WET STORAGE STAIN vs WHITE RUST

Q: *I have heard the terms "wet storage stain" and "white rust" used interchangeably. Are they the same and how do they occur?*

A: Many perceive wet storage stain to be the same as white rust and use the two terms interchangeably. The truth is these two phenomenons are not synonymous and although similar, they do have distinct differences.

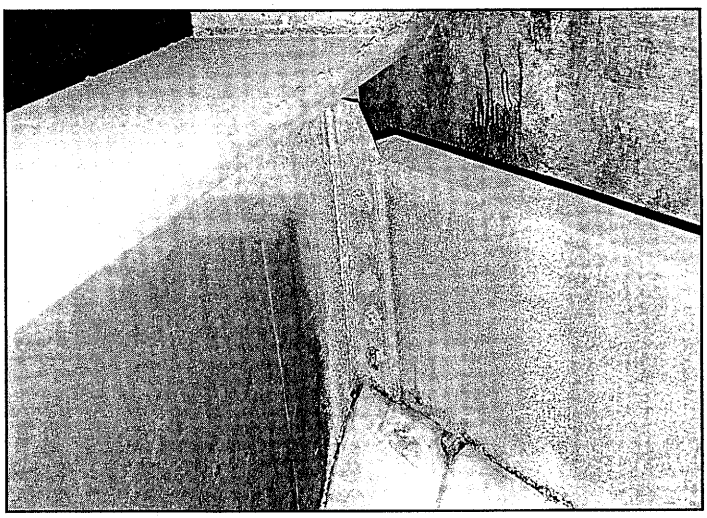
Both wet storage stain and white rust occur due to oxidation on a newly galvanized surface with the presence of moisture and absence of free flowing air. The protective zinc patina is not allowed to form by converting zinc oxides and hydroxides to zinc carbonates.

Wet storage stain is the commonly known problem of white surface oxide formed due to packing items too tightly and/or storing in a humid environment. If moisture can bridge the gap between galvanized pieces, the local shortage of oxygen created by this moisture can set up a galvanic cell that will give rise to rapid attack at those places where oxygen is deficient. The common solution for wet storage stain is to store items with room to breathe and out of a wet and humid environment. Another preemptive solution is to passivate the zinc surface after galvanizing.

White rust, on the other hand, is associated with cooling towers. Cooling towers were first galvanized in 1965. The white rust problem wasn't noticed until 1986. White rust appears on the surface of newly galvanized cooling towers as a patch of white sticky material. The white material has been identified as basic zinc carbonate ($3Zn(OH)2.ZnCO3.H2O$). White rust can penetrate the zinc coating and quickly reach the iron-zinc intermetallic layers, forming a visible red iron oxide.

The older towers, not plagued with white rust, all received a chromate treatment after galvanizing. In the mid 1980s chromate treatments suddenly became taboo and environmental restrictions on using them for cooling towers gave way to an alkaline water treatment. The chromate treatment effectively protects the newly galvanized surface from oxidizing before the formation of the zinc patina. The combination of no chromate treatment and an operating pH level above 8.2 or 8.3 creates the white rust because the alkaline level in the water is effectively washing away the corrosion products that help form a protective surface. Likewise, chloride is most corrosive to zinc in water, and even more evident in a soft water environment where the carbonate level is lowered. Without the passivation of the zinc surface, the more predominate the pH and hardness become in affecting corrosion.

Maintaining proper water pH and hardness levels helps alleviate the white rust problem. The solution is to use a phosphate treatment and operate the tower at a pH no higher than 7.8 for a few months, then return to normal operating levels.



Wet storage stain

In the past, the Technical Department attempted to formally designate the terms of wet storage stain and white rust and differentiate their occurrences. However, a majority of galvanized steel owners never picked up on the differences between the two. Now if someone asks about white rust and wet storage stain, you can dazzle him or her with your knowledge of the two processes.