

**Q I am contemplating powder-coating some hot-dip galvanized steel to further increase its corrosion protection. I have heard some rumors regarding the adhesion of powder coatings on galvanized steel. Apparently the adhesion is compromised due to the zinc coating outgassing. Is there any truth to this? Is there anything I can do to prevent outgassing of the zinc coating?**

**A** Yes, outgassing of the zinc coating can occur when applying a powder coating over galvanized steel, which could potentially affect the adhesion and continuity of the coating. However, it can be prevented if the proper surface preparation techniques are used in conjunction with good powder application practices.

The key to achieving good adhesion between powder coatings and galvanized steel is surface preparation. The surface must be entirely free from zinc oxides prior to powder coating. Any zinc, or other metal oxides, that remain on the surface of the galvanized steel can potentially retain air or moisture. Upon heating during the curing stages of the powder application, the oxides may release water vapor or air, which can expand and penetrate the powder coating, causing blisters or voids.

The galvanized coating may also release gas due to trapped air or water in the galvanized coating. Water or air may be able to penetrate small crevices within the outermost layer of the zinc and become trapped. When air or water become heated during the curing stages of the powder coating process, they can release through the powder coating in the form of gas to form a small crater or blister.

To reduce the potential for outgassing, it is essential to remove any surface oxidation with a light sweep blast and/or chemical cleaning. A light sweep blast will clean off any metal oxides that have developed on the surface as well as open up surface cavities that have trapped air. Sweep blasting will also increase the surface profile of the steel. This promotes good adhesion between the steel and the powder coating. In conjunction with a sweep blast — or as a stand-alone treatment — a phosphate wash treatment can be employed to remove surface oxidation. This

lightly-acidic solution will remove oxides from the surface as well as slightly etch the steel surface, providing a better surface profile for top coating to adhere to. Proprietary solutions are available that are designed to work effectively on galvanized or other zinc surfaces.



**Pipes color-coded using powder coating; a common application.**

Pre-baking in a drying oven can also reduce the potential for the galvanized coating to outgas. This process will aid in the expulsion of any trapped air or water in the coating as well as ensure that the surface of the steel is free from any moisture. The pre-baking oven should be operated at higher temperatures than the curing oven; this temperature is typically 55 F (30 C) higher than the curing oven. If the galvanized steel is run through a phosphate wash prior to

powder coating, it is recommended that the pre-bake oven temperature not exceed 535 F (280 C). Higher temperatures will deteriorate the thin phosphate coating, converting it into a powdery substance that could affect adhesion.

The cure oven temperature should be operated as low as possible to further reduce the potential for outgassing. Best results are achieved with lower oven temperatures and longer times as opposed to higher temperatures with shorter times. Not only will the lower temperatures inhibit gassing, but the longer curing times might lead to the resealing of any craters that may have formed.

As the techniques for surface preparation and powder application are refined, the application of powder coatings over galvanized steel is becoming increasingly popular. The corrosion protection provided by this duplex system will extend the life of the galvanized coating by many years, and will allow the galvanized coating to take on many different appearances.