High-Performance Equivalent Coatings Offer Superior Corrosion Resistance for Steel Framing

By ClarkDietrich™ Building Systems

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SEVERAL INDUSTRIES, INCLUDING COLD-FORMED STEEL MANUFACTURERS, have developed high-performance "EQ" coatings that meet or exceed ASTM C645 requirements for corrosion resistance equivalent to traditional G40 protective coatings for nonstructural steel. These performance coatings, applied to zinc-coated steel coils pre- and post-reduction, utilize new corrosion-inhibiting and adhesion-enhancing formulas, which greatly improve the corrosion resistance of steel framing members.

The purpose of this paper is to define EQ coatings and how they differ from galvanized-only protective coatings specified for steel framing members by industry standards and codes. By doing this, we hope to position EQ coatings as a solid alternative to traditional protective coatings, offering superior corrosion resistance.

EQ COATINGS CONFORM TO ASTM A653

The durability of cold-formed steel framing depends greatly on its ability to resist corrosion. 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 manufactured with protective coatings, which prevent moisture from reaching the steel substrate. Acceptable coatings for steel framing members are defined by a chain of industry codes and standards.

International Building Code (IBC) 2012 lists ASTM C645, *Standard Specification for Nonstructural Steel Framing Members*, as its governing industry standard for the performance of nonload-bearing steel studs. ASTM C645, in turn, draws from ASTM A653, *Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process*, for coating requirements. Per ASTM C645, steel framing members must be manufactured from steel meeting the mechanical and chemical requirements of ASTM A1003 and have a protective coating conforming to ASTM A653 G40 or a protective coating with an "equivalent corrosion resistance."

The minimum protective coating requirement of ASTM C645 is G40. To explain the meaning of this coating designation, the alpha character "G" indicates that the coating is galvanized (zinc-based), and the numeric character refers to the weight of zinc on the surface of the steel sheet in ounces per square foot units. Using G40 as an example, the coating weight on one square foot of the steel sheet shall have a triple-spot test (TST) average minimum of 0.40 ounces per square foot. If the coating is equally applied to both sides of the sheet, there would be a minimum of 0.20 ounces on each square foot of surface. The TST measures the coating weight of three sample test coupons obtained from the centerline of the galvanized steel sheet and from no less than 2 inches from each sheet edge. The three individual results are then averaged to generate the TST minimum.

ASTM requires a single-spot test (SST) for steel sheets with a width of 18 inches or less. These designations specify the minimum allowable coating mass for any galvanized steel sheet. When the SST is used, the SST minimum for G40 is a coating weight of 0.30 ounces per square foot. Since nonstructural steel studs are produced from steel sheets less than 18 inches wide, the SST is the proper test method.

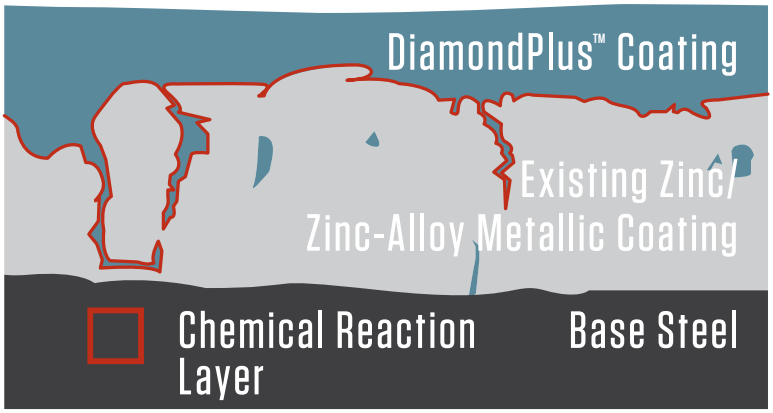
Now, we will address the "equivalent corrosion resistance" reference found in ASTM C645. The most recent industry development in regards to coatings is the development of equivalent (EQ) coatings that further advance the performance characteristics of nonstructural steel framing. These coatings represent a scientific breakthrough in coating protection, with the ability to perform better than traditional G40 coatings.

WHAT ARE EQ COATINGS?

EQ coatings are supplementary coatings added to zinc-coated steel coils to enhance the corrosion resistance of the coils' existing base coating—usually a standard zinc-based metallic coating. The EQ coating attaches to the base zinc coating and penetrates down into any of its cracks and voids. This reaction forms a permanent bond, which seals off the zinc layer, as well as the carbon steel base metal below it, protecting them from any exterior corrosion sources. An EQ coating is not a paint, primer or barrier coating system applied to the top of the metallic-coated substrate—all of which will allow corrosion when scratched. It is a permanently bonded coating that provides unparalleled corrosion protection.

Cold-formed steel framing members with EQ coatings were introduced to the industry in the 1990s and now account for a significant portion of the nonstructural cold-formed steel stud market.

SALT SPRAY TEST: VERIFYING EQ



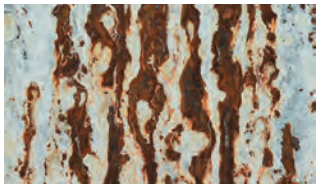
This photo illustrates EQ coatings at 6,000 times magnification.

CORROSION RESISTANCE

Industry organizations, such as the Steel Framing Industry Association (SFIA), offer third-party compliance programs, which include random destructive testing of member products. The samples are subjected to a battery of tests, including assurance that the coating meets the "or equivalent" statement in ASTM C645.

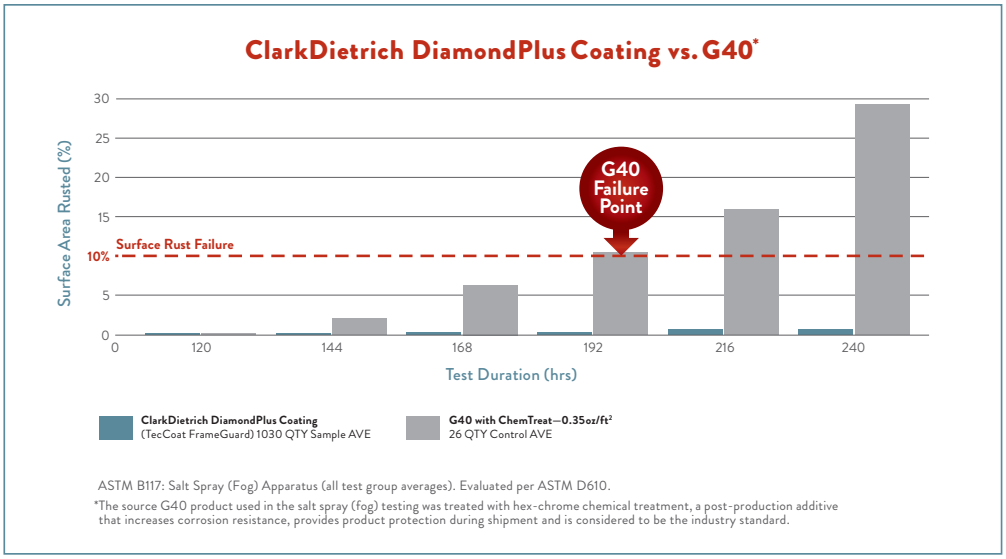
Some cold-formed steel manufacturers, such as ClarkDietrich™ Building Systems, have taken initiative to further verify their EQ coatings through the ASTM B117 Salt Spray Test. The apparatus for this common test consists of a closed testing chamber, where an atomized salted solution—typically 5 percent sodium chloride—is introduced through a nozzle at an elevated temperature of 95° F. This produces an environment of dense saline fog in the chamber, exposing the test samples to severely corrosive conditions. The EQ-coated sample is tested alongside G40-coated samples to confirm equivalent corrosion resistance.

Surface rust 240 hours
DIAMONDPLUS™: 1.00%



Surface rust 240 hours
G40: 29.00%

Results from numerous salt spray tests reveal that ClarkDietrich DiamondPlus™ Coating significantly exceeds the performance level of standard G40 steel. This is consistent with EQ coatings tested in other industries. During the tests, G40 steel samples that included a chemical treatment with a protective coating began failing at 120 hours and rapidly reached the 10 percent failure threshold at 192 hours on average. By comparison, EQ-coated samples did not climb above 5 percent surface rust, even after 240 hours. Further, each test was run to—and beyond—the 10 percent surface rust failure point of G40 steel. In averaged data, ClarkDietrich EQ-coated samples did not reach failure, even after hundreds of hours. Testing was conducted in accordance with ASTM B117 standards at an accredited laboratory.



FUTURE CHANGES TO INDUSTRY STANDARDS

Clarified requirements for nonstructural steel framing lay 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 next version of the International Building Code—IBC 2015. Though AISI S220 will likely replace ASTM C645 as the universal industry standard for the specification of nonstructural steel framing, IBC 2015 will still reference the two standards in tandem. Thus far, no major changes have been made regarding coating requirements. Similar to ASTM C645, AISI S220 states that nonstructural members utilized in cold-formed, steel-framed construction "shall have a protective coating conforming to ASTM C645 G40 minimum or shall have a protective coating with an equivalent corrosion resistance."

In addition, the SFIA is currently conducting research to determine the true hourly life of hot-dipped zinc coatings. This is being done in conjunction with AISI, the Association of the Wall and Ceiling Industry (AWCI) and the Zinc Institute, and conducted by a third-party laboratory. Once completed, the information will be submitted to ASTM and AISI, with the ultimate goal of developing a universal program that will contain performance standards for EQ coatings on nonstructural steel.

CONCLUSION

Today's EQ coatings meet or exceed the industry standard requirements for corrosion resistance equivalent to G40 coatings. This positions them as a superior alternative to traditional nonstructural steel coatings, and makes EQ studs a formidable, high-performance option for construction projects. Armed with the information included in this paper, construction professionals can specify nonstructural steel framing products that will provide a stronger defense against corrosion.

ABOUT CLARKDIETRICH™ BUILDING SYSTEMS

ClarkDietrich™ Building Systems is the leading manufacturer of a full-line of drywall studs and accessories, structural studs and joists, metal lath and accessories, shaft wall studs and track, interior finishing products, and connectors and accessories for commercial and residential construction. Quality manufacturing, a full-line offering, national distribution, engineering services and responsive customer service position ClarkDietrich Building Systems as the largest and fastest growing manufacturer of cold-formed steel framing in North America. ClarkwesternDietrich Building Systems LLC is a 75/25 joint venture with Marubeni-Itochu Steel America Inc. (MISA) and Worthington Industries, Inc. For more information, visit www.clarkdietrich.com.

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