

## Relevant Standards for Zinc Coatings on Steel

Some steel products are zinc coated by means of different processes carried out in-house by the manufacturer. Pre 2000, AS1650-1989 "Hot dipped galvanized coatings on ferrous articles" covered all zinc coatings regardless of product type or application method.

In 1999, Australia Standards and New Zealand Committee MT/9 recognized the unique characteristics of hot dip galvanizing on fabricated items and how these varied from those of other coating systems. A number of separate standards were created to distinguish different coating processes and the attributes of each:

### **AS/NZS 4680 Hot Dip Galvanized (zinc) coatings on fabricated ferrous articles**

**The scope of this standard covers structural steel, steel reinforcements, steel sheet fabrications, assembled steel products, tubular fabrications, fabricated wire work, steel forgings, steel stampings, ferrous castings, nails and other small components. The standard applies to both centrifuged and non-centrifuged articles. The standard does not apply to products such as wire and welded wire fabric, sheet, or open sections and tube hot dip galvanized in continuous, semi-continuous or specialized plants. Definition of Hot Dip Galvanizing – a process comprising of pre-treatment, and molten zinc baths in which steel products are dipped so as to form adherent zinc and zinc-iron alloy coatings.**

Zinc-iron alloy coatings are formed when molten zinc reacts with elements of the steel's surface in the galvanizing bath at a nominal operating temperature of 450°C. Hunter Galvanizing provides hot dip galvanized coatings with zinc-iron alloy layers in most cases harder than the base metal upon which they are applied. An average coating mass of 600g/m<sup>2</sup> is achieved on fabricated items of steel thickness 6mm (and greater) in accordance with AS/NZS 4680. Details of this process form the basis of this manual.

AS1397	Steel sheet and strip – Hot dipped zinc coated or aluminium/zinc coated
AS/NZS 4534	Zinc and zinc/aluminium – alloy coatings on steel wire
AS/NZS 4791	Hot dip galvanized (zinc) coatings on ferrous open sections, applied by an in-line process
AS/NZS 4792	Hot dip galvanized (zinc) coatings on ferrous hollow sections, applied by continuous or specialized process

## Different Zinc Coatings

As recognized by the Standards committee, it is advisable that specifiers and fabricators have an understanding of the advantages and limitations of the variety of zinc based coatings available. As coating and service life are determined by the zinc thickness, each coating type provides a different level and period of corrosion protection. Furthermore some processes do not use heat to form a metallurgical bond and subsequent zinc-iron alloy layers and as such these do not meet the defined criteria for hot dip galvanizing. A summary of zinc coatings follows:

### • **Metallizing / Zinc Metallizing / Zinc Metal Spraying/ Thermal Spraying**

Melted zinc powder or wire is manually or mechanically sprayed from a heated gun onto an abrasive blasted surface. This process allows large items to be coated which are unable to fit into galvanizing baths or cannot be removed from site. Coatings of 250µm (microns) can be achieved, however the coating is not alloyed to the base steel therefore not a 'galvanized' coating. Zinc spraying has difficulty in reaching recesses, cavities, and hollow spaces. Coatings may be uneven and costly.

### • **Zinc Rich Paint / Cold Galvanizing**

Zinc dust in organic or inorganic binders is applied to an abrasive blasted surface by brush or spray. Zinc rich coatings are barrier coatings and do not form alloyed layers with the base metal thus reference to galvanizing is incorrect. Suitable zinc rich paint coatings provide a useful repair media for hot dip galvanized coatings. As with zinc spraying it is difficult to reach recesses, cavities, and hollow spaces however the application provides an alternative if items are unable to be removed from site or placed in a galvanizing bath due to size limitations.

### • **Continuous Galvanizing / In-Line Galvanizing / Galvanized Sheet / Galvanneal / Zincanneal**

Sheet steel is cleaned, pickled, and galvanized on a processing line run at very high speeds. The automated process allows accurate control of the coating process. Aluminium is included in a shallow zinc bath to suppress the formation of the zinc-iron alloys, resulting in a thin coating (25µm microns) that is mostly pure zinc. In-line products have thin coatings and may require additional protection for outdoor exposure. Galvanized strip is further processed into pipe and tube hollow sections. If sheet or strip is to be painted an additional process is carried out called galvannealing / zincannealing. An in-line heat treatment process is used to produce a fully alloyed coating which will provide alloy layers on the steel surface to help paint adhesion. Coating mass quoted on continuous/in-line product refers to the total of all surfaces. Galvanized sheet with a coating mass of 300 grams/m<sup>2</sup> has in effect 150 grams/m<sup>2</sup> each side. In comparison coating mass quoted on a hot dip galvanized item details the zinc thickness on each side: eg 600 grams/m<sup>2</sup>.

**•Electroplating / Zinc Plating / Electrogalvanizing**

Surfaces are cleaned then submerged in a zinc salt solution. Rods or balls of pure zinc are charged with an electrical current and a very thin coating of between 5µm–15µm (microns) is applied to the steel surfaces producing a very even and metallic sheen. Electroplated components should be finished with a layer of paint or other organic coating prior to outdoor exposure in order to increase their service life.



Metallizing

**•Sherardizing**

Steel components are cleaned with acid and packed in a drum with zinc powder and sand. The drum is rotated and heated. With continued rotation, iron and zinc galvanize and iron/zinc alloys are formed on the steel surface. Sherardizing produces relatively thin coatings between 15µm–50µm (microns) with dark grey surfaces.



Hot Dip Galvanizing



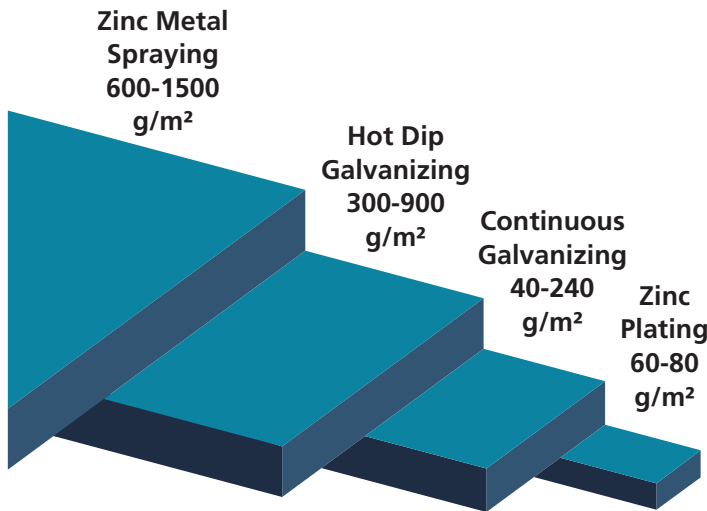
Continuous In-Line

**•Mechanical Plating / Peen Plating**

Items mechanically plated receive a flash coating of copper followed by the zinc coating. Coating thickness range available is between 5µm–110µm (microns).

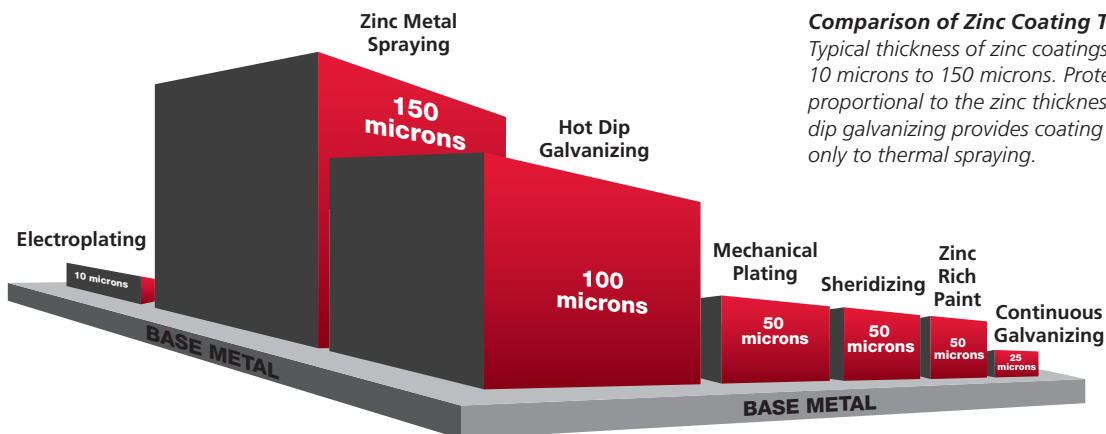
The mechanical bond between zinc and steel in this process is weaker than the metallurgical bond found in hot-dip galvanizing. Edge, corner, and thread coating thicknesses are usually lower due to minimal peening action at these locations.

**Comparison of Zinc Coatings**



**Comparison of Zinc Coating Mass**

Zinc coating mass is measured in grams per square metre. Hot dip galvanized coatings have an average 600 grams of zinc per m². This is more than twice the zinc coating mass found on in-line galvanized products such as sheet, wire and hollow sections.



**Comparison of Zinc Coating Thickness**

Typical thickness of zinc coatings range from 10 microns to 150 microns. Protective life is proportional to the zinc thickness and as such hot dip galvanizing provides coating protection second only to thermal spraying.