Comparing the Zinc Plating Methods for Metal Strut

A summary of tests of four different types of zinc plating to measure performance in resisting oxidation in corrosive conditions, and recommendations for which plating type is best for specific applications.
Metal strut, also known as metal channel and strut channel, is a system of structural support for wiring and heating, ventilation and air conditioning (HVAC) components.

Formed from sheet metal, it usually has inward-curving edges and holes along its central panel for mounting of interconnecting components. The holes also enable the metal strut to be fastened to building structures. Metal strut is designed to offer numerous options for assembly, and can be easily modified and added to. It also is known for being quick to assemble, requiring minimal tools and construction skills.

Even though stainless steel metal strut is available and used primarily in food and beverage processing applications, it is usually constructed of carbon steel which is plated and galvanized using zinc to provide protection from corrosion. Thomas & Betts, manufacturer of two lines of metal strut, Kindorf® and Superstrut® channel systems, offers three factory-approved zinc galvanizing options:

- **SilverGalv® finish**: All surfaces are electroplated with an average of 0.5 mils of zinc and a clear chromium sealant, which does not obscure the zinc plating’s silver color. As with the GoldGalv® finish, the SilverGalv® finish is applied after cutting and punching, providing a durable, corrosion-resistant product. SilverGalv® finish’s corrosion resistance is between that of a GoldGalv® finish and that of a hot-dipped galvanized coating.

- **GoldGalv® finish**: All surfaces are protected with a trivalent chromium finish applied over zinc, creating a chemically bonded, nonporous barrier, as well as its characteristic gold color. GoldGalv® finishes are applied after cutting and punching, which protects all surfaces of the finished product.

- **Hot-Dipped Galvanized**: The material is zinc coated after fabrication, providing total product protection on all surfaces. Hot-dipped galvanized finishes are typically two to three mils thick.

A fourth type of finish is pre-galvanized finish. This finish is a zinc coating that is applied by hot dipping the steel at the mill prior to fabrication. This results in some surfaces remaining exposed without zinc plating as a result of the rolling and cutting process to form the strut profile.

The processes used for GoldGalv® and SilverGalv® finishes are electrochemical in nature, as opposed to the strictly mechanical processes involved in hot-dipped galvanized and other zinc coatings, which entail submerging steel components in molten zinc. The electrochemical process, commonly known as electroplating, establishes a chemical bond that adheres the zinc finish to the steel surface.

The GoldGalv® and SilverGalv® finishes provide unique advantages over mechanically applied zinc finishes, such as hot-dipped galvanized or pre-galvanized. GoldGalv® finish, in particular, requires longer submersion in chromium baths than the SilverGalv® finish, which results in its characteristic yellow-gold color.

The SilverGalv® finish typically sells at a similar price point as pre-galvanized finishes, but offers a cleaner surface that can be painted easily, without requiring the end user to clean off the rolling oils and other grime that are typically found on pre-galvanized strut.

Thomas & Betts recently conducted a study that compared these four different types of zinc plating in terms of their performance in resisting red rust, which is oxidation and corrosion of carbon steel, and white rust, which is oxidation and corrosion of zinc. Both affect the service life of metal strut.

The test entailed exposing the samples to salt fog and recording how many hours transpired before each sample showed evidence of white and red rust of at least five percent of the sample’s surface. The results indicated that both hot-dipped galvanized and pre-galvanized finishes show almost immediate evidence of white rust; five percent of the surface of these finishes showed white rust after only 24 hours of exposure. This is the result of a lack of chromate sealer on hot-dipped galvanized and pre-galvanized samples, leaving the zinc to be exposed directly to the air in the

<table>
<thead>
<tr>
<th>Sample</th>
<th>Description</th>
<th>White Rust</th>
<th>Red Rust</th>
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<tbody>
<tr>
<td>GG4</td>
<td>Gold Galv Finish</td>
<td>96</td>
<td>410</td>
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<tr>
<td>GG5</td>
<td>Gold Galv Finish</td>
<td>81</td>
<td>359</td>
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<tr>
<td>GG6</td>
<td>Gold Galv Finish</td>
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<td>410</td>
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<td>GOLD AVERAGE</td>
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<td>393</td>
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<tr>
<td>HDG4</td>
<td>Hot Dip Galv Finish</td>
<td>24</td>
<td>624</td>
</tr>
<tr>
<td>HDG5</td>
<td>Hot Dip Galv Finish</td>
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<td>624</td>
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<tr>
<td>HDG6</td>
<td>Hot Dip Galv Finish</td>
<td>24</td>
<td>531</td>
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<tr>
<td>HDG AVERAGE</td>
<td></td>
<td>24</td>
<td>593</td>
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<tbody>
<tr>
<td>PG4</td>
<td>Pre-Galv Finish</td>
<td>24</td>
<td>306</td>
</tr>
<tr>
<td>PG5</td>
<td>Pre-Galv Finish</td>
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<td>PG6</td>
<td>Pre-Galv Finish</td>
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<tr>
<td>PG AVERAGE</td>
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<td>283</td>
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<tr>
<td>SG4</td>
<td>Silver Galv Finish</td>
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<td>306</td>
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<tr>
<td>SG6</td>
<td>Silver Galv Finish</td>
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<tr>
<td>SILVER AVERAGE</td>
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same white-rust tests, the SilverGalv® and GoldGalv® finishes demonstrated comparable white-
rust resistance that was vastly superior to hot-dipped galvanized and pre-galvanized finishes. This
capability is particularly significant, given the risk of micro contamination that white rust poses to
sensitive environments.

Thomas & Betts conducted similar salt-spray testing for red rust, the results of which indicated that
five percent evidence of red rust occurred on pre-galvanized finishes after an average of 280 hours
of exposure, SilverGalv® finishes after an average of 375 hours of exposure, GoldGalv® finishes after
an average of 393 hours of exposure and hot-dipped galvanized after an average of 593 hours of
exposure.

Environmental conditions in real-world applications vary drastically; therefore, salt-spray testing
does not correlate directly to the overall life of the product being tested. Salt-spray testing, however,
can indicate the likely performance of the product under real-world conditions.

Effective product selection is based on weighing the benefits of the product against its cost.
In terms of performance, the tests indicate that SilverGalv® and GoldGalv® finishes perform
significantly better against white rust than hot-dipped galvanized and pre-galvanized finishes,
while hot-dipped galvanized finishes performed best against red rust. Besides providing superior
protection against white rust, SilverGalv® and GoldGalv® add to the value proposition by being
similarly priced to pre-galvanized finishes while offering superior protection and ease of use.
Extensive protection against red rust is found with hot-dipped galvanized finish at a moderately
premium price while SilverGalv® and GoldGalv® are the more economical choice for all applications
being comparably priced to pre-glavanized finishes.

The results of the test further reinforce the SilverGalv® finish as being the best choice for metal
strut used for commercial and light industrial applications, while the GoldGalv® finish is more
appropriate for heavier-duty, industrial applications in which resisting oxidation and corrosion is
particularly critical, performing as the second best finish against both white and red rust in the test.
Examples include facilities that require no micro-contamination from oxides, such as those used
to manufacture high-technology equipment; those with exposure to moisture, such as pulp and
paper plants; or those exposed to outdoor elements, such as utility and infrastructure (e.g., water
treatment) facilities.

SilverGalv® and GoldGalv® finishes provide superior value in protecting strut from corrosion and
deterioration, while being much less costly than hot-dipped galvanized finishes (and only a fraction
of the cost of stainless steel strut), while providing a similar level of performance. Specifying strut
with SilverGalv® and GoldGalv® finishes will provide dependable performance while reducing cost
of ownership.