General Hot-Dip Galvanizing vs.Continuous Sheet Galvanizing

Hot-rolled structural steel, plate, grating, expanded metal, fasteners, small parts, tubing pipe, etc. is singularly (collectively on fixtures or perforated baskets for small parts) suspended by chain, hook, or wire and passed through a cleaning process, molten zinc bath, and quench (air or water).

Uses
Bridges, light poles, communication towers, electrical poles, electrical substations, transmission towers, guardrail, sign structures, nails, fasteners, stadiums & racetrack structures, truck & trailer frames, wastewater treatment facilities, agricultural and irrigation equipment, ornamental gates & fences, transportation (rail & bus stations), ports/docks

General Galvanizing (aka After-Fabrication Galvanizing)			**Performance & Condition**	**Continuous Galvanizing** (aka Coil to Coil Galvanizing)		
Controlled but not guaranteed: bright, shiny, matte, or some combination			**Appearance**	Controlled: regular spangle, minimum spangle, no spangle, dull, shiny		
Structural oz/ft^2 (µm)	**Plate** oz/ft^2 (µm)	**Pipe & Tube** oz/ft^2 (µm)	**Coating Thickness for Steel**	**G60** oz/ft^2 (µm)	**G90** oz/ft^2 (µm)	**G185** oz/ft^2 (µm)
1.0 (45)	1.0 (45)	1.0 (45)	1/16" (1.6 mm)	0.30 (12)	0.45 (19)	0.92 (41)
1.5 (65)	1.0 (45)	1.0 (45)	1/16" to 1/8" (1.6 to <3.2 mm)	0.30 (12)	0.45 (19)	0.92 (41)
1.7 (75)	1.7 (75)	1.7 (75)	1/8" to 3/16" (3.2 to <4.8 mm)	0.30 (12)	0.45 (19)	0.92 (41)
2.0 (85)	1.7 (75)	1.7 (75)	>3/16" to <1/4" (4.8 to <6.4 mm)	0.30 (12)	0.45 (19)	0.92 (41)
2.3 (100)	1.7 (75)	1.7 (75)	≥1/4" to <5/8" (6.4 to <15.5 mm)	0.30 (12)	0.45 (19)	0.92 (41)
2.3 (100)	2.3 (100)	1.7 (75)	≥5/8" (15.5 mm)	0.30 (12)	0.45 (19)	0.92 (41)
ASTM A123 for structural steel shapes, plate, pipes & tubing, rollforming ASTM A153 for small parts & fasteners			**Coating Designation**	ASTM A653 Galvanized: G90, G185, G210, G235 Galvannealed: A60, A90, A120 Galvalume: (55% Al, 45% Zn) Galfan: (95% Zn, 5% Al)		
Interior/Exterior			**Exposure Conditions**	Interior only, unless painted/powder coated over galvanized coating (≥G185 have some exterior applications)		
≥14 gauge to 20" thick ≤ 90' long Nails, fasteners, structurals, grating, expanded metal, rod, pipe, tubing, reinforcing bar, rounds, flats, squares, plate, rollformed			**Size/Configuration Availability**	7 gauge (3/16") to 32 gauge (0.102") thick Coil: 1" to 60" wide Flat sheets: 36 to 60" wide		
Alloy layers are harder than the substrate steel - protects against wind dust and sand abrasion, durable during pile driving, trucking, and erection			**Abrasion Resistance**	Pure zinc coating is softer than steel - will scratch during pile driving, quicker to abrade by wind and rough handling		
American Galvanizers Association www.galvanizeit.org			**Authority**	**GalvInfo Center** www.galvinfo.com **Steel Manufacturers Association** www.steelnet.org **American Iron & Steel Institute** www.steel.org		
100% throughout, including edges, corners, and interior surfaces			**Coating Coverage**	None on sheared edges, punched holes		

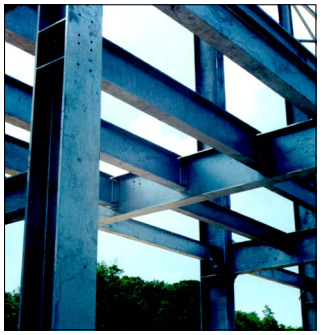
Hot- or cold-rolled steel in coil form is unwound and in ribbon fashion passed through a chemical cleaning process, a bath of molten zinc (or zinc alloy), a high pressure air flow to remove excess zinc and control the coating thickness, dried, and recoiled for further processing into slit coil or cut-to-length form.

Uses
Automotive body panels, appliances, HVAC duct, framing studs, roofing, guiderail, signs (painted).

General Galvanizing and Continuous Sheet Notes

Appearance

The appearance of general galvanized zinc coatings is largely a function of the chemistry of the steel being galvanized. The bulk of steel galvanized in the general galvanizing process comes from fabricators who purchase it from steel service centers and thus the chemistry is either not known or not specifically selected. Silicon and phosphorous of certain percentages in the steel yield the customary shiny silver coating and other percentages result in matte gray coatings. Regardless, after a short period of time (approximately 6 months or less in most atmospheric exposure conditions) the galvanized steel will look the same, i.e. matte gray. It is important to note, the corrosion protection is the same for bright and dull coatings of the same thickness.



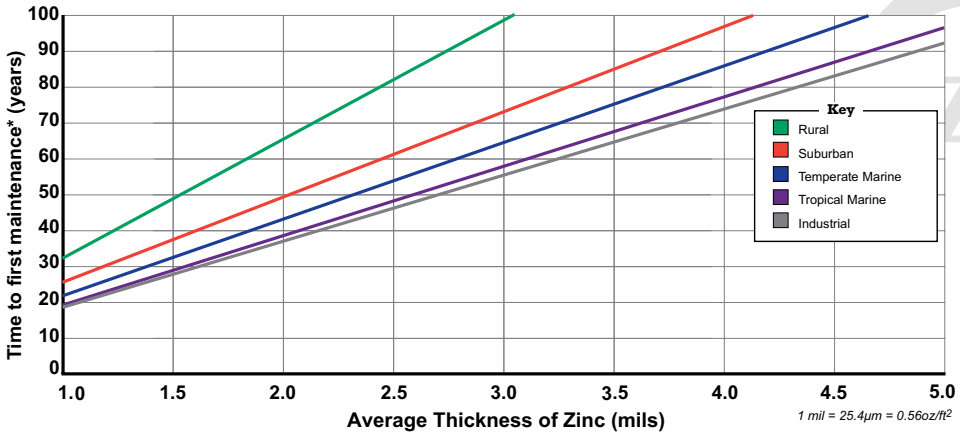
Continuously galvanized steel can have a number of different appearances, custom to the order. Typically, it exhibits a spangle (flake look) and is bright and shiny. However, passivation coatings can be applied to dull the coating in preparation for painting or other value-added processes.

Coating Thickness

Corrosion protection is linearly related to the zinc coating thickness, i.e. the thicker the zinc coating, the longer lasting the corrosion protection of the steel. (See Time to First Maintenance chart below.) General galvanized steel coating thickness is largely a function of the available iron in the steel - the more mass, the more iron and the thicker the coating. Elements such as silicon and phosphorous in certain ranges can also promote thicker coatings. General galvanized steel coatings have three zinc-iron alloy layers, all harder than the steel itself, and a ductile, pure zinc outer layer.

Continuous sheet is largely pure zinc, with little alloy layer and thin relative to general galvanized coatings. Regulating the speed of the steel as it passes through the molten zinc bath and the force of the air knife as the steel exits the bath controls whether the coating is a G60 or a G210.

Time to First Maintenance Chart



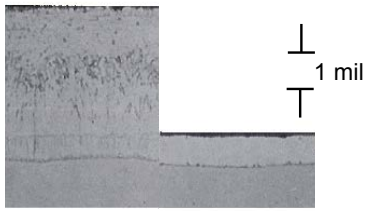
1 mil = 25.4µm = 0.56oz/ft²

**Time to first maintenance is defined as the time to 5% rusting of the steel surface.*

Coating Designation

All general galvanized coatings are produced the same way, in a > 98% pure zinc bath and have no specific coating designation. However, various steel products are galvanized with specific coating thickness minimums per ASTM) A123, A153, A767, ISO 1461, CSA G164, or AASHTO specifications. Continuously galvanized sheet steel is most commonly produced to ASTM A653 and designated as a G120, G185, G210, etc. coating.

Coating Thickness Micrograph



Exposure Conditions

General galvanized steel is used primarily for corrosion protection in exterior applications (utility poles, sign structures, boat trailers, agricultural equipment, guardrail) but may also be used for indoor applications (swimming pools, pulp and paper plants).

Continuously galvanized sheet steel zinc coatings are so thin they do not provide long term corrosion protection on their own for exterior applications. They are usually painted for use in electrical cabinets, automotive body panels, or building façades. Primary interior uses for continuously galvanized sheet steel include appliances, almost always painted, HVAC duct, and electrical junction boxes.

Size/Configuration Availability

Any steel piece (≥ 14 gauge rollforming) or weldment that can fit into the general galvanizing bath can be galvanized. Furthermore, structural steel members up to 1.5 times the length of the galvanizing bath can be galvanized via a process called progressive dipping.

Sheet steel is always galvanized coil to coil. Once the coil has cooled, the steel is uncoiled and either slit into narrower width coils or cut to length in sheets commonly available in sizes such as 48” x 96” and 60” x 120.” Some manufacturers stamp parts directly from the coated coil.

Abrasion Resistance

The general galvanized coating is comprised of four distinct coating layers, three of which are alloys of zinc and iron and harder than the substrate steel. The Gamma alloy layer at the steel-coating interface has a Diamond Pyramid Number (DPN) hardness of 250 compared to the steel DPN of 159. The Delta and Zeta layers above the Gamma layer have a DPN of 244 and 179, respectively. Only the pure zinc outer layer (Eta) is softer than the steel with a DPN of 70. All this means the galvanized coating can withstand the abrasive forces applied during the process of driving posts into the ground, during shipping, and erection.

Continuously galvanized sheet is a 100% pure zinc coating with minimal alloy layers. This coating is subject to abrasive damage during rough handling and pile driving.

Coating Coverage

Because the general galvanized coating is a complete immersion process and applied after all welding, shearing, flame-cutting, drilling, and hole punching, all surfaces are protected from corrosion by zinc, including the interior of tubing and pipe.

Continuously galvanized sheet is formed, punched, drilled, cut, and sheared after the zinc is applied, leaving bare edges exposed to corrosion. These bare, corroding surfaces accelerate the corrosion of the zinc surrounding the exposed area and shorten the durability of the overall coating.

American Galvanizers Association Phone: 720-554-0900 Fax: 720-554-0909 www.galvanizeit.org aga@galvanizeit.org