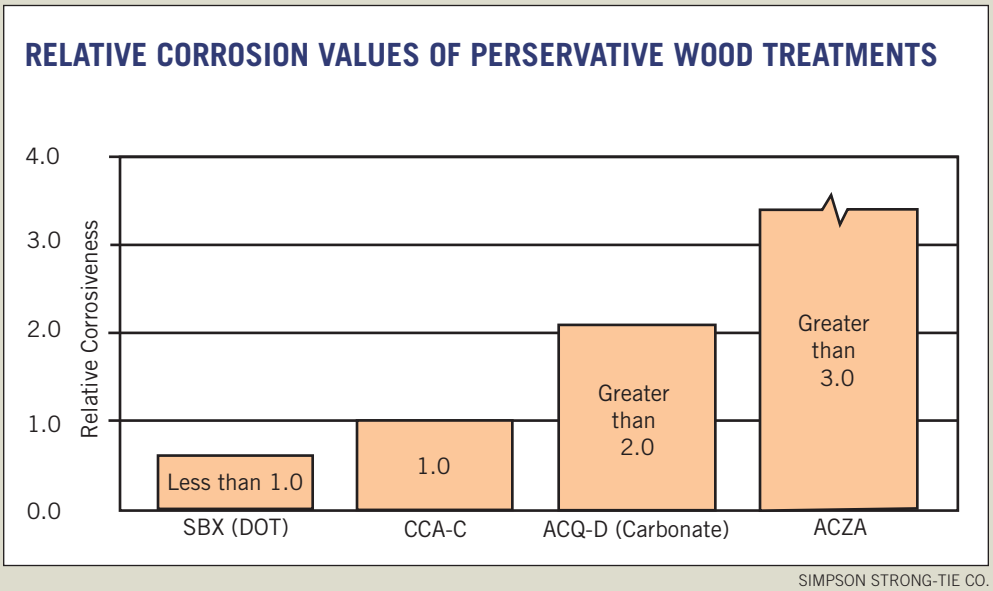
## The Science of Corrosion

Why do new treating formulas treat galvanized steel differently than the old recipes did? The reason is rooted in the process known as "galvanic corrosion." Even by itself, any pure metal tends to oxidize in the presence of water and air; the most familiar example is iron oxide, or rust. When two different metals come into contact in a moist environment, however, things get more complicated. An electric current gets set up between the dissimilar metals, causing one to corrode faster and the other to corrode slower — or to even stop corroding.

Galvanized hardware takes advantage of that natural process. Regular galvanizing is nothing but a sacrificial coating of zinc on steel. Under normal outdoor conditions, the zinc will start to corrode until a layer of zinc oxide forms on its surface. That zinc oxide scale protects the underlying zinc from oxygen and moisture; meanwhile, the steel underneath it all is protected by its coating of zinc. That's why galvanized hardware can stay more or less immune to rust for decades. But when it's in contact with wet wood that contains a solution of copper, galvanized steel behaves differently. The copper solution strips the protective zinc away from the nail or the hanger, eventually leaving the steel core exposed to rust.

The traditional old "CCA" formula — chromated copper arsenate — did contain copper. But its other metallic ingredients, chrome and arsenic, worked in the opposite way, neutralizing the corrosive effect of the copper and to a slight extent even protecting steel from corroding. The new formulas don't contain chrome or arsenic. And some of them have other ingredients, such as ammonia or chloride, that can actually speed up the corrosive effect of copper on zinc. In lab testing, different treating formulas seem to cause different rates of corrosion in galvanized nails as well as in bright (ungalvanized) common nails, but all the new wood treatments appear to be significantly rougher on galvanized steel that the old CCA treatments were.

Unfortunately, it's not clear exactly what the lab test results mean in terms of real hardware and wood on actual decks in service. Test conditions vary widely in many ways: labs may use different kinds of wood, orient the pieces upright or flat, expose the samples to various levels of moisture and heat, and continue the exposure for various lengths of time. There's also wiggle room in how the samples are cleaned and inspected after exposure. All these variations increase the "scatter" in the recorded results. But in any case, even if all the lab results were consistent, nobody really knows what they mean in terms of real-world corrosion: the "accelerated" testing protocol may induce a very different effect than years of actual outdoor exposure. "A challenging aspect of this research is drawing a correlation between different accelerated corrosion methods and performance in actual environments," notes Greg Greenlee, P.E., director of engineering at USP Structural Connectors. "There is very little information available on the performance of metal in contact with the new wood preservatives in coastal environments."




SIMPSON STRONG-TIE CO.

The baseline for corrosion is established by CCA-C (chromate copper arsenate) treated wood, with a corrosion level set at 1.0. Tests demonstrate the relative corrosiveness of other wood treatments, including SBX (sodium borate), which is less corrosive than CCA-C, and ACQ-D (alkaline copper quat) and ACZA (ammoniacal copper zinc arsenate), both of which are more corrosive. The numbers shown reflect an average of tests performed with G90 and G185 continuous hot-dipped galvanized steel samples.