CASCADIA METALS

55% Aluminum-Zinc Alloy Coated Steel

TECHNICAL BULLETIN #10

Prevention of Oxide Formation (Black Rust) on Sheet

10.0 Introduction.
55% Aluminum-Zinc Alloy Coated Steel is a proven product exhibiting superior long-term corrosion resistance in a multitude of atmospheric environments. However, as with any steel product, there are precautions which must be observed during receiving, handling, processing, shipping, storage and assembly of 55% Aluminum-Zinc Alloy Coated Steel products. If no precautions are taken, oxidation (i.e. black rust) can occur. This technical bulletin briefly describes the various sources of oxidation affecting the typical 55% Aluminum-Zinc Alloy Coated Steel end user. This technical bulletin also provides guidelines to prevent the occurrence of oxidation and how to potentially remove an oxidation stain if it occurs.

10.1 Sources of Oxide Formation on 55% Aluminum-Zinc Alloy Coated Steel.
Oxide stains can occur on either coils or tightly bundled sheets of 55% Aluminum-Zinc Alloy Coated Steel. Although oxidation of the metallic coating is usually superficial and confined to the extreme upper layer of the coating, it is aesthetically displeasing and can quickly become more severe if the cause of the stain is not removed. In the most severe instances, there can be a weight loss of metallic coating and a potential reduction of service life. When the cause of an oxidation stain is removed or (in the case of a formed panel) when affected panels are assembled at the job site, the oxidation stain will not worsen.

The basic cause of an oxide stain on 55% Aluminum-Zinc Alloy Coated Steel is water or moisture interacting with the metallic coating in an oxygen-deficient environment. Under normal service conditions, 55% Aluminum-Zinc Alloy Coated Steel has excellent durability because of a protective oxide formed when the coating comes into contact with air. However, when moisture is in contact with the strip, and the strip is tightly stacked or wrapped into a coil, there is no exposure to air allowing the barrier oxide layer to form. As a result, accelerated corrosion is initiated. Oxide stain can occur in this type of oxygen-deficient environment in less than 48 hours.

The following paragraphs briefly describe various sources of oxide formation affecting the typical 55% Aluminum-Zinc Alloy Coated Steel user.

10.1.1 Condensation.
Oxidation can occur due to condensation when cold steel is moved from out of doors into a warmer building. The moisture in the air of the warmer building can condense on the colder steel surface. The presence of condensation-type oxide is typically identified as a dark gray oxidation condition which subsequently becomes darker. It is distributed on the material in a generalized pattern (rather than localized). A condensation-type oxide pattern occurs inward from both edges of the strip and is shallow in penetration from the edges.

Steel products must not be exposed to combinations of temperature and humidity which can result in condensation. Steel products should not be allowed to vary by more than 20°F from their surrounding environment. If an incoming shipment of 55% Aluminum-Zinc Alloy Coated Steel appears to exceed 20°F difference from the storage environment, the product should be allowed to warm slowly in a cooler indoor area free from cold air drafts. All material storage areas must be properly ventilated with adequate circulation of air. Circulation of air, however, should not be defined as allowing doors to remain open where moist air from the outside can enter the building and increase the probability of condensation.

Condensation can also occur on tightly bundled stacks of sheets or panels of 55% Aluminum-Zinc Alloy Coated Steel. In its very early stages, it may appear as a white stain similar to the white oxide that can form on galvanized steel. Even pre-painted and roll formed 55% Aluminum-Zinc Alloy Coated Steel sheet is not immune to this type of oxidation.

10.1.2 Wet Storage.
Oxidation can occur due to transport or storage of the steel in a wet environment. Oxidation frequently occurs when the material comes in direct contact with water during transportation to the end user facility or job site. In such a situation, the material will have evidence of water penetration by capillary action, from the side wall of the coil or the edge of a sheet (in the case of formed sheets). The oxide penetrates deeper into the metallic coating and becomes more difficult to remove than a condensation type condition. Oxide occurs as a more localized pattern than general across the entire surface. Oxidation also will occur within stacks of tightly bundled sheets when the stack comes into direct contact with water while the sheets are bundled at the end user facility or job site. In its very early stages, it can appear as a somewhat removable, white stain, similar to the oxidation stain that can form on galvanized steel. Even pre-painted 55% Aluminum-Zinc Alloy Coated Steel is not immune to wet storage oxidation.

Other sources of oxidation could evolve during processing of the 55% Aluminum-Zinc Alloy Coated Steel itself. Inadequately cured surface treatments (passivants) or water-based remnants of forming lubricants allowed to remain on the surface during storage will provide entrapped moisture for oxide formation. The net effect would be a dark oxidation stain (rust) with a linear and blotchy pattern not necessarily associated with the edges.

10.2 Prevention of Oxide Formation on 55% Aluminum-Zinc Alloy Coated Steel.
The typical 55% Aluminum-Zinc Alloy Coated Steel production process incorporates surface passivation, resin coating and oiling capabilities to minimize the potential of oxide formation on the finished product during transportation and storage. We recommend, depending on what treatment an order has received, coils should be stored no longer than the periods listed below.

Product Ordered	**Max. Storage Period after Ship Date**
55% Aluminum-Zinc Alloy Coated Steel - Oiled/No Chem.-treat	3 months
55% Aluminum-Zinc Alloy Coated Steel - Chem.-treat/Dry	4 months
55% Aluminum-Zinc Alloy Coated Steel - Chem.-treat/Oil	6 months
55% Aluminum-Zinc Alloy Coated Steel with a Resin Coating	1 year

10.2.1 Responsibility of the Steel Fabricator.
To prevent the occurrence of an oxidation stain, the following precautions should be practiced by a fabricator.

1. Order 55% Aluminum-Zinc Alloy Coated Steel product with an optimum combination of surface treatment, oil and coil packaging.

2. Verify any transit carriers adhere to shipping instructions and provide optimum protection to the steel coils during transit to the fabrication plant.

3. Inspect 55% Aluminum-Zinc Alloy Coated Steel coils for moisture upon arrival and stock 55% Aluminum-Zinc Alloy Coated Steel coils indoors in a clean, dry area away from any sources of chemical pollution.

4. Establish defined coil receiving inspection procedures which establish carrier responsibility.

- Documentation should include the following elements:
  - Weather conditions at time of delivery.
  - Tarp or protective equipment conditions/exceptions.
  - Equipment conditions/exceptions.
  - Coil conditions, (i.e., wet, package damage, etc.).

- Document transit-related water damage on the manifest. Photos or video must be taken of any questionable condition.

- Notify Cascadia Metals as quickly as possible when oxidation of the surface is confirmed.

5. Store 55% Aluminum-Zinc Alloy Coated Steel product at an even temperature above the dew point with adequate air circulation to prevent condensation problems.

6. Remove plastic or paper packaging upon arrival, if the storage area is heated and dry. If the material is wet, the sheets should be wiped dry. Wet coils should be scheduled into production as soon as possible.

7. Inspect the storage site regularly to ensure standing moisture has not penetrated the 55% Aluminum-Zinc Alloy Coated Steel coils.

8. Stack the product on wood or metal skids so that the coils are not in contact with the ground and elevate one end of each bundle to allow any moisture to run off rather than puddle on the top of the bundle or between nested panels.

9. Ensure 55% Aluminum-Zinc Alloy Coated Steel roll formed sheets are paper-wrapped when the sheets are not scheduled for erection on the day of delivery.

10. Avoid using plastic material for covering. Non-breathing materials should not be used to shroud bundles because they tend to trap moisture.

11. Verify transit carriers adhere to shipping instructions and provide optimum protection to the steel sheets during transit to the job site.

Note: *To correctly wrap a bundle of 55% Aluminum-Zinc Alloy Coated Steel sheets, the bottom paper sheet is put in place first and the top laps are covered smoothly with the top covering sheet with the folds underneath the bundle. If folded improperly, the laps on top can create a catch for water and actually encourage accumulation of water in transit.*

10.2.2 Responsibilities of the Erector at the Job Site.

To prevent the occurrence of an oxidation stain, the following precautions should be practiced by an Erector at a job site:

- Inspect bundles on arrival at the building site and note on the delivery receipt any exceptions such as damage, corrosion or wet material.

- Store the bundles on racks at least one foot above ground level. Do not use uncured lumber.

- Use under-roof storage when possible. If the bundles must be stored in the open on bare ground, a plastic ground cover should be used under the bundles to minimize condensation on the sheets from moisture in the soil.

- Elevate one end of the bundle to allow moisture to run off rather than puddle on the top of the bundle or between nested panels. Water resistant paper will not keep out puddled moisture beyond its rated moisture vapor transmission time.

10.3 Removal of Oxide Stains on 55% Aluminum-Zinc Alloy Coated Steel.
The oxide stain (black rust) that forms on 55% Aluminum-Zinc Alloy Coated Steel sheet is primarily a hydrated aluminum oxide and can be very difficult to remove if progressed beyond the initial stages. In mild cases the oxide may be removed by using a solvent, such as mineral spirits, applied to a cloth. Mineral spirits would also be used to remove an oxide stain from pre-painted 55% Aluminum-Zinc Alloy Coated Steel without damaging the paint. A mild, nonabrasive household cleanser may also be successful in removing the stain from a panel.

In more severe cases, industrial solvents may be used. However, as more aggressive chemicals are used to remove the stain, there is an increased possibility for damage to the coating itself. Harsh alkaline cleaning solutions should never be used. High pressure sprays should be avoided. Steel wool should never be used to remove an oxide stain from 55% Aluminum-Zinc Alloy Coated Steel since it is too abrasive and it will leave embedded iron files causing a cosmetically displeasing red rust condition.

In all cases of oxide stain, removal of the stain will affect the appearance of the metallic coating under and near to the stain. The area near the stain will usually appear duller after the stain is removed.