

Galvanized Steel

TECHNICAL BULLETIN #7

Successfully Manufacturing Products Made With Galvanized Steel Sheet

7.0 Introduction.

During the manufacture of products made with Galvanized steel sheet, there are infrequent, but potentially serious surface appearance imperfections and other irregularities that can arise and sometimes result in the product being unsuitable for use. Here we will highlight some of those surface imperfections.

7.1 Fingerprinting

Metallic-coated sheet products are susceptible to surface marking during processing and handling. Galvanized sheet can be permanently affected by white staining due to the perspiration of workers who come in contact with it during the manufacture of products like heating and ventilating ductwork. While not harming product durability, the white stains affect its esthetics when intended for an exposed end use. These stains are the result of salt and other compounds in the worker's perspiration reacting with the zinc to permanently mark the surface. Once stained in this manner it is very difficult to remove, and there is no known method of restoring the original metallic luster. Typical mill passivation treatments do not necessarily offer resistance to this staining.

To provide a product that is resistant to marking, the industry has developed special coatings (typically acrylic-based) for metallic-coated sheet

The resin coating is clear and consists of a water-soluble acrylic resin with inorganic corrosion inhibitors added. Benefits include resistance to hand and/or foot marking during handling/installation, good resistance to storage stain/transit corrosion, and retention of zinc brightness over a longer time. To avoid fingerprinting and handling marks, the purchaser can request the Galvanized sheet be acrylic treated at the time of production. For material that is not acrylic treated, and where the final product must be free of these marks, the best option is to have the workers wear long sleeves and clean, soft cotton gloves when handling the sheets during manufacturing and installation.

Premature darkening of the zinc coating can sometimes occur on Galvanized sheet after a few days of exposure on new buildings. It has even been reported to occur on industrial products after being placed outdoors. The significance of outdoor storage is that it can allow dew to condense on the surface of the metal. As soon as the dew dries, corrosion ceases, usually leaving the observer wondering what happened in such a short time. Passivated galvanize will resist such attack and allow the normal, colorless, slow-forming patina to develop. Such a patina can also form on unpassivated zinc if it is protected from aggressive corrosion when freshly exposed.

Darkening is the result of forming protective basic oxy-carbonate layers and is influenced by the presence of other atmospheric species, including sulfates and chlorides, which influence appearance (darkness). Rainwater is known to have a higher degree of mineralization, which could complex with sulfate ions, thus rendering it less aggressive than dew condensate. Whatever the cause, darkening is a fast acting corrosion process that is very superficial, but creates an unattractive corrosion product.

To prevent this problem from happening, unpassivated galvanize should not be applied to applications where the product will be placed outside. The surface of passivated Galvanized sheet is 'deactivated' enough that atmospheric reactions are slowed to the point where its normal patina takes at least a few months to develop. Unpassivated zinc has a very active surface and experience has shown that corrosion



products can form quickly and have different appearances. Allowing dew or other condensate to form on unpassivated sheet should be avoided.

7.2 Fluting and Stretcher Strains

Fluting and stretcher strains are marks that appear on the surface of the carbon steel sheet after forming operations. They are caused by discontinuous yielding of the steel substrate and show through the zinc coating. For many end uses it is important to suppress this behavior, because if not done, the sheet will exhibit stretcher strains when stretch-formed, or fluting when bent.

To prevent this, a small amount of cold work imparted to the sheet by temper rolling (or leveling) suppresses the discontinuous yielding phenomenon. With this behavior having been masked, the steel can be formed with no concern about stretcher strains or fluting. Temper rolling or leveling are processes that are performed on all Galvanized sheet during the coating process (unless intentionally omitted). This ensures that the product can be formed without these problems happening. Steel sheet that is used within a reasonable time after being received from a steel supplier should not flute or show stretcher strains when bent or stretch-formed. If it does, then it is non-conforming product. To minimize the chance of aging causing a problem, manufacturers should control inventories to use the oldest steel stock first, hopefully before aging can create forming issues.

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