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INDUSTRIAL
GALVANIZERS
CORPORATION

Tech Tips

Metals in contact – Avoiding Electrochemical Incompatibility.

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

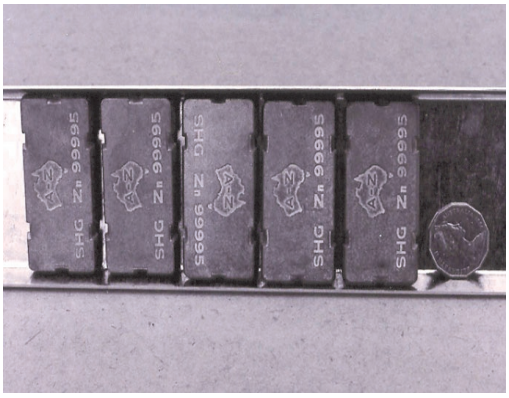
Only hot-dip galvanizing gives a coating that can reach the 50 year life required of structural building products.

THICKNESS COUNTS

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

- THICKER
- HARDER
- FULLER

HOT-DIP GALVANIZED PRODUCTS LAST LONGER...



Different metals in contact: can cause problems such as accelerated corrosion.

The derivation of the term 'galvanizing' has absolutely nothing to do with protecting steel from corrosion. The name comes from the Italian physiologist, Luigi Galvani, who identified the effects of electric current on the nervous system of dead frogs. In the formative years of electrical science, zinc was the most widely used metal for producing galvanic electricity. In 1837, French scientist Sorel took out a patent in France for a process of dipping steel in molten zinc and provided the process with the name `galvanizing' in honour of Galvani, who died in 1798.

The Electrochemical Series of Metals

When metals are in electrical contact, one metal will give up electrons and oxidise (the anode) while the current generated will prevent oxidation of the other metal (the cathode).

All metals have an electrochemical pecking order that determines whether they will act as an anode or a cathode to other metals in the Series. The following table (overleaf) illustrates the relative position of the common metals in the Electrochemical Series.

The electrochemical protection provided to steel by zinc coatings is a vital element in the effectiveness of galvanized coatings in protecting steel from corrosion. All pre-galvanized products rely on the cathodic protection provided by zinc to prevent corrosion of exposed steel at cut edges.

Industrial Galvanizers has frequent requests for information about the effect of galvanized coatings in contact with other metals. The most commonly asked questions involve the use of stainless steel fasteners in contact with galvanized coatings and contact between galvanized and un-galvanized reinforcing bar in concrete.

Electrochemical Corrosion and Galvanized Coatings

Tables of Electrode Potentials (ee overleaf) are of value in drawing the attention to the dangers of electrochemical corrosion between dissimilar metals but such tables can be misleading. While the potential difference between metals is the prime driving force providing the corrosion current, it is not a reliable guide to the rate and type of corrosion occurring at a particular point of contact.

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TRIED & PROVEN

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

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.

Metal / Alloy	Potential (Volts)*
Magnesium	- 1.55
Zinc	- 1.10
Aluminium	- 0.86
Cadmium	- 0.77
Cast iron	- 0.68
Carbon Steel	- 0.68
Stainless Steel	- 0.61
Lead	- 0.57
Solder	- 0.52
Tin	- 0.49
Copper	- 0.43
Aluminium bronze	- 0.41

All voltage values with respect to copper sulfate half cell. (Zinc Handbook, Porter 1991)

The severity of bi-metallic corrosion also depends on the ratio of the areas of metals in contact, the duration of wetness (bi-metallic corrosion can only occur in the presence of a conductive solution) and the conductivity of the electrolyte. The presence of oxide films on the surface of one or both of the metals can greatly inhibit bi-metallic corrosion.

In general, galvanized surfaces may safely be in contact with most aluminium alloys, stainless steel 304 and 316F, chrome steel (>12% chrome) and tin, provided the area ratio of zinc to metal is 2:1 or higher and oxide layers are present on the aluminium alloys and the stainless steels.

Bi-metallic corrosion rates are greatly reduced if electrical resistance is high due to the presence of insulating films or other non-conductive membranes.

Where the points of contact between galvanized coatings and other metals are not subject to wetness, no bi-metallic corrosion will occur. This is important with galvanized reinforcing bar in contact with uncoated rebar. The points of connection are inevitably deep within the concrete mass and after curing of the concrete, are maintained in an inert environment.

The use of stainless steel fasteners on hot dip galvanized items in well drained atmospheric exposure conditions will also cause minimum stress to the galvanized coating, because of the very high zinc/stainless surface area ration and the short periods of wetness to which the assemblies are exposed in Australian weather conditions.

Electrochemical Protection and Coating Mass

In any situation where zinc is corroded sacrificially to protect exposed steel, the mass of available zinc will determine the anti-corrosion performance. Corrosion rates of zinc coatings required to cathodically protect uncoated steel in aggressive environments (saltwater/marine) may be 25 times as high as the normal zinc corrosion rate.

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