ArcelorMittal

Galvanize, Galvanneal, & Electrogalvanize Steel Fact Sheet

For Multiple Applications and Long Lasting Corrosion Protection

ArcelorMittal offers a variety of Galvanized Steel Sheet Products which are zinc coated steel products with long lasting corrosion performance and paintability for a diverse range of construction applications and environments. The galvanic and barrier properties of the zinc coating protects the base steel and any cut edges from corrosion and provides a good surface for paint for additional barrier protection and aesthetics.

The galvanized products offered by ArcelorMittal include **Hot Dip Galvanize** (most commonly used) which can be produced with a wide range of light to heavy zinc coatings, **Hot Dip Galvanneal** which consists of light hot dipped zinc coatings which are heat treated/annealed after coating to produce a zinc-iron alloy for improved weldability and paintability, and **Electrogalvanize** which consists of a precise light electroplated coating of zinc typically for painted applications.

Product Description

Hot Dip Galvanize (HDG or GI) is produced at numerous ArcelorMittal galvanizing facilities in Canada and the USA on continuous lines by passing pre-heated continuous strip through a bath of molten zinc. The required zinc coating thickness for different coating specifications is achieved as the result of passing the hot dipped strip through a variable low pressure, high volume air stream called an "air knife" prior to solidification of the zinc coating. In addition, based on the application, the zinc coating can be produced with minimized (no) spangle, be a light to heavy zinc coating for additional corrosion protection, and can be inline or post temper rolled if a smoother surface is required.

Galvanneal (GA) is produced at ArcelorMittal galvanizing facilities in Canada and the USA on continuous lines by passing pre-heated continuous strip through a bath of molten zinc. In this case after zinc coating, the strip is passed through an annealing furnace which transforms the zinc into a zinc-iron alloy coating on the steel surface. As with HDG, the required zinc coating thickness for different coating specifications is achieved by passing the hot dipped strip through an "air knife" just before the galvannealing furnace. The zinc-iron alloy coating has no spangle, has a uniform grey matte appearance, and the coating weights are typically less than most HDG products. This material can also be temper rolled after coating for an extra smooth surface for surface critical applications.

Electrogalvanize (EG) is produced on an ArcelorMittal Electrogalvanizing Line in the USA. On this continuous line, previously annealed continuous strip is passed through a series of plating cells where zinc is electrolytically plated onto the strip. By regulating the amount of electricity used, a precise uniform coating of zinc is applied to the strip and an "air knife" is not needed for zinc coating control. No pre- or post-heating of the strip is needed on an EG Line, and the zinc coatings produced are light weight zinc coatings with no spangle, have a uniform appearance, and are used primarily for surface critical painted applications.

Product Characteristics

Proven Corrosion Resistance

For similar unpainted galvanize applications, the corrosion performance is directly related to the zinc coating weight, with heavier zinc coating weights giving better performance by providing increased protection and more sacrificial zinc to prevent corrosion of the base steel and any cut edges. In addition, painting of galvanize products provides additional barrier protection, extended product life, and aesthetics.

Cut Edge Protection

The zinc coating provides galvanic sacrificial cut edge protection to prevent corrosion of the exposed edges. For these applications, as steel thickness is increased, heavier galvanize coating should be used to insure sufficient galvanic edge protection for the increased cut edge surface area.

Enhanced Surface Treatment

ArcelorMittal offers a variety of surface treatments suited to specific manufacturing and application needs. Unpainted Galvanize can be passivated with a chemical treatment and can be produced non-oiled or oiled. Surface treatments that are RoHS compliant are also available. If paint is specified, galvanize steel can be ordered as prepainted coil. This option offers an additional layer of paint barrier protection in a wide assortment of attractive colors and paint systems.

Applications

Hot Dip Galvanize, Galvanneal, and Electrogalvanize have many proven applications in Commercial, Industrial, Institutional, Agricultural, and Residential Construction.

Example applications for each product are shown below (but not limited to):

- **Hot Dip Galvanize (bare/pre-painted)** for roofing, cladding (siding), ceiling grid systems, light steel framing, garage doors, major appliances, HVAC, electrical boxes, pools, building components, culverts, grain bins, truss plates, water heaters, and many other applications
- **Galvanneal (bare/prepainted)** for floor decking, commercial doors, and corner beads
- **Electrogalvanize (prepainted)** for doors, ceiling grid systems, and miscellaneous construction components

Prepainted Galvanize

Galvanized sheet steel can also be ordered as a prepainted coil. Prepainted Galvanize provides additional paint barrier protection while offering a wide assortment of attractive colors and paint systems to fit many unique needs and applications, and can offer improved properties in:

- Corrosion resistance
- Solvent, chemical and stain resistance
- Adhesion (for bonding or foaming)
- Mechanical properties: hardness, toughness and flexibility
- Color and aesthetic properties: appearance (gloss/matte and smooth/texture) and opacity
- Durability
- Energy Efficiency
- Meeting health, safety and environmental regulations

Depending on paint requirements and exposure, a variety of polyester, silicon modified polyester, fluoropolymer, polyurethane, and plastisol paint systems are available, and should be specified with assistance from ArcelorMittal. A schematic of a typical paint system and the benefits of each component are shown in Figure 1.

Product Availability

Products	Grades	Gauge (in)		Width (in)	Coating Weights
		Min.	Max.	Max.	
Hot Dip Galvanized	CS, DDS, EDDS, FS, SS, HSLA	0.011 (0.28 mm)	0.168 (4.27 mm)	72 (1829 mm)	G30, G40, G60, G90, G115, G140, G165, G200, G235 (Z90, Z120, Z180, Z275, Z350, Z450, Z610, Z720)
Galvanneal	CS, DS, DDS, EDDS, FS, SS, HSLA	0.011 (0.28 mm)	0.168 (4.27 mm)	72 (1829 mm)	A25, A30, A40, A60 (ZF75, ZF90, ZF120, ZF180)
Electro-Galvanize	CS, DS, DDS, EDDS, FS, SS, HSLA	0.019 (0.48 mm)	0.081 (2.06 mm)	72 (1829 mm)	20G/20G, 30G/30G, 40G/40G, 50G/50G, 60G/60G, 70G/70G, 80G/80G, 90G/90G, 100G/100G
Prepaint	HDG, EG	0.011 (0.28 mm)	0.058 (1.47 mm)	61.5 (1562 mm)	Paint Systems: Acrylic, Polyester, Silicon Modified Polyester (SMP), Fluoropolymer (PVDF), Polyurethane, Plastisols

Notes:
- Gauge, width, and available coating weights are overall capabilities and vary by production line. Please inquire with exceptions.
- Pre-painted products at wider widths/heavier gauges may be available depending on coil coater used.
- On bare heavier gauge galvanize applications with cut edges, heavier galvanize coatings (>G90) should be used to ensure galvanic protection of the cut edge.

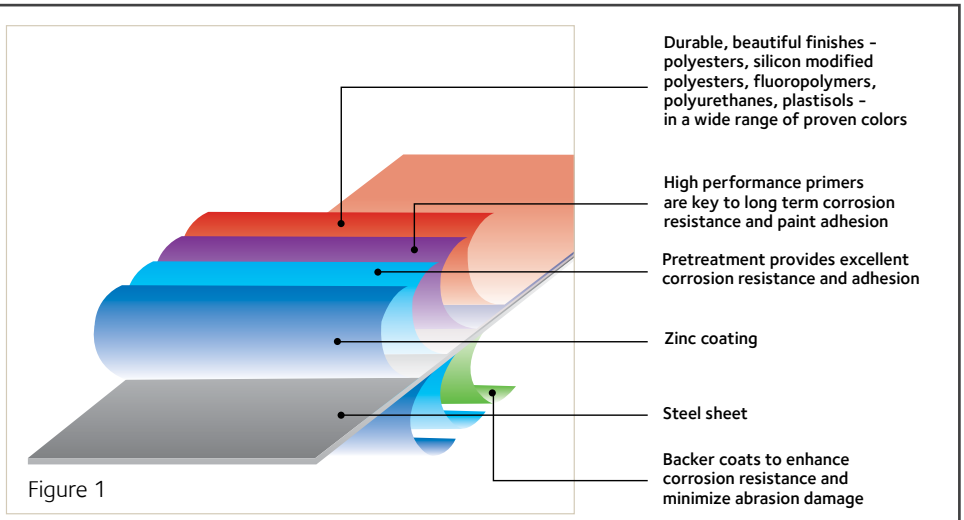


Figure 1

Recycling & Sustainability

Recycling

All galvanized steel products are essentially 100% recyclable at the end of their usable life and can be used in the basic oxygen furnace (BOF) or electric arc furnace (EAF) steel making processes to make new steel products. This reduces the amount of raw materials and energy needed along with greenhouse gas generation. Steel construction products are generally produced with at least 25% and up to nearly 100% recycled steel.

Energy Efficiency

Solar Reflectance (SR) or Reflectivity is the ability of a material to reflect solar energy from its surface back into the atmosphere. The SR "value" is a number from 0 (100% absorbance) to 1.0 (100% reflectance). For construction roofing products, a higher value indicates less energy absorption and lower roof surface temperature and subsequent heat transfer into a building.

The US Environmental Protection Agency (EPA) and Department of Energy (DOE) – ENERGY STAR™ Program require an initial SR value of 0.25 or higher for steep slope (more than 2:12) roofs and 0.15 or higher after 3 years, or an initial SR value of 0.65 or higher for low slope (2:12 or less) roofs and 0.50 or higher after 3 years. The use of select prepainted systems (typically lighter colors) on Galvanized "cool roofing" products can meet or exceed these ENERGY STAR requirements resulting in significant savings in a building's air conditioning requirements. In addition, higher SR values are also now achievable on select dark color paint systems which allow architects more color choices while still achieving energy savings (though these systems may not qualify for the ENERGY STAR rating).

The Solar Reflectance Index (SRI) is used to determine compliance with Leadership in Energy and Environmental Design (LEED™) requirements for reduced heat island effect and is calculated using values for reflectance and emissivity (a material's ability to release absorbed energy). To meet LEED requirements, a roofing material must have an SRI value of 29 or higher for steep slope (more than 2:12) roofing, or an SRI value of 78 or higher for low slope (2:12 or less) roofing. These performance requirements can also be met with the use of select prepainted systems on Galvanized products.

Points to Remember

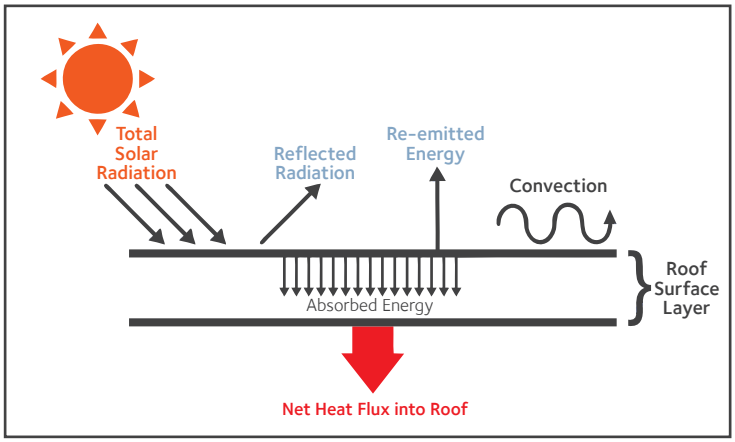
Compatibility with Dissimilar Metals and Environmental Affects

For Galvanize coated steels, contact with lead or copper must be avoided (including products containing lead or copper such as pressure treated lumber) as it can result in accelerated corrosion.

In addition, Galvanize coated steels are not recommended (or require additional zinc coatings and/or paint to limit corrosion) for applications near seawater (chlorides accelerate corrosion) or other harsh corrosive environments which have heavy exposure to corrosive chemicals (such as caustic soda, ammonia, lime, hydrochloric acid, nitric acid, hydrogen sulfide, sulfuric acid, sulfur dioxide), or excessive water contact with wet materials or standing water.

For all outdoor, bare HDG applications a minimum G90 (Z275) or heavier is recommended, and for additional protection in corrosive or polluted environments, prepainted galvanized products should be considered.

Galvanize and Galvalume™ steel should not be combined on the same building elevation because Galvanize will likely exhibit corrosion before Galvalume. As a design practice, when both materials are in contact, always use Galvalume steel downstream from unpainted Galvanized steel, otherwise accelerated corrosion of the Galvanized steel can occur. However, Galvalume steel can be used for the roof and Galvanized steel for the sides of a building.



Handling and Storage

To preserve the surface, handling should only be carried out using clean, dry gloves. Do not slide sheets over rough surfaces or each other.

As with painted steel products, bundles of Galvanize steel sheets or products made from Galvanize steel in all finishes must be kept dry in transit. After transit, material should then be covered and stored off the ground, at a slight angle, to prevent water or condensation from being trapped between adjacent sheet surfaces.

If the bundles become wet, sheets should be separated, wiped with a clean cloth without delay, and then placed so that air circulation completes the drying process. These procedures are recommended to avoid possible deterioration of the coating, which could result in non-uniform appearance.

Joining and Sealing

Common fasteners used on galvanize, galvanneal, and electrogalvanize steel sheet include:

- **Mechanical Zinc Plated Fasteners** are produced by impacting/adhering zinc to the fastener surface which results in a porous light to heavy zinc coating (as required) that may have a top sealer, and provides good galvanic corrosion protection (which improves with zinc coating thickness). However non-uniform zinc may be deposited in the base of the screw threads.
- **Electro-Zinc Plated Fasteners** are produced by acid cleaning the fastener prior to electroplating zinc, followed by a sealer for additional temporary protection which results in a fastener with good galvanic and barrier protection. They are the most commonly used type of fastener.
- **Hot Dip Galvanized Fasteners** are produced by immersing the fasteners in a bath of molten zinc which results in thicker continuous zinc coatings with good galvanic and barrier protection. However excessive zinc may be deposited in the base of the screw threads.
- **Specialty Coated Fasteners** are produced with metallic and polymer coatings typically in a dip, spin, bake operation, and offer improved fastener corrosion performance over just zinc plating. This fastener also typically has a built-in gasket.
- **Stainless Steel Fasteners** are typically made of 304 or 316 stainless steel which contains ferrous alloys containing chromium and nickel which gives the steel very good corrosion resistance. These generally require a non-conductive gasket between the stainless steel fastener and galvanized material, and due to higher cost are typically used in highly corrosive environments.

In addition, washers made of EPDM or a similar material should be used, fasteners containing lead or copper should be avoided along with lead headed nails and lead washers. **The ultimate selection of suitable fasteners to be used rests solely with the buyer.**

For construction projects using pressure treated wood, fasteners should be hotdipped galvanized (for limited applications such as connecting strapping to an ACQ pressure treated wood framing member), or stainless steel (300 series recommended), or other fasteners or coatings as recommended by the fastener manufacturer. In addition non-permeable membrane materials (such as ice/water shield) should be used between galvanize panels, components, etc., in direct contact with pressure treated wood.

For sealing, neutral cure silicone or butyl rubber based sealants should be used. Sealants containing acetic acid or amines should not be used on galvanized steel. Check with your sealant supplier for brand name recommendations.

Special Customer Note:
The Information in this Fact Sheet is provided for the general guidance of customers and does not imply any warranty. Information provided is based on research conducted by ArcelorMittal and other organizations. Interpretation and/or use of this information is the sole responsibility of the user. For further details, contact ArcelorMittal USA or Canada.

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