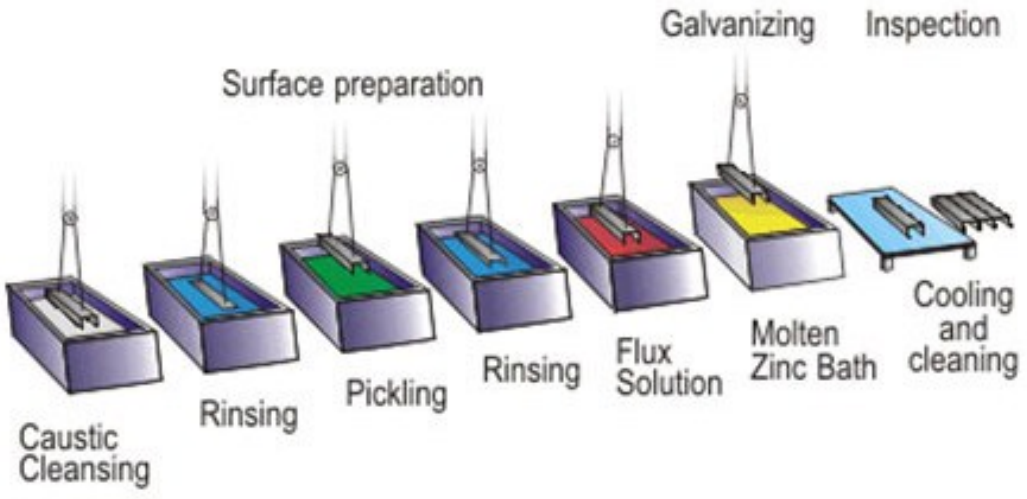
WHAT IS HOT DIPPED GALVANIZING?

Hot-dip galvanizing (HDG), as referenced on this site, is the process whereby fabricated steel, structural steel, castings, or small parts, including fasteners, are immersed in a kettle or vat of molten zinc, resulting in a metallurgically bonded alloy coating that protects the steel from corrosion.



The galvanizing process naturally produces coatings that are at least as thick at the corners and edges as the coating on the rest of the article. As coating damage is most likely to occur at the edges, this is where added protection is needed most. Brush- or spray-applied coatings have a natural tendency to thin at the corners and edges. The figure below is a photomicrograph showing a cross-section of a corner of a galvanized piece of steel.

Hot Dip Galvanizing is one of the oldest methods of zinc coating which involves immersion of a fastener in molten zinc to provide a corrosion protecting finish. This zinc coating provides sacrificial or cathodic protection to the steel. Because zinc is more reactive than iron, the zinc galvanized coating corrodes first, protecting the steel substrate. The appearance of the galvanized surface can vary from shiny silver to a dull matte gray finish depending upon variables such as the steel composition, rate of withdrawal from the molten zinc bath and cooling method. The dark gray matte finish will provide just as much corrosion protection as the shiny appearance

FACTS ABOUT HOT DIPPED GALVANIZING:

- Using zinc to protect steel from corrosion (hot-dip galvanizing) is a 150-year-old practice!
- Corrosion is caused by the inherent tendency of metals, when subjected to air and moisture, to revert to their original earthly forms, usually an ore state. They do this through a chemical or electrochemical reaction with the environment.
- Galvanizer's kettles (Galva Source) are set at temperatures ranging between 815 F and 850 F (435 C to 454 C).
- A galvanizer knows that a piece of steel should be immersed for a specific amount of time in order for the metallurgical reaction between zinc and iron to reach completion. The completion of the metallurgical reaction is observed when bubbling of the molten zinc in the kettle stops. At this point, the galvanizing is complete and the steel is removed from the kettle to cool. Galvanizers can hot-dip galvanize a piece of steel that is larger than the kettle dimensions; it's called progressive dipping.
- Zinc seals the underlying steel from contact with its environment. If the steel is exposed to the elements due to mechanical damage, the surrounding zinc corrodes sacrificially, protection the underlying steel from corrosive attack.
- The zinc coating on galvanized steel is uniform: inside, outside, corners and edges.
- The hot-dip galvanized reinforcing steel bond with concrete is at least as great as the bond of bare steel to concrete.
- When the Brooklyn Bridge was built, over 14,500 miles of hot-dip galvanized wire were used for its four main cables. Over 100 years later when the bridge underwent massive rehabilitation, the hot-dip galvanized wire was in excellent condition.

Though the process may vary slightly from plant to plant, the fundamental steps in the galvanizing process are:

Surface Preparation

Degreasing/Caustic Cleaning

A hot alkaline solution removes dirt, oil, grease, shop oil, and soluble markings.

Pickling

Dilute solutions of either hydrochloric or sulfuric acid removes surface rust and mill scale to provide a chemically clean metallic surface.

Fluxing

Steel is immersed in liquid flux (usually a zinc ammonium chloride solution) to remove oxides and to prevent oxidation prior to dipping into the bath of molten zinc. In the dry galvanizing process, the item is separately dipped in a liquid flux bath, removed, allowed to dry, and then galvanized. In the wet galvanizing process, the flux floats atop the molten zinc and the item passes through the flux immediately prior to galvanizing.

Galvanizing

The article is immersed in a bath of molten zinc between 815-850 F (435-455 C). During galvanizing, the zinc metallurgically bonds to the steel, creating a series of highly abrasion-resistant zinc-iron alloy layers, commonly topped by a layer of impact-resistant pure zinc.

Finishing

After the steel is withdrawn from the galvanizing bath, excess zinc is removed by draining, vibrating or—for small items—centrifuging. The galvanized item is then air-cooled or quenched in liquid.

Inspection

Coating-thickness and surface-condition inspections complete the process. The galvanizing process has existed for more than 250 years and has been a mainstay of North American industry since the 1890s. Galvanizing is used throughout various markets to provide steel with unmatched protection from the ravages of corrosion. A wide range of steel products from nails to highway guardrail to the Brooklyn Bridge's suspension wires to NASA's launch pad sound suppression system benefit from galvanizing's superior corrosion protection properties.