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Galvanized for Action: Proper User of Galvanized Sheet Metal (GSM)

Introduction

Quality Built, LLC is sharing information on a topic of vital importance to the building community regarding the proper use of galvanized sheet metal flashings (GSM), used to protect buildings in areas that are vulnerable to water penetration. This article serves as a reminder of the pitfalls associated with galvanized sheet metal flashings and factors concerning improper installation that may cause certain building components and construction applications to fail. Third party plan review is strongly recommended for due diligence, construction defect prevention and precautionary pre-construction quality assurance to ensure that flashing materials are compatible with building envelope components, roofing systems and building sealants.

An important distinction in the application of GSM in construction is that galvanized sheet metal should be considered a diverter metal, not a waterproofing metal; and, as such, should not be exposed to constant water on its surface raises the following questions:

- If GSM is not supposed to rust; why should it not be used in conditions where it is constantly exposed to water on its surface?
- What are the circumstances that limit the location and proper installation of GSM?
- What are the consequences of using GSM with
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**What is Galvanization?**

Galvanization is an electrochemical process named after Italian scientist, Luigi Galvani, and, refers to the coating of steel with zinc to prevent galvanic corrosion, otherwise known as rust. The method of alloying the two metals together is accomplished by submerging steel in melted zinc causing a chemical reaction that permanently bonds the zinc as the most external layer, through a process called hot-dipped galvanization. In other words, zinc, the more active metal on the Galvanic Scale transfers ions to steel, the more passive metal, to form galvanized steel. These multiple layers are responsible for the amazing property of galvanized metal to withstand corrosion-inducing circumstances and environments.

The surface of a painted metal with no prior galvanizing will rust if scratched. In GSM, zinc, acting as a sacrificial layer, corrodes first, forming a protective barrier by way of cathodic protection to inhibit galvanic corrosion. Hot-dipped zinc coatings generally are not used for smaller sized bolt and nut sizes because the thickness of the coatings displaces too much threading thereby reducing the strength of fasteners.

**Electroplating**

Electro-galvanization is a galvanization process involving electroplating, in which a layer of zinc is bonded to steel by running a current of electricity through a saline/zinc solution with a zinc anode and steel conductor in order to protect against corrosion. Electroplating produces a thin coating of zinc that is much more quickly consumed by the elements and, therefore, makes electroplating unsuitable for outdoor applications, except in very dry climates. Adding a protective coating of paint to electroplated steel increases its durability and is utilized in appliances, automobiles and exterior signs. Both hot-dipped and electro-galvanizing processes that protect steel are favored over other flashing metals like copper, stainless steel, lead, aluminum and tin, because of their low cost, ease of application, and the extended maintenance-free service that they provide. Pure electroplated steel is processed more economically than hot dip galvanization and produces a shiny surface, whereas hot dip zinc coating produces a matte, grey surface. Nails that are to be used indoors are electroplated (shiny) compared to nails for outdoor use, which are hot-dipped galvanized (matte grey color). Note: Galvanized nails will corrode copper flashing.

**ASTM Specifications**

On houses, small apartment buildings and townhouses, GSM flashing and counter flashings should be no thinner than 28 gauge, however, GSM gutters and downspouts should be 26 gauge metal. The lower the gauge the thicker the GSM flashing and the harder it is to bend, form and cut in the field. On larger jobs, site-specific work specifications typically call for GSM to conform to ASTM specifications A653 and A924:

- **ASTM A924** outlines requirements for carbon steel metal coated by the hot dipped process and tolerances for thickness, width, camber, and
shape.

- **ASTM A653** outlines the general requirements for hot dipped coated steel including steel chemistry requirements and the mechanical properties of various metallurgical grades. The degree of galvanizing, known as coating thickness, is measured as the coating weight in ounces per square foot. G-150 is 1.50 ounces of zinc per square foot on both sides of a 28-gauge sheet of steel. A coating designation of G-90 specifies a minimum coating weight of .90 ounces per square foot on both sides of a steel sheet. Simpson Strong-Tie calls their strongest galvanized connector "ZMAX-G185", which has 1.85 ounces of zinc per square foot of surface area.

**Flashings**

Flashings refer to a thin continuous piece of sheet metal or other impervious material installed to prevent the passage of water into a structure. Flashing may have gotten its name from sunlight "flashing" off the metal used on a structure. GSM must be configured to resist three specific ways water penetrates into the building envelope; gravity, wind pressure and wicking action by joints between moisture absorbing materials. Flashing material, generally, should be durable, low maintenance and compatible with adjacent materials, and, capable of resisting exposure to briny sea air, excessively high ambient temperatures, acid rain, heavy snows and scouring winds. It is of utmost importance to examine substrates to verify proper installation before commencing the installation of flashings. **Quality Built strongly recommends that flashing installation not proceed until all unsatisfactory conditions have been corrected and the considerations enumerated in this article regarding the proper use of GSM addressed.**

GSM flashings expand and contract with heat from the sun and air temperature changes; and will also move and stretch with resonant building shifts. Therefore, units of work involving GSM should be anchored securely with compatible fasteners to penetrate from 7/8" to 1" and provide for thermal expansion joints on long runs to prevent deformation of metal sheets. Flashings are generally installed in either an exposed or concealed application in the following locations;

- **Roof flashing** - placed around objects which penetrate through the **roof**, such as pipes, chimneys, intersections with other roofs or vertical walls to divert **water** away from **seams**, joints or penetrations.
- **Wall flashing** - embedded in exterior walls in a manner intended to divert water away from windows, doors, and points of structural support.
- **Sill flashing** - a concealed flashing placed under door thresholds and window sills to divert water away from entering the building envelope at those points.
- **Base flashing** - installed at foundations, the base of exterior walls to protect wood floor joints and
through-wall flashings with weep holes to permit the escape of water from behind exterior walls.

Corrosion and GSM
Flashings should be installed in conjunction with other trades so that flashings are inserted and joined together to provide a compatible watertight installation. Although galvanizing inhibits attack of the underlying steel, rusting is inevitable. There are several locations that may increase the rate of corrosion in GSM. When placed at balcony decks containing lightweight, hard-rock concrete, or concrete pavers during the initial installation or during the course of deck maintenance, galvanized sheet metal can be subjected to a variety of damaging chemicals and moisture that cause corrosion. Galvanized sheet metal at concrete balcony decks should be fully protected by an approved waterproof membrane, extending above the finish surface. Other locations and conditions which may subject GSM to accelerated corrosion are; unprotected contact with stucco, buried in concrete, at grade adjacent to soils, part of waterproofing in foundations and touching mortar beds in exterior conditions where the galvanized sheet metal is left unprotected. The wrong type of fasteners could cause corrosion to take place sooner than expected as well. Exposed GSM should have galvanized or stainless steel fasteners with soft EPDM (a PVC type material) or cadmium washers. Galvanized sheet metal will peel over time if for no reason other than exposure to the natural acidity of rain, but its efficacy can be extended if prepared and painted properly. New GSM surfaces that are to be painted should be cleaned with a water based cleaner or degreaser to remove oil or contaminants, dried off and the surface wiped down with white vinegar. Acid in the white vinegar etches the metal and helps paint adhere. On older galvanized metal surfaces where the zinc coating has begun to break down as indicated by white rust, wire brush or fine sandpaper should be used to remove the chalky film before cleaning and painting as described above.

GSM Disadvantages
GSM is the least durable of metal flashing materials especially in more severe environments where corrosion may occur within 10 to 15 years. Deterioration of GSM flashings accelerates when in contact with concrete which has a pronounced tendency to hold moisture. Also, contact with green lumber, preservative treated lumber, copper, or lead should also be avoided. Galvanized steel flashing; is a stiff, relatively non-malleable material that has to be used with a sheet metal brake for custom applications; field soldering should follow specific instructions per ASTM B-32, as the required acid wash and heating process may damage the galvanized coating, exposing raw steel; and is not cost-effective when used with long lasting roofing materials such as slate and tile unless a thicker gage and coating is considered.

Galvalume Sheet Metal Flashing
Galvalume is similar to regular galvanized steel but instead of a hot-dipped coating of pure zinc, Galvalume
is galvanized with a coating of 55% aluminum and 45% zinc by volume. Developed by Bethlehem Steel approximately 30 years ago, the composition combines the excellent barrier protection of aluminum with the galvanic protection of zinc to attain a bright appearance and high performance corrosion resistance. Galvalume coatings lasts much longer then regular galvanized coating of comparable thickness. Another product in the Galvalume family is Acrylume, a Galvalume base steel with an acrylic or baked enamel coating on top.

**Other Flashings**

When it comes to flashing most of the cost is for labor, so it does not pay to skimp on quality materials in the long run. Other flashings type materials that may be considered are:

- Aluminum flashing, 0.032 inch as opposed to the thinner 0.019 inch, is suitable for step flashings which are covered by roofing and sidings, but, inappropriate around masonry because the lime and acids in the masonry eats the aluminum.
- Copper is useful for complicated or decorative jobs where malleability and longevity is desired. A green patina becomes visible on copper due to weathering and acid rain; eventually causing red streaks on the roof and green stains on siding.
- For most jobs, the best flashing in a hostile weather environment is lead-coated copper, which combines copper’s durability with lead’s resistance to staining. In South Florida, for instance, many municipalities require the use of copper flashing, trim, downspouts and gutters on all new buildings east of I-95 due to the proximity of the Atlantic Ocean and the elevated corrosion factor of the briny ocean sea breeze.
- Stainless steel flashings are perform very well but are expensive, hard to work with and rarely used.

**Conclusion**

In summary, the three questions at the beginning of the article have been answered. GSM will eventually rust as noted above; however, it is important to consider the thickness or gauge of the sheet metal, the coating thickness (galvanization) of the zinc and the environment in which it is placed when selecting the type of GSM flashing materials to be used. Additional protection for GSM is painting or the use of baked enamel or acrylic coatings. Remember, once the zinc coating corrodes, the underlying steel is left bare to the elements resulting in rust stains running down exterior walls. Dissimilar metals should not be in contact with each other to prevent galvanic corrosion; however, if contact is unavoidable, dissimilar metals should be separated with building paper, bituminous membrane or special bituminous paint.

The bottom line is flashing should last at least as long as the roof and the exterior wall coverings, preferably longer. The proper use and successful installation of galvanized metal flashings can be economically achieved with a good preventative maintenance program that concentrates on diligent observation of GSM flashings.
that have deteriorated to the point where they have lost their galvanizing action or have reached the end of their remaining useful life, and, immediately replace, paint or repair this most amazing and popular metal.

**About Quality Built**

Quality Built, headquartered in Fort Lauderdale, Florida, is a leading national construction quality assurance and inspection management company. Quality Built provides third-party quality assurance services and a full spectrum of quality and risk management solutions such as property condition assessments, tainted drywall assessments, building evaluations, data collection tools, collateral inspection services, reporting and support services on high-quality residential and commercial construction projects nationwide.

Quality Built is well known for its work in Total Quality Management and was one of first firms to transition from using a traditional quality assurance approach into implementing a proven, user-friendly and fully automated, online inspection system. Quality Built’s proprietary software is cost efficient, paperless, fully customizable and completely scalable to handle the demands of most inspection and quality assurance protocols.

**Quality Built's Quality Management System is ISO 9001:2008 registered**


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**Sincerely,**

Elizabeth Michaelis - President
Quality Built LLC