Guide to Galvanized Nails

by Ted Cushman

All galvanized nails are coated with zinc — but how the coating is applied makes a big difference in performance

Tough conditions call for tough materials. Any time wood is exposed to the weather, it can take a beating — and so can the nails used to fasten it. Even if you frame a deck with pressure-treated wood, rusting nails can weaken your structure over time. Rusty nails also cause appearance and performance problems for wood siding.

Builders typically use galvanized nails for framing decks, for applying wood siding, and for installing exterior trim. But not everyone knows that "galvanized" can have more than one meaning when you're talking about nails. All galvanized nails are made of steel and coated with zinc. The zinc coating is what protects the nail from rust. But how much zinc is on the nail, and how the zinc is applied, make a big difference in how well the nail will resist rust.

Hot-Dipping

The traditional way to coat steel nails with zinc is "hot-dipping." In the hot-dipping process, the nails are immersed in a bath of molten zinc, like french fries in a pot of oil. The intense heat of the zinc bath causes the zinc and the steel to bind together in an alloy layer that acts as a base for a heavy zinc coating and provides long-lasting protection against rust.

"Double hot-dipped" galvanized nails are actually dipped twice in molten zinc, and are processed for uniformity between dips. The second dip is designed to fill up any pinholes and adds thickness to the outer layer of zinc (see illustration).

Electroplating

Steel nails are electroplated by immersing them in an electrolytic solution. An electric current in the bath deposits a thin film of zinc from a zinc anode onto the surface of the nails. With their smooth, shiny coating, electroplated nails work well as collated nails in mechanical nail guns — and they look beautiful when they're brand-new. But the thin zinc coating commonly applied to nails in commercial electroplating oxidizes away rapidly when exposed to weather, and the nails then begin to rust. Siding trade associations warn against using these nails in exterior applications.

Hot-Galvanizing

A lot of the galvanized nails sold in lumberyards are coated by "hot-galvanizing." Nails produced this way are labeled "HG," while nails produced by hot-dipping are labeled "HD." Because the labels are so similar, carpenters looking for hot-dipped galvanized nails are often sold hot-galvanized nails. But even though the terms sound similar, there is a significant difference in the nails. In hot-galvanizing, also known as "tumbler galvanizing," zinc chips are sprinkled on top of cold nails in a large barrel, then the barrel is rotated in a large furnace to melt and distribute the zinc. Like buttering popcorn, the results are uneven. Some nails receive too much zinc, and others not enough. It is hard to deposit enough zinc on and under the nail heads by this

Extractive Bleeding & Wood Staining

Builders who install wood siding and leave it natural or use a clear finish frequently notice staining of the wood around nail heads. This staining is often blamed on the nails themselves. But if wood contains moisture when installed or gets wet after installation, stains often occur around nail heads even when the galvanized layer is still intact, and even when stainless steel or aluminum nails are used. In these cases, the source of the problem is extractive bleeding.

All wood contains a certain amount of naturally occurring substances like pigments, tannins, oils, and resins. These substances are called extractives because they can be drawn from wood by various solvents, including water. The water-soluble extractives are sometimes brought to the surface of the wood by moisture inside the wood — whether from the wood's inherent moisture, from moisture inside a dwelling that migrates into the siding because there is no vapor barrier, or from moisture that penetrates the wood from outside. This migration of extractives is intensified by the "drawing effect" of the sun. Extractive bleeding often stains the wood, and can also discolor applied finishes, whether paint or stain. Extractive bleeding is a risk any time wood siding is used. Beautiful woods like cedar and redwood, which are durable because they contain the most extractives, have the highest risk of bleeding.

Extractive bleeding often occurs around nail holes. A poor-quality nail makes the problem worse because tannins react with unprotected iron to form a blue-black stain that spreads around and below the nail head.

To prevent extractive bleeding, pay close attention to construction details. Protect wood siding from water before, during, and after installation. Proper drying of lumber, moisture control within the building, effective finishing, and careful flashing and caulking are all important. And keep in mind that painted or stained siding requires periodic refinishing to retain its beauty.

— T.C.

"Extractive bleeding" has streaked these shingles below the nail holes (top). Iron in nails can react with natural wood tannins to make bleeding worse. Bleeding stains can also emerge from wood grain, even on stained or painted siding (middle). Bleeding is caused by water — note that the shingles protected by the eaves show less staining (bottom).

method, and globs of zinc tend to clog the threads of ring- and screw-shank nails.

Unlike hot-dipping, the hot-galvanizing process does not create a uniform alloy layer between the steel nail and the surface layer of pure zinc. Lacking this metallurgical bond between the nail and the coating, some percentage of hot-galvanized nails will be prone to rusting if used on the outside of a building. Often you can spot the rust on these nails in their shipping cartons, even before they are used.

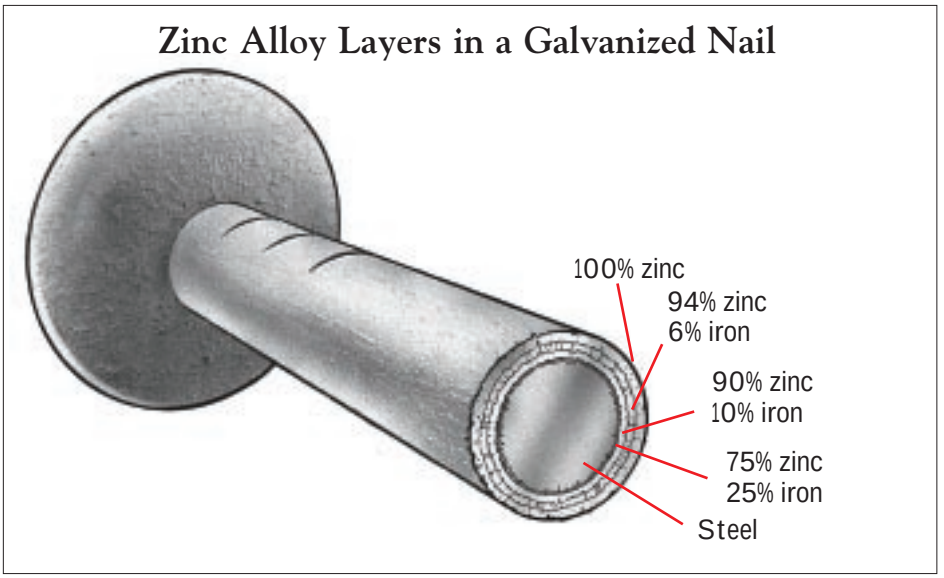
Mechanical Plating

Mechanically plated nails are also called "peen-plated." In this relatively new process, the cold nails are rolled around in a drum containing zinc dust, tiny glass BBs, and an activator fluid. As the drum rotates, the BBs hammer, or "peen," the zinc dust onto the nails.

Mechanical plating works well for adding a zinc coating to screws or ring-shank nails, because the thin zinc coating applied does not clog the threads or rings. Mechanical plating is also commonly used to apply a zinc coating to hardened nails like the concrete fasteners used in powder-driven nail guns (hot-dipping is unsuitable for hardened nails because the intense heat of the molten zinc bath would soften the tempered nails). But mechanical-plated nails typically lack the thickness of zinc found on a hot-dipped nail, and they do not have the alloy layer that hot-dipped galvanized nails have. Most mechanically-plated screws or nails are less corrosion-resistant than hot-dipped nails.

To try to increase corrosion resistance, manufacturers of mechanically plated

Electroplated nails (top left) are bright and shiny, but have a relatively thin zinc coating. Peen-plated nails (top right) also have a thin zinc coating. "Hot-galvanized" nails (bottom left) are not hot-dipped, but coated with zinc chips in a hot tumbler, a process that can yield an uneven coating. Double hot-dipped galvanized nails (bottom right) have a thick zinc alloy coating. High-quality hot-dipped nails outperform all other types of galvanized nails in exterior applications.



According to the American Galvanizers' Association in Aurora, Colo., hot-dip galvanizing creates a series of protective alloy layers around a steel nail. The outer layer is 100% zinc, while inner layers contain progressively less zinc and more steel. If the zinc and alloy layers are scratched and some steel is exposed, zinc in the outer layers will corrode before the steel does, preventing rust formation.

nails frequently roll their zinc-coated nails around with chromate or organic solutions after plating. This gives good initial results in the lab, but in actual use many of these extra films are broken down by ultraviolet light and ozone, exposing the zinc film to weathering.

All the methods of galvanizing nails add a layer of zinc to the nail. But only one method, hot-dipping, actually creates a bona fide alloy layer over the entire nail undersurface, thus providing the best type of zinc coating for a wide variety of exterior applications.

Stainless Steel and Aluminum

Galvanized nails are not the only rust-resistant nails available. Stainless steel nails are a more costly but very effective alternative. Stainless steel is a steel-nickel-chromium alloy that provides excellent rust protection, even when exposed to substances that might ultimately corrode a hot-dipped galvanized nail. Stainless-steel nails are definitely worth the extra expense in seashore environments, below-grade applications, or when cedar or redwood trim or siding is left natural or given a transparent finish.

Most stainless steel nails found in lumberyards are labeled either "304" or "316." The 316 stainless nails contain higher levels of the alloy metals. You should use 316 stainless nails in rough environments like the seashore.

Aluminum nails are also available for use on exterior siding. They will not usually rust or corrode when exposed to the weather, but they may cause corrosion in other metals.

The Western Wood Products Association, the California Redwood Association, and the Western Red Cedar Lumber Association all recommend stainless steel nails for installing natural wood siding on homes — especially in corrosive environments like an oceanfront building. But in most applications, all those associations agree that a galvanized nail can give excellent performance — as long as it is a high-quality, hot-dipped galvanized nail. Other methods of applying zinc to nails, they say, are not usually as resistant to corrosion. ■

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