Galvanizing Insights

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Hot Dip Galvanized Steel Distribution Poles Offer Numerous Benefits

Hot dip galvanizing is used all over the world to protect a diverse range of steel structures. Often, galvanized steel is the more widely used material for electrical utility applications. Such applications as transmission towers and distribution poles are designed to carry conductors and equipment for electrical distribution, light duty transmission, telephone, cable, and other telecommunications facilities.

As a direct substitute for wood or painted (non-galvanized) steel, hot dipped galvanized poles need less long-term maintenance care. Galvanized steel distribution poles withstand atmospheric and environmental rigors much better than wood or painted steel. Without adequate protection against corrosion, which galvanizing offers, maintenance would be required more frequently and the total serviceable life of the tower would be shortened.

Hot Dipped Galvanized Steel Distribution Poles Offer Premium Corrosion Protection

A substantial amount of the zinc used in the hot dip galvanizing industry is applied to electric utility products. Zinc protects steel from corrosion because of the two-fold nature of the coating. As a barrier coating, it provides a tough, metallurgically bonded zinc coating which completely covers (inside and out) the steel surface and seals the steel from the corrosive action of the environment. Additionally, the sacrificial action of the zinc protects the steel even where damage or minor discontinuity occurs in the coating. Hot dip galvanizing is adopted for many electrical utility applications because of the benefits it offers. Here's a glimpse of some of those benefits:

1. unrivaled life-cycle cost
2. competitive initial cost
3. long life until first required maintenance
4. lower percentage of "out of service time" for maintenance
5. zinc coating provides sacrificial and barrier protection
6. zinc coating completely covers steel - inside and out
7. ease of coating inspection
8. ease of assembly and disassembly, if required, by bolting using galvanized fasteners

In this Issue:

Benefits of Steel Distribution Poles

Environmental

If concerned with purchasing recycled and recyclable materials, steel distribution poles are the answer. Galvanized steel poles are also the answer to Environmental Protection Agency (EPA) regulations and deforestation issues. Steel is the most recycled material in the world, and in 1997, more than 70 million tons of steel were recycled in North America alone.

The zinc coating is also environmentally friendly, and virtually 100 percent recyclable. According to the 1990 publication, *Zinc Recycling*, by the European Zinc Institute, about 30 percent of the world's zinc supply comes from recycled zinc. This translates into nearly two million tons of zinc recycled each year.

So remember, after the considerably long design life span of galvanized steel poles, the poles can then be salvaged and recycled. In fact, zinc can be recycled indefinitely without any valuable loss of its chemical or physical properties.

Flexibility

Galvanized steel poles can be customized for embedded or anchor base installations, which will expand application possibilities. Galvanized steel poles can also be fabricated to support larger and heavier loadings with longer spans, and are also capable of handling greater height requirements.

Safety

Since steel poles retain their strength and shape over many years, maintenance and inspection of steel poles are minimal, therefore reducing risks of accidents. Also, steel structures do not require a full-length copper grounding wire because they are already self-conducting for grounding purposes. As a result, no installation of a ground wire is required. Since steel does not burn, ground and pole fires are unlikely occurrences.

Cost-Benefit Analysis

Just because the steel poles are high doesn't mean the cost is! Galvanized steel poles cut costs in transportation, handling, and installation because some pole types weigh approximately 60 percent less than wood structures.

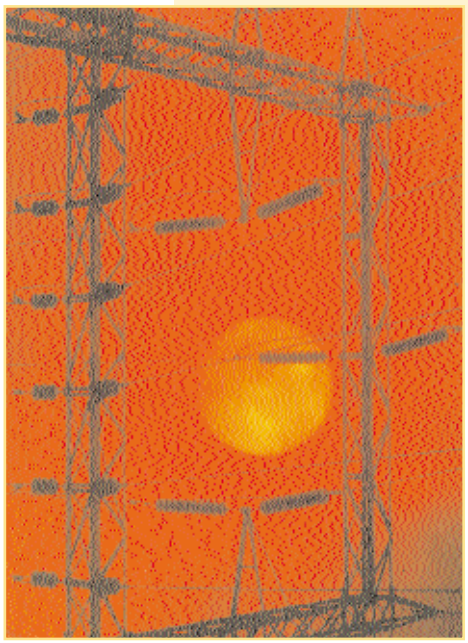
Furthermore, steel distribution poles do not require tightening of hardware, rot, or woodpecker damage. The poles can also be predrilled in the factory which results in lower labor costs and faster installation.

Maintenance

Steel transmission towers stand exposed 24 hours a day to numerous weather and pollution conditions, and tower design makes coating maintenance difficult.

For even longer galvanizing life, use galvanized hardware such as nuts and bolts.

Ungalvanized hardware elements often discolor before any other components on towers and substations. After installing galvanized steel poles, hardware will never need to be retightened due to pole shrinkage. Steel retains its shape and strength and is not susceptible to damage by woodpeckers, insects, rot, or fire.

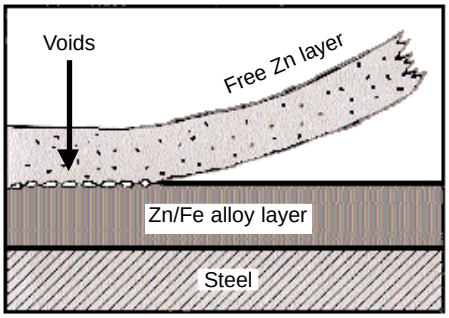


Ask Dr. Galv:

Difference Between Peeling and Flaking

Dear Dr. Galv: **During a recent inspection of a project I noticed a roughness of coating on areas of my galvanized part. Is this peeling or flaking of the galvanized steel? What is causing this to happen and what is the difference?**

Peeling is the detachment of the outer zinc layer from the underlying layers of iron-zinc alloy. These iron-zinc alloy layers stay firmly attached to the steel. One cause of peeling is a metallurgical change that occurs between the outer zinc layer and the intermetallics layers. While the part is still near the galvanizing temperature a considerable quantity of zinc can diffuse into the alloy layers creating a separation as voids on the boundary of the two layers. This is called the Kirkendall Effect. The result is that the outer zinc layer will separate from the alloy layer and peeling will occur. Peeling can occur when the galvanized part has been cooled too slowly. The following diagram shows how the diffusion of zinc from the outer layer can create a series of voids and completely separate the outer layer from the intermetallics.



Peeling can also happen when galvanized parts are stacked on top of each other soon after removal from the galvanizing kettle. The stacked parts can have their free zinc layers bond together and, when separated, the free zinc sticks to one part and pulls off of the other part. When galvanized parts are exposed for long periods of time to temperatures of 400 F or more, again, peeling can occur. To prevent peeling, very slow cooling of the galvanized parts should be avoided. If possible, quench the galvanized parts immediately after galvanizing. When stacking parts, be sure the parts are cooled below 300 F before they are stacked or bundled.

Flaking occurs when nearly the entire zinc coating, including the iron-zinc alloy layers, has separated from the base metal. Flaking is usually caused by galvanized coatings that are thicker than normal coatings. Besides high-silicon steels, killed or semi-killed steels can develop a thicker than normal coating. Also, low-silicon steels can develop coatings with thicker than normal delta alloy layers when galvanized for long times. Thick galvanized coatings are often brittle and less adherent than normal coatings. Flaking occurs often when galvanized parts receive blows during handling.

The following picture shows an example of flaking of the galvanized coating.

Shortening the amount of time the part is in the galvanizing kettle can minimize flaking. Flaking usually occurs on coatings that are over 10 mils in coating thickness.

To tell the difference between flaking and peeling of the galvanized coating, a thickness measurement of the remaining coating on the steel should be made. If the thickness gauge records a near zero reading, there is only the gamma layer of intermetallic left on the steel. This is the surface coating problem of flaking. If the thickness gauge records a reading of two to six mils, there is still some intermetallic material covering the base steel. This is referred to as peeling of the galvanized coating. Peeling can be handled by touching up the surface, while flaking is a total coating rejection.