20. GALVANIZING GLOSSARY

This glossary of galvanizing terms provides a brief description of the meaning of commonly encountered words associated with galvanized coatings and the galvanizing process. More detailed information on many of these descriptors is available elsewhere in this manual.

Acid pickling	Hydrochloric acid at 10% concentration is used to remove rust and mill scale from the steel surface prior to galvanizing
Air lock	An area where air is trapped in a fabrication and prevents the molten zinc from contacting the steel's surface, causing an uncoated area on the work.
Alloy layer(s)	The hot dip galvanized coating consists of a series of zinc-iron alloy layers that make up typically 80% of the coating thickness. These alloy layers are coated with a layer of zinc. The zinc-iron alloys are much harder than zinc with excellent abrasion resistance.
Ash	Zinc oxidation products formed by the molten zinc reacting with oxygen in the air, and oxidation products arising from the flux reaction form on the surface of the molten zinc. This ash is skimmed off and recycled.
Bare spots	Defects on the steel surface that have not galvanized because of poor design or poor pretreatment
Beam work	Beams or head frames are used to support steelwork on wire or hooks to allow it to be handled through the galvanizing process.
Blowout(s)	Areas adjacent to unsealed overlapping surfaces that have been affected by pre-treatment solutions boiling out of the overlap area.
Brush blasting	Galvanized steel needs to be lightly abrasive blasted prior to painting. Brush blasting required the use of fine abrasive media at relatively low pressure (less than 40 psi) to prevent damage to the galvanized coating.
Cathodic protection	Zinc is higher in the electrochemical series than iron, and will corrode sacrificially to prevent the corrosion of adjacent exposed steel. Pre-galvanized products (sheet, tube and wire) rely on this feature of the galvanized coating to protect the cut edges of products processed from these sections. Also called `galvanic protection'.
Caustic degreasing	All steel products are degreased in a hot caustic solution as the first stage of the pretreatment process for galvanizing. The acid pickling will not be effective unless all organic contamination, grease and oil is removed from the steel's surface.
Centrifuge work	Small parts that cannot be efficiently handled individually are centrifuged or spun to remove excess zinc and allow them to be processed in bulk in baskets. Nails, washers, bolts and chain are typical centrifuge products
Chain work	Large or complex steel fabrications that need to be handled individually are suspended on chains for galvanizing. These products include large pipes, box and boat trailers and heavy items.
Chromate quenching	After galvanizing, the steel item is cooled by quenching in a water bath containing a low concentration of sodium dichromate. The sodium dichromate solution creates a passivation film on the galvanized surface.
Clearances	Where galvanized components have to fit together (e.g. hinged items), galvanized bolts), sufficient clearance must be allowed to accommodate the galvanized coating on each surface.

Coating mass	Galvanized coatings are generally specified in terms of coating mass, in g/m^2, on the surface of the steel. For ease of measurement, the thickness of a galvanized coating is measured in microns (μ) using non-destructive techniques, One micron in thickness approximates 7 g/m^2 in coating mass.
Coating thickness	The hot dip galvanized coating thickness is determined by galvanizing bath chemistry, steel chemistry, steel surface condition and steel section thickness. Australian Standard AS/NZS 4680:2006 defines minimum acceptable coating thickness for a range of steel sections.
Continuous galvanizing	Sheet wire and tube sections are galvanized using a continuous process associated with the manufacturing of the product. The galvanized coating is almost 100% pure zinc and applied to a maximum thickness of about 30 microns.
Corrosion rate	Galvanized (zinc) coatings oxidize progressively over time. This loss of metal from the surface is deemed to be the corrosion rate and is consistent over time. It is measured in μ/year. A typical corrosion rate for galvanized coatings is 1-2 μ/year.
Degreasing	First pre-treatment stage in the galvanizing process using a hot caustic soda bath to remove organic contaminants and paint from the steel surface.
Delta layer	The thickest alloy layer in the galvanized coating containing about 5% zinc. Reactive steels increase the delta layer thickness.
Distortion	Some steel sections will distort during galvanizing due to differential heating and cooling or inbuilt welding stresses.
Double-dipping	Fabricated items longer or wider than the galvanizing bath in one dimension can be galvanized by double dipping, where one side or end of the fabrication is galvanized first. The fabrication is then rotated or turned over allowing the second section to be galvanized.
Draining	Fabricated items immersed in molten zinc must be designed and to allow the zinc to freely drain from internal and external surfaces and must be suspended correctly during the galvanizing process.
Dressing	After galvanizing, the coating is inspected and irregularities are removed by dressing the surface by buffing or filing.
Dross	Steel reacting with molten zinc for small zinc-iron crystals in the galvanizing bath. These are heavier than zinc and settle to the bottom of the galvanizing kettle where they are periodically removed.
Duplex coating	When galvanized surfaces are painted or powder coated, these are called duplex coatings. Duplex coating systems enhance the appearance or durability of the steel being protected.
Electroplating (Electo-galvanizing)	Zinc is deposited on a clean steel surface from a zinc chemical solution to form a thin, bright zinc coating. Electroplated zinc coatings are not suitable for exterior exposures as they contain very little zinc – typically less than 10 μ in thickness.
Embrittlement	Some high strength or severely cold-worked steels are susceptible to embrittlement in the galvanizing process. This can be caused by hydrogen embrittlement from the acid pickling, or the heat of the process with severely cold worked (strain aged)) steel.

Etch priming	Some galvanized coating primers contain acid etching components to improve adhesion. These are application critical products that require experience in their application.
Flux staining	After galvanizing crevices and overlaps that are not sealed may show signs of brown staining bleeding out of the crevices. This is the result of iron-rich flux residues being trapped in the crevices absorbing moisture.
Fluxing	A hot zinc ammonium chloride preflux solution is use to condition the cleaned steel prior to its immersion in the molten zinc.
Galvanizing	Applying a protective coating of zinc to steel by immersing the cleaned steel in molten zinc. The zinc and steel react to form the galvanized coating.
Galvanizing alloy	Galvanizing baths are alloyed with small amounts of other metals such as aluminium, nickel or lead to improve the fluidity and resistance to oxidation of the zinc.
Gamma layer	The zinc-iron alloy layer closest to the steel's surface in the galvanized coating. It contains about 10% iron and is the hardest layer in the coating.
Gray coatings	Some steels produce a matt gray galvanized coating. These coatings are 100% alloy layer and contain no free zinc. They tend to be thicker than standard shinier galvanized coatings.
Hydrogen embrittlement	High strength (over 800 MPa) steel is susceptible to hydrogen embrittlement arising from hydrogen in the acid pickling solutions penetrating the steel surface.
Jig	A specially designed fixture for holding fabricated items during the galvanizing process to improve quality and productivity.
Magnetic thickness testing	Non-destructive measurement of galvanized coatings is usually done with electronic instruments that measure the distance from the surface of the coating to the steel surface that is magnetic. Any non-magnetic coating over steel can be measured with these instruments.
Metallising	Zinc wire or powder is applied to an abrasive blast cleaned steel surface through a gas flame that melts the zinc. Metallising is used to repair large damaged areas of galvanized coating.
Normalising	The heat of the galvanizing process is insufficient to affect steel properties by performs a stress relieving (normalizing) function.
Passivation	Galvanized items are quenched in a weak sodium dichromate solution to passivated the fresh galvanized surface and allow it time to develop its protective oxide layer.
Pimples	Small lumpy inclusions may sometimes occur in galvanized coatings, caused by dross stirred up from the bottom of the galvanizing kettle.
Reactive steel	Some grades of steel will react more quickly with molten zinc. This is usually caused by steel chemistry, particularly silicon and phosphorous content.
Silicon steel	Steel high in silicon will give rise to thicker coatings that may be gray in appearance.
Spangles	Crystalline formations on the surface of the galvanized coating caused by the presence of lead and other alloying elements in the galvanizing bath.

Strain-ageing	Steel that has been severely cold-worked by bending of punching is susceptible to strain-age embrittlement. The onset of this type of embrittlement is accelerated by the heat of the galvanizing process.
Venting	All hollow sections must be vented to allow molten zinc to freely enter and leave the fabrication, and allow condensation or moisture to escape.
White rust	Bulky white oxide deposits will form on galvanized coatings if they are stored in damp, poorly ventilated conditions. This oxidation product is zinc hydroxide.
Zeta layer	The outer alloy layer in a galvanized coating containing about 3-4% iron. This sometimes merges with the delta layer, depending on the steel chemistry.


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01 - SPECIFIERS MANUAL — THIRD EDITION

Industrial Galvanizers Australian Galvanizing Division (IGAG) operates nine galvanizing plants around Australia, ranging in size from large structural galvanizing facilities to specialised small plants designed to process small parts.

The Australian Galvanizing Division has galvanized in excess of 2 million tonnes of steel products in Australia since its first plant was commissioned in 1965 and is recognized for its ability to handle complex and difficult projects, as well as routine contracts.

This experience has been collated in the Specifiers Design Manual, to assist those involved in the design of steel products and projects to better understanding the galvanizing process and allow the most durable and cost-effective solutions to be delivered to these products and projects. All sections of this Third Edition have been completely updated and additional sections have been included to provide additional technical information related to the use of hot dip galvanized steel.

In addition to its Australian Galvanizing operations, Industrial Galvanizers Corporation has a network of manufacturing operations in Australia, as well as galvanizing and manufacturing businesses throughout Asia and in the USA.

The company's staff in all these locations will be pleased to assist with advice on design and performance of hot dip galvanized coatings and products. Contact details for each of these locations are located elsewhere in this manual.

This edition of the Industrial Galvanizers Specifiers Manual has been produced in both html and .pdf formats for ease of access and distribution and all documents in the Manual are in .pdf format and can be printed if paper documents are required.

The Specifiers Manual is also accessible in its entirety on the company's web site at www.ingal.com.au.

Additional copies of the Specifiers Manual are available on CD on request.

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