

Duplex Powder Coating for Galvanized Substrates

BY TERRY WATSON



Photo courtesy A Plus Powder Coaters Inc.

Each step in the powder coating process over a galvanized substrate is important in achieving a durable, attractive finish.

From design to field, there is proper processing for powder coating over galvanized substrates. Learn why each step is important to achieving a durable, attractive finish suitable for harsh environments.

When it comes to fabrication, it is important that the designer and fabricator know the intended end use application of the product so that design, fabrication and finish can be planned around that particular application. In this article, we discuss product that is specifically designed with the intent of being galvanized and powder coated (commonly referred to as a duplex coating system). The assumption has been made that the product to be coated is to be used in a relatively harsh and corrosive environment because the product is receiving a duplex coating system.

It is absolutely critical that the company performing the galvanizing know that it will have a powder coating applied over the top of the galvanized surface. The party responsible for sending the parts out for galvanizing will need to clearly communicate that the parts absolutely must not be quenched. They

must be air cooled. Quenching is a commonly used process in the galvanizing industry where either water or more commonly a chromate solution is sprayed on the parts after they exit the molten zinc. This is done both to accelerate cooling of the metal and slow the reactivity of the zinc so that product can be shipped from the galvanizer without the presence of excessive oxidation. All types of quenching will need to be avoided in that they can create disastrous field failure of coated product due to adhesion loss. Quenched galvanized surfaces also are likely to outgas during the curing process of the powder

coating which will cause a "crater effect" that will not only give an ugly appearance but will create voids in the coated surface and allow moisture to penetrate directly to the galvanized substrate. Even if the coater is fortunate enough to maintain an attractive appearance, the chromate that is used in the quenching process is designed to oxidize and fall off of the substrate. This will result in poor coating adhesion and premature field failure.

All galvanized product should be shipped to the powder coater as quickly as possible so that the amount of oxidation that is allowed

to form on the zinc can be minimized.

Ideally, galvanized substrate should be coated within 12 to 24 hours of being galvanized. Since these processes are typically performed at different facilities, unfortunately this does not usually occur.

Once material is received by the powder coater, the staff there will need to ensure that the galvanized surface is free of oil, grease and dirt.

Metal Prep

The galvanized surface should be sweep media blasted to SSPC-SP7 standard (also known as brush blasting). Care must be taken when

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choosing what type of media to use. It is advised not to use steel shot, aluminum oxide, or other types of media that if impinged into the surface could corrode when exposed to the elements or to dissimilar metal substrate. Some coaters recommend soft media such as corn cob and walnut shell, but it has been my experience that harder media can be used effectively as long as it is used at low pressure by a trained technician who understands that they are not to dwell in any particular place of the galvanized surface. If galvanized surface has voids or has an appearance of the galvanizing having flaked from the metal surface, chipping from the edges or has blisters present, it is being blasted far too aggressively. The goal is to take away the shiny appearance and surface oxidation while removing as little zinc as possible from the work piece.

Enhancing Primer Coat

The addition of a primer coat is recommended as a way to enhance the overall quality of the coating system. It has been my experience that the



Photo courtesy A Plus Powder Coaters Inc.

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Primer coats should be sprayed within 12 hours of brush blasting the galvanized surface. The powder coater should apply the primer to manufacturer's recommended film thickness. In some cases the manufacturer will recommend a particular level of cure for the primer, ranging

from some percent of cure to full cure. It is important to understand the degree of cure required as recommended by the manufacturer. Most manufacturers recommend "green curing" or partial curing of the primer so that proper inter coat adhesion can be accomplished once the top coat is applied. The primer coat should be allowed to cool and then a top coat should be applied as quickly as possible. It is advised that the top coat be applied within an hour or two of priming so that dust or other contaminants do not have time to accumulate on the surface.

Top Coating

As soon as possible after the primer coat is complete, the parts should be coated with the desired UV stable top coat. We tend to use a lot of super durable polyester chemistries as top coats because of the additional UV stability that they provide at only a slightly higher cost than stan-



Photo courtesy Rodger Talbert

Powder applied over galvanized guard rail provides a different look than traditional hot-dipped galvanized steel.

standard polyesters. The top coat powder will need to be fully cured if it is intended as a final coat.

We sometimes use super durable anti-graffiti clear over top of the color coat to provide extra UV stability, protect metallics, or thwart the local urban art community. Some customers are willing to use the additional resources to assure long term protection and aesthetic value of their product.

In summary, duplex powder coatings have the potential to add beauty and lifespan to products intended for harsh outdoor environments. If processes are planned and performed properly by all parties involved, it can be a relatively simple and trouble-free process. The key ingredients are making sure that everyone is aware of the intended use of the finished product and steps that will need to happen both upstream and downstream of each individual process.

Final Cure

After the topcoat is applied the product is sent to the oven for full cure of both coats. The amount of cure depends on the metal mass and the recommended cycle time and temperature as recommended by the manufacturer of the powder. The total time in the oven must include the time required to raise the metal to the intended cure temperature and the recommended dwell time at peak metal temperature.

Most powders have some flexibility of time and temperature for cure. This typically ranges from 10 to 15 at 350°F to 400°F. In most cases the longer time is preferred to allow the

powder to reach full film properties. Lower temperatures are also desirable to reduce energy use. In the case of galvanized steel or other

products that occasionally release trapped porosity during the cure cycle it is sometimes helpful to cure at the lower end of the recommended

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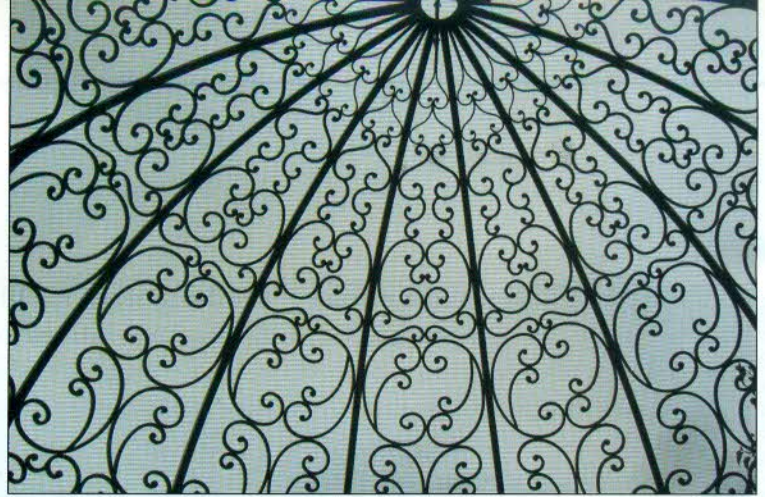
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temperature range. In any case, cure should be tested to confirm that the product has the necessary performance properties. Cure can be tested using a chemical rub test as long as the test piece is compared to a known cured sample. Some powders may give off some powder when exposed to solvent but it is more the result of chemical resistance than degree of cure. Pencil hardness and gloss can also be helpful in evaluating the degree of cure. The film will not reach full hardness if it is under-cured and the gloss may be incorrect.

Be sure to get the surface clean. That is always a requirement but

especially critical when coating galvanized. Be sure to test every step of the process to confirm that it is working. It is usually helpful to

request that the customer send few small samples of the same thickness and type of substrate to be used by the coater for destructive testing. Galvanized is commonly coated with powder but it is more challenging



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than steel surfaces so do your homework and test, test, test.



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