High quality galvanized coatings are obtained when steel assemblies are designed to promote unrestricted flow of cleaning solutions and molten zinc during the hot-dip galvanizing process. A basic understanding of how steel is handled in the galvanizing plant and what the steel undergoes in the application of the galvanized coating will aid steel detailers in preparing drawings that will produce the best possible galvanized finish.

**Keep the following details in mind when developing and reviewing structural details and shop drawings:**

- Are the vent and drain holes of sufficient size and quantity?
- Are the vent and drain holes located properly? (One or more for drain and one or more for venting.)
- Are corners of gussets, stiffeners, and bracing cropped to allow for free flow of zinc?
- If the fabrication is comprised of steel of two or more thicknesses, is it designed to promote minimal change in camber/straightness?
- Are welds at overlapping surfaces seal welded?
- Does the fabricator know to remove all weld flux and to use a weld material of suitable chemistry to produce good zinc coating?
- Have I accounted for marking/tracking of the parts through the galvanizing process and on to the job site?
- Have I planned for tapping of nuts or threaded holes after galvanizing?

The viscosity of liquid zinc at the galvanizing temperature plays a large role in which assemblies can be galvanized easily. The viscosity of molten zinc prevents it from entering gaps or crevices less than 3/32”. Inside corners on steel fabrications also present quality issues if not properly designed for galvanizing. In general, the number of corners should be minimized. When applicable, corners should be cropped or enough space (3/32”) must be provided for the molten zinc to easily flow in and out of tight spaces. When this issue is overlooked, zinc will tend to “pool” in these areas causing excessively thick coatings that may flake during rough handling.

In addition, cleaning solutions are much less viscous than molten zinc and can enter tight spaces that the zinc cannot. Dried residue from cleaning solutions may remain trapped in the crevices after galvanizing and may bleed onto the surface if they come into contact with moisture. This will cause unsightly rust staining on the surface of the steel.

Arguably the most important components of galvanized steel design are vent and drain holes. Tubular or hollow fabrications must allow for cleaning solutions and zinc to freely flow on both the interior and exterior surfaces. To accomplish this, vent and drain holes should be placed near the ends of steel articles to allow zinc to penetrate the interior, as well as drain from the interior upon withdrawal from the galvanizing kettle.

Recommended Details for Hot-Dip Galvanized Structures, produced by the American Galvanizers Association (AGA), is a useful reference and can be downloaded from [www.galvanizeit.org/ref/details](http://www.galvanizeit.org/ref/details). It includes working drawings containing the most commonly galvanized structures and includes the necessary details required for quality galvanizing. Another useful reference is *Designing with Hot-Dip Galvanized Steel*, an AGA-produced CD-ROM.

After choosing hot-dip galvanizing as the corrosion prevention system for your project, ASTM A123/A123M-02, **Standard Specification for Zinc (Hot-dip Galvanized) Coatings on Iron and Steel Products** should be the cornerstone of your project specification. ASTM A123 applies to structural...
Typical galvanized coatings range from 3-8 mils (75-200 microns) thick. When designing and detailing tapped holes, the increased thickness is important. Best practice suggests that the hole be tapped after galvanizing, removing the coating on the interior mating surface. If a galvanized component is used to mate with the hole (recommended to avoid galvanic corrosion), the galvanized coating on the mating surface will cathodically protect the bare steel of the interior threads. This also reduces the thickness loss of the hole and ensures a clean connection. On threaded assemblies with diameters greater than 1.5” (3.8 cm), it is often more practical, if design strength allows, to have the male thread cut 0.031” (0.8 mm) undersize before galvanizing so a standard tap can be used on the nut (refer to ASTM A563, Standard Specification for Carbon and Alloy Steel Nuts, for overtapping allowances).

Throughout North America, a variety of sizes of hot-dip galvanizing kettles is available, allowing a wide size-range of structural fabrications to be galvanized (refer to www.galvanizeit.org/ref/galvanizers for a complete listing of AGA-member North American galvanizers and their kettle sizes). Designing and fabricating in modules suitable for the available galvanizing facilities allows almost any component to be galvanized. For oversized fabrications, best practice suggests that they be designed in modules or sub-units and assembled after galvanizing. In some instances, fabrications that are larger than the galvanizing kettle may be progressively dipped to obtain complete coating coverage on all surfaces.
Have I referenced all of the pertinent specifications that cover hot-dip galvanizing of steel after fabrication? (ASTM A123 or ASTM A153 and ASTM A385)

Is it practical to specify steel of certain chemistry in order to better control the coating thickness and appearance? (For small projects less than 20 tons, it is not likely that the fabricator has the selectivity to order steel of specific chemistry from a steel service center/warehouse. Larger projects that have schedule flexibility may allow for steel of a specific chemistry to be ordered from the mill.)

What sampling method will be used by the galvanizer? Have I specified a set number of thickness measurements or a random sampling?

Did I stipulate that a certificate of conformance be provided by the galvanizer?

Will the thickness of steel yield a zinc coating thickness appropriate for the intended use and environment of use?

Have I communicated with the fabricator and galvanizer about the intended use of the galvanized steel? (The intended use may dictate special post-galvanizing procedures.)

Are there any special packaging requirements to protect the galvanized steel during a long storage period? (Nested or tightly stacked galvanized steel does not allow the natural development of zinc's protective patina.)

What is my expectation for the coating appearance (matte gray, bright/shiny, spangled)? Do I care, or is corrosion protection my primary concern?

If there are any bare spots on the galvanized steel that result from contaminants on the black steel that prevent proper cleaning, what touch up method should be used in the galvanizer’s plant (per ASTM A780-01, Practice for Repair of Damaged and Uncoated Areas of Hot-dip Galvanized Coatings)?

If there is damage in transit or during erection, which of the three approved touch up methods is to be used?

Vent and drain holes prevent trapped moisture or gas from flashing to steam in the heated galvanizing kettle, which may result in localized uncoated surfaces or ruptured fabrications.