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INDUSTRIAL
GALVANIZERS
CORPORATION

Tech Tips

Galvanizing Special and Alloy Steels.

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...

Cracking of special alloy steel plate can usually be avoided by design and modification to the hot-dip galvanizing process.

From time to time, galvanizers get inquiries about galvanizing special steels or unusual steel sections that are outside the normal range of steels processed on a day to day basis through jobbing galvanizing operations. While these steels can present problems for galvanizers, it is sometimes possible to accommodate these problems in the design of the components or through modifications to the hot dip galvanizing process.

Galvanizing alloy steels

While high strength alloy steels are rarely used for structural applications, they are sometimes used as performance-critical components in assemblies or as individual manufactured items. There are three factors that effect the ability of steel to be galvanized. These are:

- The chemical composition of the steel
- The strength rating of the steel (the yield strength in MPa)
- The steel's section thickness (this determines the immersion time of the steel in the molten zinc)

When a request is received to galvanize an unusual type of steel, the chemical composition is first checked. Most special steels contain carbon (C), phosphorous (P), manganese (Mn), silicon (Si), sulfur (S), chrome (Cr), nickel (Ni) and may also contain copper (Cu), Vanadium (Va) and other elements that are used to give the steel particular performance characteristics.

What is in alloy steels?

While there are hundreds of different types of special steels, there are generic chemistries that fit particular applications and these are useful in determining what is likely to happen when these steels are hot dip galvanized. The following list is a guide to the most prominent alloying elements likely to be in these special steels that will have an effect on their ability to be galvanized:

Spring steels. These steels contain high levels of silicon which can be up to 2.0%.

Tough steels. These steels contain high levels of manganese which may be over 1.0%

Hard steels. These steels contain high levels of carbon which may be over 0.8%

Free machining steels. These steels contain high levels of sulfur

Electrical steels. These steels contain high levels of phosphorous

Stainless steels. These steels may contain high levels of nickel, chrome and manganese.

INDUSTRIAL GALVANIZERS
A valmont COMPANY

Galvanizing Special and Alloy Steels.

TRIED & PROVEN

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

CAN YOU GALVANIZE SPECIAL STEELS?

It is possible to successfully galvanize special steels, particularly spring steels which are the type most likely to turn up for galvanizing. Section thickness and the method of surface preparation are key to ensure galvanizing will not affect their performance.

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.

The galvanizing characteristics of these steels are as follows:

- High silicon steels will produce thick galvanized coatings which may be brittle because the steel reacts very rapidly with the zinc. The effects of high silicon content can be minimised by keeping immersion time in the zinc as short as possible. This becomes increasingly difficult as section thickness increases.
- High manganese steels will produce brownish coloured coatings that may be brittle and easily damaged in handling compared to galvanized coatings on conventional steels.
- High carbon steels can be successfully galvanized as long as their yield strength is within an acceptable range (see note below).
- High sulfur steels are used for high speed machined components (threaded fasteners, sockets etc) and should not be galvanized. The high sulfur steel can be severely eroded in the galvanizing process, rendering threaded items unserviceable.
- High phosphorous steel are rarely encountered in galvanizing operations but are unsuitable for galvanizing. They react rapidly with the zinc to form thick, dark coatings that are easily damaged and may delaminate from the surface.
- Stainless steels can be galvanized but are susceptible to liquid metal embrittlement and can fracture under load after immersion in molten zinc. Stainless steels are only galvanized incidentally if they are attached to mild steel assemblies.

Steel strength and galvanizing

High strength steels (around 800 MPa yield strength and over) are susceptible to hydrogen embrittlement arising from the pickling process in galvanizing. Pickling should be avoided for steels in this strength range.

Steel size and galvanizing

While all conventional steel structural sections can be galvanized, from time to time, unusual sections arise that may present problems. Very thick sections over 100 mm in thickness may be difficult to galvanize acceptably in a conventional galvanizing bath. The mass of these items per unit of volume is very high, and as the zinc in the galvanizing bath is only about 35 degrees above its freezing point, the zinc freezes around the item when it is immersed, and may form a layer of frozen zinc 50 mm or more in thickness.

This zinc has to be re-melted and then the item itself heated up by the zinc bath to the same temperature for the galvanized coating to form. This sequence of events may interfere with the performance of the flux on the surface of the item and cause uncoated areas on the surface.

These defects can be minimised by pre-heating the item or operating at higher galvanizing bath temperatures, which requires special galvanizing bath design.

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