



**CONDITIONS CORROSIVE TO HOT-DIP GALVANIZED AND  
GALVALUME® COATED STEEL SHEET**

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Hot-Dip Galvanize (HDG) and GALVALUME®<sup>1</sup> Coated Steel Sheet are intended for applications where excellent corrosion resistance is required. The metallic coatings provide barrier and galvanic protection to the steel. However, under certain conditions, United States Steel Corporation (U. S. Steel) does not recommend using HDG and GALVALUME® Coated Products or recommends using additional precautions to minimize corrosion. These conditions include:

**CONTACT WITH ELEMENTS LESS ACTIVE THAN ZINC OR ALUMINUM**

Galvanic corrosion occurs when two dissimilar metals are electrically coupled in the presence of a corrosive electrolyte, one of them is preferentially corroded while the other is protected from corrosion. Any alloy will be preferentially corroded when coupled to a less active alloy. The relative activities of various metals are ranked in the Galvanic Series of metals for a given corrosive electrolyte such as seawater. The relative positions of some common metals in the Galvanic Series for seawater are:

**Magnesium > Aluminum > Zinc > Chromium > Iron > Nickel > Tin > Copper > Silver > Graphite**  
(More Active) ←————→ (Less Active)

The relative positions of the metals may change in different environments. Even so, this is a good guideline for the environments in which HDG and GALVALUME® Coated Products are commonly used. Examples of some materials to avoid contacting with HDG and GALVALUME® Coated Products are:

- Copper, including copper bearing chemicals from pressure treated lumber, and water drainage from copper pipes such as air conditioning units.
- Iron, including iron debris and saw fines left over from cutting panels, or weld splatter.
- Graphite including pencil marks. Coal dust, although not graphite, should not be allowed to accumulate on HDG or GALVALUME® Coated Products.
- Lead.

**TIME OF WETNESS AND CONDITIONS THAT DO NOT ALLOW PROTECTIVE OXIDES TO FORM**

Zinc and aluminum form a protective oxide layer when exposed to air, which reduces the corrosion rate of the metal. Conditions that lead to the breakdown of the protective films and adversely affect the corrosion resistance of the HDG or GALVALUME® Coated Products include:

- Harshly corrosive environments such as marine environments. Salt water destroys the protective oxide films of aluminum and zinc making them much more chemically active.

<sup>1</sup> GALVALUME® is an internationally registered trademark of BIEC International, Inc. and some of its licensed producers.

- Contact with materials that retain moisture including wet insulation, piles of leaves, ash, dust, or other organic debris, etc., which can become wet. Extend the time of wetness should not be left in contact with the coated sheet.
- Ponding water or maintaining wet conditions for extended periods of time. The GALVALUME® warranty is voided to bare GALVALUME® roof panel that has a pitch less than ¼ :12 (1 degree).
- Material kept in tight wraps, bundles or coils and allowed to get wet either by rain or condensation. Under these conditions, air cannot move in to repair the protective oxide films and corrosion can be developed quite rapidly. It is important that HDG and GALVALUME® Coated Products are not allowed to get wet during storage or at the construction site. More information on storage stains can be found in U. S. Steel Construction Technical Bulletins on the web site at <http://www.ussconstruction.com>.

## CORROSIVE ENVIRONMENTS

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Zinc and aluminum are readily attacked by acids having a pH less than 4, for example:

- Muriatic Acid (hydrochloric acid, HCl) that is contained in some of the cleaning products used to clean brick and concrete, which is very corrosive to HDG and GALVALUME® Coated Products.
- Oil of Vitriol (sulfuric acid, H<sub>2</sub>SO<sub>4</sub>), sulfur dioxide (SO<sub>2</sub>) from chemical plants dissolves in water and forms sulfuric acid. Very strong acid can develop as the water evaporates.
- Similarly, hydrogen sulfide (H<sub>2</sub>S) in animal confinement buildings can dissolve in water condensate to eventually produce sulfuric acid.
- Nitric acid (HNO<sub>3</sub>) in fertilizers and also present in animal wastes.

Zinc and Aluminum can be attacked by alkalis having a pH greater than 9, for example:

- Caustic Soda (Sodium Hydroxide, NaOH).
- Lime and Slaked Lime (CaO and Ca(OH)<sub>2</sub>). For this reason, HDG and GALVALUME® Coated Products should not come in contact with uncured concrete.
- Fly ash from power stations.
- Ammonia (NH<sub>3</sub>) dissolves in water to form an alkaline solution of ammonium hydroxide (NH<sub>4</sub>OH).

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For further assistance on the use of steel building panels or related topics,  
contact U. S. Steel Construction Sales Group:

U. S. Steel Construction Sales  
6200 E. J. Oliver Boulevard  
Room 106  
Fairfield, AL 35064  
1-800-633-8226 or 1-888-243-6851  
Ext. 2683

[ConstructionGroup@uss.com](mailto:ConstructionGroup@uss.com)