Steel Framing Alliance™
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CORROSION PROTECTION FOR LIFE

Residential homes are one of the few necessities that consumers expect to last a lifetime or more. It is critical therefore, that a home's framing material perform its function for as long as other critical components such as the roof structure, exterior and interior wall coverings, and flooring. To last a lifetime, cold-formed steel framing needs proper corrosion protection.

Galvanizing has proven to be the most economical and effective way to protect steel. All steel framing materials used in residential construction can be effectively protected by a galvanized coating.

Galvanizing

Galvanizing is a process whereby steel is immersed into a bath of molten zinc (850°F/450°C) to form a metallurgically bonded zinc coating. This same hot dip immersion process is also used to produce zinc-aluminum alloy coatings. Most cold-formed steel is galvanized by unwinding coils of cold rolled steel and feeding the sheet continuously through a molten zinc bath at speeds up to 600 feet per minute (200 metres/minute). As the steel exits the molten zinc bath, air "knives" blow off the excess coating from the steel sheet and control the coating thickness to the specification requirement. The coated sheet steel is passivated, oiled and recoiled for shipment to the fabricator.

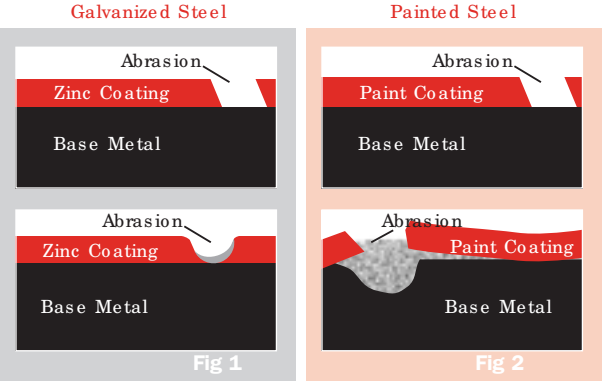
Corrosion Process

Freshly exposed galvanized steel reacts with the surrounding atmosphere to form a series of zinc corrosion products. In air, newly exposed zinc reacts with oxygen to form a very thin zinc oxide layer. When moisture is present, zinc reacts with water resulting in the formation of zinc hydroxide. A final common corrosion product to form in atmosphere is zinc carbonate as zinc hydroxide reacts with carbon dioxide in the air. Zinc carbonate is usually a thin, tenacious and stable (insoluble in water) layer that provides protection to the underlying zinc. These corrosion products are what give zinc its low corrosion rate in most environments.

How Zinc Protects Steel

Galvanized coatings protect steel by providing an impervious barrier that does not allow moisture to contact the steel - without moisture (the electrolyte) there is no corrosion. The nature of the galvanizing process ensures that the metallic zinc coating has excellent coating adhesion and abrasion resistance.

Figure 1 and Figure 2 scratch in the coating exposes underlying steel



Surrounding zinc coating cathodically protects the exposed steel.

Exposed steel corrodes further damaging the surrounding paint film

Cathodic Protection

When base steel is exposed, such as at a cut or scratch, the steel is cathodically protected by the sacrificial corrosion of the zinc coating adjacent to the steel. This occurs because zinc is more electronegative (more reactive) than steel in the galvanic series. In practice, this means that a zinc coating will not be undercut by rusting steel (Figure 1) because the steel cannot corrode adjacent to the zinc coating.

Durability of Steel Framing

Just as water leakage, excesssive humidity or condensation will damage any construction material over time, so will it accelerate the corrosion of zinc coated materials. In residential and most categories of low-rise commercial properties, the corrosion rate of zinc coated materials is generally very low. Interior, non load-bearing walls will likely experience the most benign atmosphere, while vapor barriers and thermal breaks in exterior walls should eliminate exposure to any significant moisture. For joists and track that are attached directly to concrete or exterior walls, precautions should be taken so that the environment remains dry. Special care should be given the use of any steel studs or joists that are exposed to extended periods of high humidity or aggressive industrial or marine environments.

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No			Finish	to Water	
1	Miami,Fla.	Humid, inland	Slab-on-grade	Several miles from Atlantic Ocean	Stucco
2	Leonardtown, Md.	Semi-marine with humid	Crawlspace	Less than 75 feet from Potomac River	Vinyl
3	Long Beach Island, N.J.	Marine	Piers with enclosed area under house	Less than 1/4 mile from Atlantic Ocean	Aluminum Siding
4	Hamilton, Ontario Canada	Industrial with cold winters	Basement	Inland	Brick Veneer

Fabricating Galvanized Steel Members

Galvanized steel is shipped to fabricators as coils. The coils are slit lengthwise into individual "ribbons" of galvanized steel strip. These ribbons are roll-formed, cut to length and punch-outs made to produce the various steel sections used for framing. Galvanized zinc coatings are metallurgically bonded to the steel sheet and will not spall or flake off during these forming operations.

Report Confirms Durability

Life expectancy of more than a millennium and minimal loss of coating after years of exposure were two indicators cited in a report sponsored by the International Lead & Zinc Research Organization and completed by the NAHB Research Center. Its chief objective was investigating the corrosion performance of metallic-coated steel framing components in steel-framed homes.

Four sites were chosen so that field results would be applicable to a large selection of homes and climates (See Table Above)

The study concluded that steel with industry-standard galvanizing had a life expectancy as high as 1260 years, and that the fastest coating corrosion rate observed equated to a life expectancy in excess of 200 years.

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Erection and Handling

A galvanized metallic coating is very adherent and abrasion resistant. As a result, normal handling during distribution, storage and erection will not damage the zinc coating. Job site procedures such as shearing, cutting or fastening will expose bare steel, but generally this is of no consequence because of zinc's ability to cathodically protect any cut edges.

Welding

Galvanized steel can be joined by spot or continuous welding. Welds may volatilize the zinc coating, however, and affected areas must be treated with a zinc-enriched paint or other approved treatment to maintain the corrosion protection of the welded area.

Fasteners

Fasteners are required to have a coating that inhibits rust, or be manufactured from a material that is no sisceptible to corrosion. Steel framing fasteners are usually protected against corrosion by electroplated zinc coating. Zinc plated coatings are typically thinner and therefore not quite as protective as the galvanized coatings on the surrounding steel framing members.

Conclusion

Zinc and zinc alloy hot dip galvanized coatings are an economical, and recommended,method of providing long term corrosion protection of steel framing members. The galvanizing process produces a tough metallic coating that can withstand the physical demands created during distribution, site storage and erection of the steel-framing members. In most indoor environments where steel framing is used, the corrosion rate of zinc and zinc alloy coatings are very low. By using the recommended coating weights, steel framing will remain protected for the life of the home.

Additional Information

1) Galvanized Steel Framing for Residential Buildings, International Lead Zinc Research Organization, 2003, Research Triangle Park, NC

2) AISI, Standard for Cold-Formed Steel Framing – General Provisions, 2001, American Iron and Steel Institute, 2001,Washington, DC.

3) AISI, Durability of Cold-Formed Steel Framing Members, September 2004, American Iron & Steel Institute.

4) LGSEA Technical Note 140, Corrosion Protection for Cold-Formed Steel Framing in Coastal Areas, 2003, Light GaugeSteel Engineers Association, Washington, DC.

5) LGSEA Technical Note 560-b5, Fastener Corrosion, 1999, Light Gauge Steel Engineers Association, Washington, DC.

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