



COOLING TECHNOLOGIES

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## Coating over Galvanized Steel for Cooling Towers – An Unwise Choice

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Coating damage is inevitable, whether during assembly, transportation, operation, or maintenance. If the coating barrier is breached in any way, through damage, deterioration, defects, or water absorption, the protection is compromised. Also, coating over galvanized reduces the cathodic protection provided by the zinc. While cuts and scratches of bare galvanized steel are protected by the anodic action of the surrounding zinc surface, if the galvanized steel is coated, this action can be impeded since the zinc surface is not available to the electrolyte. In effect, the coating disables much of the protection provided by the zinc and the durability of the material is largely dependent on the quality of the coating alone.

Coating quality is sensitive to surface preparation, ambient conditions at time of application, process variables, and human error as evidenced by the need for complex quality assurance programs. There are many opportunities for problems to occur. For example, optimal surface preparation is difficult to obtain with mild chemical cleaning alone. Harsh chemical or mechanical preparation is better but will remove some zinc, thus reducing the benefit of the galvanizing.

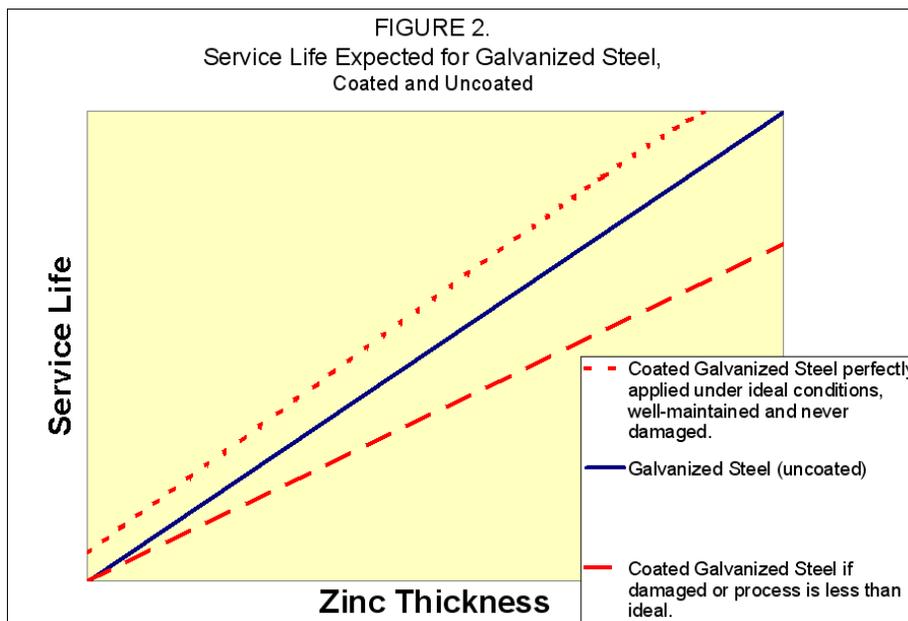
Electrostatically applied powder coatings can easily be non-uniform due to incomplete or imbalanced electrical fields. Unavoidable phenomena such as back-ionization and the Faraday cage effect result in coating defects such as orange peeling, “star” blemishes, and incomplete coating.<sup>[1,3]</sup> Powder coating over galvanized steel presents unique problems such as poor adhesion, outgassing of air pockets (causing pinholes in coating), and bubbling during cure stage, which result in poor coating quality. In fact, one powder coating consultant calls galvanized steel an “unstable substrate” which is “high-risk” and “comes with a higher defect rate”.<sup>[2]</sup>

Porosity is a common problem with coatings and can actually be a local accelerator of corrosion. Also, coatings can blister, and peel away or chip off to create plugging problems in cooling systems. Furthermore, by the nature of coatings, maintenance is inevitable. Maintenance accessibility of many of the surfaces in a factory assembled cooling tower is severely limited or non-existent.

Coating of galvanized steel will not allow increased cycles of concentration nor increased limits for water constituents such as chlorides or sulfates. Promoters of coated galvanized steel will not explicitly guarantee extended product life.

Because the life of a coated surface is highly variable due to process, handling, and environmental factors, cooling tower purchasers should not regard coated galvanized steel as a viable material option. While properly and carefully applied coatings can add life to galvanized steel under limited circumstances, uncoated galvanized steel is the more prudent choice for HVAC cooling towers. Coated galvanized steel for cooling towers should not be considered a premium material. Truly premium materials such as stainless steel or plastics are available if water or environmental conditions warrant.

Given the possibility of zinc removal, pinholes, damage, or general poor quality of a coating applied over galvanized steel, the service life of the equipment can actually be less than that of uncoated galvanized steel (Figure 2).



Features of Tower Basin Material Choices:

<b>BASIN MATERIALS:</b>	<b>Coated HMG</b>	<b>HMG</b>	<b>Stainless Steel</b>
<b>Abrasion resistant</b>		<b>x</b>	<b>x</b>
<b>Consistent quality</b>		<b>x</b>	<b>x</b>
<b>Low initial cost</b>		<b>x</b>	
<b>No white rust</b>	<b>x</b>		<b>x</b>
<b>Long life expectancy</b>			<b>x</b>
<b>Low maintenance</b>		<b>x</b>	<b>x</b>
<b>Scratch resistant</b>		<b>x</b>	<b>x</b>
<b>Easy to inspect</b>			<b>x</b>
<b>Homogeneous</b>			<b>x</b>
<b>Corrosion-resistant full thickness</b>			<b>x</b>
<b>Fire proof</b>		<b>x</b>	<b>x</b>
<b>Unaffected by UV and aging</b>		<b>x</b>	<b>x</b>

(HMG = Heavy Mill Galvanized steel)

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