

# the construction specifier

## Specifying EQ Coatings for Steel Studs

by Gregory S. Ralph

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**THE USE OF HIGH-PERFORMING MATERIALS AND PRODUCTS HAS BECOME AN IMPORTANT STRATEGY IN THE DESIGN AND CONSTRUCTION OF TODAY'S NEW BUILDINGS.** THESE MATERIALS PLAY A CRUCIAL ROLE IN A BUILDING'S EFFICIENCY, SUSTAINABILITY, AND OVERALL PERFORMANCE. THEREFORE, EVERY PRODUCT ON THE PROJECT COUNTS, RIGHT DOWN TO THE CHOICE OF THE NONSTRUCTURAL STEEL STUDS.

Is it enough to specify ASTM C645, *Standard Specification for Nonstructural Steel Framing Members*, for steel studs used in nonstructural framing? ASTM C645 permits use of G40 or other protective coatings that provide equivalent or better corrosion resistance. However, steel studs with equivalent, or EQ, coatings, may actually be the better choice.

Though 'newer' to the construction industry, these studs have actually been used for several decades, accounting for a significant portion of the nonstructural cold-formed steel stud market, while meeting or exceeding *International Building Code (IBC)* requirements. Still, although many specifiers have embraced EQ coating technology, others have been slow to do

so. This article explains why EQ coatings have grown in acceptance, their future, and why it matters.

### **Defining EQ coatings for nonstructural steel framing**

EQ coatings, also sometimes referred to as organic, inter-reactive, reactive-polymer, or conversion coatings, are added to zinc-coated steel coils to enhance the corrosion resistance of the existing base coating. This additional EQ coating is applied to the already zinc-coated steel before the material is formed into metal studs. The EQ coatings are applied on a precision, digitally controlled coating line using a reverse roll coating process. The EQ-coated steel is then cured at an elevated temperature to ensure the bonding process' completion.

These coatings are not to be confused with paints, primers, or barrier coating systems applied to the top of the zinc-coated substrate. Those three product types do not bond with the zinc-coated substrate and they may therefore allow corrosion to occur when scratched. Rather, EQ coatings protect against corrosion by permanently bonding with the existing zinc-coated substrate and penetrating into any cracks or voids in the zinc-coated substrate. The reaction between the EQ coating and base coating forms a permanent bond sealing



This side-by-side comparison shows the rust area of EQ-coated steel and G40 steel samples after 240 hours of salt spray testing.

off the zinc layer, as well as the carbon steel base metal below it, to prevent rust formation.

Much of the zinc-coated steel used by producers of steel framing products with EQ coatings consist of steel purchased, but not used by, the automotive industry. This sourcing, which helps reduce post-production waste from auto manufacturers, can contribute to Leadership in Energy and Environmental Design (LEED) credits in construction projects, such as Materials and Resources (MR) Credit 4, *Recycled Content*.

Additionally, use of the automotive industry's unused steel, versus ordering steel melted specifically for nonstructural steel framing, is currently the most effective way to keep steel stud costs affordable for the construction industry. Without the addition of EQ coatings, the base coating on the automotive steel would not meet the corrosion requirements of *IBC* or *ASTM C645*. Therefore, use of EQ coatings is critical to the sustainability of post-production market for unused automotive industry purchased zinc-coated steel.

The steel framing industry is not the only industry to use EQ coatings for enhanced corrosion resistance. In fact, EQ coatings have been embraced by the transportation, military, and off-shore drilling industries. Its integration and acceptance into the manufacturing of nonstructural cold-formed steel studs has been a move toward a stronger, more sustainable future for the construction industry.

### Code requirements for non-load-bearing steel studs

The durability of cold-formed steel framing is enhanced by

the use of corrosion-resistant coatings. Untreated steel has a natural tendency to corrode, or oxidize, whenever exposed to the oxygen content of water or water vapor. For this reason, most structural and nonstructural steel framing is produced with protective coatings that prevent moisture from reaching the steel substrate. Acceptable coatings for steel framing members are defined by a chain of industry codes and standards. The use of EQ coatings with equivalent corrosion resistance is permitted by these codes and standards.

Specifically, *IBC 2012* lists *ASTM C645* as its governing industry standard for the performance of nonload-bearing steel studs. *ASTM C645* draws from *ASTM A653*, *Standard Specification for Steel Sheet, Zinc-coated (Galvanized) or Zinc-Iron Alloy-coated (Galvannealed) by the Hot-dip Process*, for the coating requirement. Per *ASTM C645*, steel framing members must be

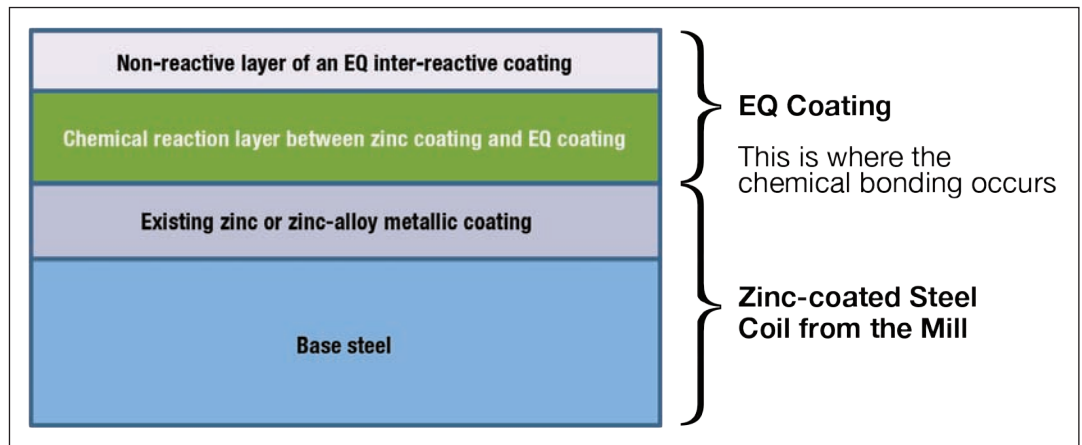
manufactured from steel meeting the mechanical and chemical requirements of *ASTM A1003*, *Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-coated for Cold-formed Framing Members*, and members shall have a protective coating conforming to *ASTM A653/A653M G40* minimum, or shall have a protective coating with an "equivalent corrosion resistance." This equivalence provision has been the standard in *ASTM C645* since 1992.

The minimum protective coating requirement of *ASTM C645* is G40. In order to explain the meaning of this coating designation, the letter 'G' indicates the coating is galvanized or zinc-based and the '40' refers to the total weight of zinc on the surfaces of the steel sheet in grams per square meter or ounces per square foot. Using G40 as an example, the coating weight on 1m<sup>2</sup> (10.7 sf) of the steel sheet shall have a triple-spot test (TST) average minimum of 120 g/m<sup>2</sup> (0.40 oz/sf). If the coating is equally applied to both sides of the sheet, there would be a minimum of 60 g/m<sup>2</sup> (20 oz/sf). The TST measures the coating weight of three sample test coupons obtained from the centerline of the galvanized steel sheet and from the edge of each sheet. The three individual results are then averaged to generate the TST minimum.

For nonstructural steel studs, however, *ASTM* requires only a single-spot test (SST) as these studs are produced from steel sheets less than 457 mm (18 in.) wide. Thus, the SST is the proper test criteria for steel sheets with a width of 457 mm or less. The SST designations specify the minimum allowable



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This illustration is a representative cross-section of an EQ-coated steel sheet.



EQ coatings—sometimes referred to as organic, inter-reactive, reactive polymer, or conversion coatings—are added to zinc-coated steel coils to enhance the corrosion resistance of the existing base coating.

coating mass for any galvanized steel sheet. When the SST is used, the minimum for G40 is a total coating weight of 90 g/m<sup>2</sup> (0.30 oz/sf).

### EQ meets performance requirements

Cold-formed nonstructural members utilizing EQ coatings have been proven by salt-spray tests to perform better than the minimum G40 permitted for use by ASTM C645. For instance, the typical G40 metallic coated substrate that meets ASTM A653 standard for galvanized sheet steel, are assumed to have a 120 g/m<sup>2</sup> (0.40 oz/sf) total coating weight for both sides of the sheet. In closer review of the tolerances allowed by ASTM, the actual coating weight can be as low as 36 g/m<sup>2</sup> (0.12 oz/sf) on a

single side. The galvanizing process can also create a surface with valleys, fractures, pits, and porosity in the zinc metallic surface.

In this example, the surface of hot-dipped steel looks smooth to the naked eye. When magnified, the imperfections in the form of cracks and voids become obvious. EQ coatings fill in these cracks and voids, providing combined coating that is superior to the minimum G40 performance requirement.

Results from numerous salt spray tests, from multiple laboratories, reveal EQ coatings exceed the performance level of a standard G40-coated steel. During the tests, G40 steel samples with an additional chemical treatment protective coating began failing at 120 hours of exposure to salt spray and rapidly reached the 10 percent surface rust failure threshold at 192 hours on average.

By comparison, EQ-coated samples did not climb above five percent surface rust, even after 240 hours of exposure. Further, each test was run beyond the 10 percent surface rust failure point of G40 steel. In thousands of tests, the EQ-coated samples did not reach failure, even after hundreds of hours of salt spray exposure. Testing was conducted in accordance with the ASTM B117, *Standard Practice for Operating Salt Spray (Fog) Apparatus*, standard and was performed at the laboratories accredited by the International Accreditation Services (IAS) a subsidiary of the International Code Council (ICC).

### EQ in the future

EQ coatings are moving the cold-formed steel stud market

Steel studs are strong, non-combustible and they must be able to endure the environment through their transport to the jobsite, the construction process, and any number of variables that occur on a building over its lifetime.



EQ studs are produced by a number of manufacturers and vary in performance. Some products employ new corrosion-inhibiting and adhesion-enhancing formulas to greatly improve the corrosion resistance of steel framing members.

forward in respect to corrosion performance. Another advancement in requirements for nonstructural steel framing lays ahead in the form of the new industry standard, American Iron and Steel Institute (AISI) S220, *North American Standard for Cold-Formed Steel Framing—Nonstructural Members*. This standard has been adopted by the 2015 *International Building Code (IBC)*, which also references ASTM C645. However, AISI

S220 will likely replace ASTM C645 as the universal industry standard for the specification of nonstructural steel framing in the future. Thus far, no major changes have been made regarding coating requirements. Similar to ASTM C645, AISI S220 states nonstructural members employed in cold-formed, steel-framed construction must have a protective coating conforming to ASTM C645 G40 minimum or a protective coating with an equivalent corrosion resistance.

### Conclusion

Steel studs are strong, non-combustible and they must be able to endure the environment through their transport to the jobsite, the construction process, and any number of variables that occur on a building over its lifetime. Specifying proven products, such as steel studs with EQ coatings for nonstructural framing, can help create a more affordable, sustainable, and durable structure.

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## ADDITIONAL INFORMATION

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### Abstract

Several industries, including cold-formed steel manufacturers, have developed high-performance 'EQ' coatings that meet or exceed ASTM requirements for corrosion-resistance equivalent to traditional G40 protective coatings for nonstructural steel. These performance coatings, applied

corrosion-inhibiting and adhesion-enhancing formulas, which greatly improve the corrosion resistance of steel framing members.

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