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INDUSTRIAL
GALVANIZERS
CORPORATION

Tech Tips

What causes Delamination Of Galvanized Coatings?

WHY GALVANIZE?

Hot dip galvanized coatings are applied to steel to improve the anti-corrosion performance of the steel to ensure that it lasts as long as possible with a minimum of maintenance

COATINGS DIFFER

Only hot-dip galvanizing gives a coating that can reach the 50 year life required of structural building products.

THICKNESS COUNTS

Compared to other zinc-rich coatings, hot-dipped galvanizing is:-

- THICKER
- HARDER
- FULLER

HOT-DIP GALVANIZED PRODUCTS LAST LONGER...

Delamination of galvanized coating. Causes include steel chemistry, cooling cycle or mechanical stress of susceptible coatings.

Hot dip galvanized coatings have a reputation for toughness, and are one of the few industrial coatings that can withstand the rigors of transport and handling without damage to the coating.

However, on some fabrications, problems arise with delamination of the galvanized coating, sometimes without any mechanical stresses being applied to the galvanized coating. The delamination, blistering or peeling of the galvanized coating only occurs when a certain set of metallurgical phenomena is present.

These phenomena are:

- Steel chemistry that is reactive with molten zinc and results in thicker than normal coatings
- A cooling cycle that induces mechanical stresses into the coating at the steel/coating interface.
- Mechanical stresses on susceptible galvanized coatings.

Hot dip galvanized coatings are formed by immersing steel in molten zinc at 455^{o}C.

The coating formed will be dependent on the immersion time in the zinc, the steel's surface condition and the steel's chemistry.

The thickness of hot dip galvanized coatings is determined by the thickness of the zinc-iron alloy layers that form when the steel reacts with the zinc. These alloy layers are typically 95% zinc–5% iron and are hard and inflexible.

Thicker galvanized coatings provide improved durability, but once the coating thickness exceeds about 200 microns, the thick alloy layers become more prone to delamination.

The most common cause of galvanized coating delamination is 'heat peeling'. This occurs when the steel, usually heavy section thickness, is cooled slowly or is not cooled sufficiently in the quenching process, causing residual heat in the steel mass to reheat the coating.

The thermal stresses generated by this differential heating or cooling will create high shear forces at the steel/coating interface, resulting in localised delamination of the coating.

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TRIED & PROVEN

Over 40 years of field testing shows that galvanized coatings perform well even in harsh environments.

WHAT IS DELAMINATION?

Peeling or blistering of the galvanized surface can be caused by reactive steel creating a thicker than normal coating; a cooling cycle that induces mechanical stresses into the coating; or mechanical stress on susceptible galvanized coatings.

WHY GALVANIZE WITH INDUSTRIAL GALVANIZERS?

For steel users requiring fast, proven corrosion protection for local or national projects Industrial Galvanizers is the established hot dip galvanizer with nationwide coverage.

This will take the form of blisters, or in the worst case, flaking of the coating from the surface.

Mechanical delamination will generally occur on edges or areas where the galvanized coating is subjected to high localized pressure or impact.

On rough steel surfaces, galvanized coating delamination is generally less likely to occur because of the better mechanical keying of the coating to the steel surface. Very smooth surfaces on ERW pipe, RHS or other cold rolled sections are more likely to delaminate on reactive steel and the presence of residual alloying elements like phosphorous increase the risk if coating delamination.

Minimizing delamination problems

The first step, which is beyond control of the galvanizer, is to use steels of appropriate chemistry. Most Australian-made steels are acceptable in this respect and have steel chemistry that is well suited to galvanizing.

A large percentage of structural and merchant section steel is now imported and as a result, the steel chemistry and surface is more variable.

The important steps in minimizing delamination problems are:

- Minimize immersion time to reduce zinc-iron alloy layer growth. This is a design factor as well as a processing issue in the galvanizing plant. Efficient design will allow the fabrication to be handled easily through the galvanizing process.
- Cool the item as consistently as possible after galvanizing. Ensure that the item is fully cooled in the quenching process and residual heat in thick sections will not re-heat the coating.
- Where fabrications need to be air-cooled, ensure they are placed in well-ventilated areas so the individual items are not subject to radiant heat from adjacent items.

A common cause of galvanized coating delamination on plate products is stacking plates on top of each other while they are still hot. This can cause delamination to occur even in steels that are normally not susceptible.

When galvanized coatings delaminate, there is always a thin zinc-iron alloy layer (the gamma layer) remaining in the surface so corrosion is unlikely to occur in the short term. Remediation of the delaminated area can be done with an approved epoxy zinc-rich paint repair system.

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