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APPLETON LUFF PTE LTD
INTERNATIONAL LAWYERS

BARCELONA KAMPALA WARSAW
BRUSSELS SEATTLE WASHINGTON, DC
GENEVA SINGAPORE

WWW.APPLETONLUFF.COM

ONE RAFFLES QUAY
LEVEL 25, NORTH TOWER
SINGAPORE 048583
TEL: +65 6622 5365
FAX: +65 6622 5364
EMAIL: NEE@APPLETONLUFF.COM

November 10, 2020

By E-MAIL
The Director - Investigations 4
Anti-Dumping Commission
GPO Box 2013
Canberra ACT 2601

Re: Dumping and Subsidisation Investigation on Aluminium-Zinc Coated Steel from Korean, Taiwan and Vietnam (Investigation No. 558) – Comments to BlueScope's October 8, 2020 Submission

On behalf of Yieh Phui Enterprise Co., Ltd. ("Yieh Phui"), a Taiwanese manufacturer and exporter of the goods subject to the above-captioned investigation, we hereby submit our comments to the submission made by BlueScope Limited ("BlueScope") on October 8, 2020 (EPR Document No. 21 or "EPR 21") with respect to Yieh Phui's product exemption application.

I. Background

On August 6, 2020, Yieh Phui submitted a product exemption application (EPR Document No. 10 or "EPR 10") in which Yieh Phui requested the Anti-Dumping Commission ("ADC") to exempt the 5% aluminium-zinc coated steel sheet in coils exported by Yieh Phui to Australia (i.e., the exemption goods) from the scope of anti-dumping duty measures, if any, resulting from the above-captioned investigation. In EPR 10, Yieh Phui explained the scope of the exemption goods. Yieh Phui also explained how the exemption goods are not alike to the goods under consideration produced and sold by BlueScope in Australia (i.e., BlueScope's ZINCALUME® and Next Generation ZINCALUME® steel products). In demonstrating how the exemption goods are not the like goods, Yieh Phui provided explanations and evidence to show the exemption goods are significantly different from BlueScope's ZINCALUME® or Next Generation ZINCALUME® steel in terms of physical likeness, commercial likeness, functional likeness and production likeness.

In response, BlueScope on October 8, 2020 submitted its comments to Yieh Phui's exemption application, in which BlueScope asserted that the goods under investigation produced in Australia are "alike in all aspects to the imported goods" and that the goods are "used interchangeably in the same end-use applications and compete directly for supply with

the same customers"[1]. BlueScope, however, provides no explanations or evidence to support its claim. BlueScope also fails to address specifically on the likeness between the exemption goods and its ZINCALUME® and Next Generation ZINCALUME® steel. By contrast, the explanations and evidence submitted by Yieh Phui in its product exemption application and further in this submission support Yieh Phui's position that the exemption goods (ZA) are not alike to BlueScope's ZINCALUME® (AZ) or Next Generation ZINCALUME® steel (AM) products.

II. The exemption goods are not alike to BlueScope's ZINCALUME® (AZ) or Next Generation ZINCALUME® steel (AM)

The exemption goods are not like goods to BlueScope's AZ/AM steel. Pursuant to the Commission's established practice, Yieh Phui in its product exemption application explained the likeness based on the four essential factors, including physical likeness, commercial likeness, functional likeness and production likeness. We hereby submit our comments to BlueScope's claim with respect to the above-mentioned four factors, as follows:

(1) Physical likeness:

BlueScope asserts that "the locally produced and the imported goods appear to be traded in a similar range of steel grades, coating types, lengths, widths, and thickness".[2] This statement is incorrect when the comparison of the physical likeness is set between the exemption goods and the goods produced and sold by BlueScope in Australia.

Firstly, in terms of coating types, the exemption goods (i.e., ZA) are dislike to the goods produced and sold by BlueScope (i.e., AZ/AM) because the metallic coating compositions of the exemption goods are significantly different from those of the AZ/AM steel. The metallic coating of the exemption goods contains merely 5% aluminium and 95% zinc, while the coating of Bluescope's ZINCALUME® and Next Generation ZINCALUME® steel metallic contains about 55% aluminium and 43.5-41.5% zinc[3]. As a result of the difference in the aluminium composition in the metallic coating layer, it is commonly known by the steel industry that the metallic coating layer of the AZ/AM steel is approximately twice as hard as the metallic layer of the exemption goods.[4] In addition, as explained in EPR 10, the intermediate layer (i.e., the layer between the metallic coating layer and the steel substrate, a reaction product of the steel substrate and the liquid zinc and aluminium) of the exemption goods is much thinner than that of AM/AZ steel. The thinner intermediate layer and the softer metallic coating layer both make the exemption goods better formability than that of BlueScope's AM/AZ steel.

Secondly, the thickness of the exemption goods is significantly different from BlueScope's AZ/AM steel when both are compared under the same or similar coating mass and this is because of the difference in density between aluminium and zinc. The density of

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[1] See EPR 21, at 1.
[2] See EPR 21, at 2.
[3] See Attachment 1 for BlueScope's Technical Bulletin which explains the coating compositions of its ZINCALUME® and Next Generation ZINCALUME® steel.
[4] The hardness of ZINCALUME® and Next Generation ZINCALUME® steel is approximately 140 Hv while the hardness of the exemption goods ranges from 50-70 Hv.

zinc is more than two times higher than the density of aluminium. Thus, the coating density of each coating type varies significantly when zinc and aluminium compositions are largely different. According to AS 1397, the coating density of each coating type is as follows[5]:

> Types 'Z' and 'ZF': 7140 kg/m^3
> Type 'ZA': For 4% to 9% aluminium use 6000 kg/m^3; for 9% to 15% aluminium use 5600 kg/m^3
> Type 'ZM': For 5% to 9% aluminium use 6000 kg/m^3; for 9% to 13% aluminium use 5590 kg/m^3
> Type 'AZ': 3680 kg/m^3
> Type 'AM': 3622 kg/m^3

According to the above, the coating density of the exemption goods is 6000 kg/m^3, almost two times of the coating density of BlueScope's AZ/AM steel (i.e., 3680 kg/m^3 and 3622 kg/m^3). Under the same coating mass (defined as volume per unit mass, typically presented as g/m^2), the coating density and the coating thickness have a reciprocal relationship because coating mass equals to coating density times coating thickness (i.e., coating mass = coating density × coating thickness). Thus, the coating thickness of BlueScope's AZ/AM steel would be almost twice thicker than that of the exemption goods when both are of the same coating mass. Accordingly, under the same coating mass and other equal conditions, the exemption goods are thinner and would have better formability than the AZ/AM steel.

Thirdly, there is a fundamental physical difference between aluminium and zinc and such difference directly impacts the physical characteristics and the production control of the exemption goods and the AZ/AM steel. Specifically, the melting point of zinc is 419.5 C while the melting point of aluminium is 660.3 C. Thus, the alloys used for a ZA coating type which contains merely 5% aluminium and 95% zinc, would melt at a lower temperature than the alloys used for an AZ/AM coating. Accordingly, as explained in EPR 10, the temperature control of the coating pot for the exemption goods is significantly different from that for AM/AZ steel. For the exemption goods, the temperature of the coating pot is controlled within the range of 400-500 °C, while for the AM/AZ steel, the temperature of coating pot has to be more than 600 °C because of a higher level of aluminium composition.

(2) Commercial likeness:

BlueScope alleges that "the locally produced and the imported goods compete directly in the Australian market – there exists a commercial likeness"[6]. This allegation, again, fails to address specifically on the commercial likeness between the exemption goods and BlueScope's AZ/AM steel. It is Yieh Phui's position that commercially the exemption goods do not compete with BlueScope's AZ/AM steel because of the limitations of AZ/AM steel.

As explained in EPR 10, the exemption goods are commercially targeted at different markets from those of the AZ/AM steel because the exemption goods could survive in certain environments which are not suitable for BlueScope's AZ/AM steel. Due to the nature of aluminium, the acidity or alkalinity of the environment significantly affects the corrosion behavior of aluminum alloys. Because AZ/AM products are coated with a high level of

[5] See AS 1397 provided in Attachment 1 of EPR 10, at page 26.
[6] See EPR 21, at 2.

aluminium composition, the AZ/AM products are not suitable for environments where the product needs to have immediate contact with alkaline substance such as cement, soil and animal excrement. By contrast, due to the low aluminium coating composition, the exemption goods are suitable for decking on concrete structures (which requires immediate contact with cement) and various farming structures used by the agriculture, aquaculture and solar industries.

Based on the publicly available information, BlueScope does not market its AZ/AM steel for applications used typically in unsuitable environments as mentioned above. For instance, in its technical bulletin[7] open to the general public, BlueScope clearly advises its potential customers about the applications which are unsuitable for ZINCALUME®, including, but not limited to, the following:

- "Animal confinement": "Structures erected to house the intensive farming activities of pigs, cattle, turkeys and chickens can present problems for ZINCALUME Steel. This form of animal confinement can result in the creation of animal waste and waste decomposition by-products which can be extremely aggressive towards ZINCALUME Steel, creating significant corrosion problems."[8]

- "Concrete": "ZINCALUME Steel is not suitable for use with wet concrete mixtures (including mortar or stucco). It is not recommended for use in framework and floor deck applications. The aluminum in the ZINCALUME Steel coating will react with the wet concrete leaving the coating porous and prone to corrosion. Adhesion between the concrete and ZINCALUME Steel is poor and the concrete itself can expand and lose strength. Small splashes of concrete onto ZINCALUME Steel are damaging, and should be removed when wet."[9]

- "Culverts"**: "**ZINCALUME Steel is not recommended for applications involving burial in the earth or soil. Soils vary widely in moisture content, acidity or alkalinity. Objects buried in the soil can be subject to bacterial activity and oxygen levels can be highly variable. ZINCALUME Steel is more sensitive to low oxygen levels and lack of passivity than galvanized products, hence heavy coating mass galvanized would be the recommended product under these conditions."[10]

BlueScope's warnings to its customers as in line with the steel industry common understanding about the limitations of AZ/AM steel and those applications unsuitable to the AZ/AM steel are exactly what the exemption goods are targeted at.

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[7] See Attachment 2, at 18-19, for a technical bulletin issued by Steelscape, one of BlueScope's branches in North America.
[8] See id. at 18.
[9] See id.
[10] See id.

Furthermore, zinc is generally more expensive than aluminium. As of the time of this submission, zinc is traded at a price approximately 40% more than the price for aluminium in London Metal Exchange. Thus, with all other conditions equal (e.g., with identical physical characteristics such as base metal and coating mass, etc.), a ZA steel is normally more expensive than an AZ/AM steel. However, due to the fact that AZ/AM steel is unsuitable for many applications as mentioned above, the demand for the exemption goods in Australia remains fairly high even though a cheaper alternative is available. This is supported by the fact that Yieh Phui exported almost equal amounts of the exemption goods (i.e., ZA) and non-exemption goods (i.e., AZ) to Australia during the investigation period. As such, BlueScope's claimed commercial likeness between the exemption goods and its AZ/AM steel is simply inconsistent with the commercial reality and should be disregarded.

(3) Functional likeness:

BlueScope further claims that "the locally produced and imported goods are used interchangeably in the same end-use and compete for sales to the same customers"[11] and BlueScope seems to suggest that as a result of the same end-use, "there exists a commercial likeness".[12] This claim is not only unsupported by any evidence but also incorrect when the comparison is set between the exemption goods and the AZ/AM steel.

In terms of functions or applications, there is significant difference between the exemption goods and the AZ/AM steel. According to AS 1397, the end-applications of the exemption goods and the AZ/AM steel do not appear to be entirely the same. In EPR 10, Yieh Phui also identified several major functional differences between the exemption goods and AZ/AM steel, including (1) sacrificial protection and corrosion resistance, (2) formability and (3) weldability[13].

Furthermore, as explained in the section of commercial likeness above, the AZ/AM steel is unsuitable for certain applications due to the high aluminium coating composition and therefore, the AZ/AM steel simply cannot be used interchangeably with the exemption goods for those applications. While we acknowledge that both the exemption goods and the AZ/AM steel have the corrosion-resistance function in common, this common function alone is not enough to serve as the basis in determining the functional likeness. In the context of the goods subject to this investigation, all coating types (AZ, AM and ZA) provide some sort of corrosion-resistance protection to the steel. A customer's choice of having the 5% aluminium-zinc coated steel (ZA, the exemption goods) over the 55% aluminium (AZ/AM) is a meaningful one based on the understanding that the variation in metal compositions would eventually lead to significant differences in end-applications. Thus, the Commission should find the exemption goods functionally dislike to the AZ/AM steel.

(4) Production likeness:

In terms of production process and raw material inputs, there is significant difference between the exemption goods and the AZ/AM steel. BlueScope's assertion that "the

[11] See EPR 21, at 2.
[12] See id.
[13] See EPR 10, at 5.

production process and the raw material inputs are substantially identical" is simply not true when the comparison is set between the exemption goods and the AZ/AM steel.

As explained in EPR 10, there is significant difference in consumption quantities of input raw materials (i.e., ingots of zinc, aluminium and other elements) due to the difference in coating compositions. In addition, the temperature control of the coating pot for the exemption goods is also significantly different from that for AM/AZ steel due to the difference in melting point for aluminium and zinc, as explained above in the section of physical likeness.

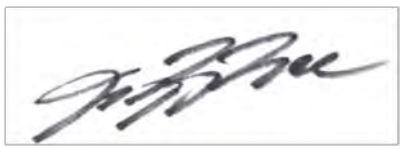
For manufacturers which use a continuous hot-dip coating process, the coating pot management is a critical one because any changes to the metal chemistry in the pot or any switch of the coating pot is time and thus cost consuming because of the inevitable retooling and shutdown of the production line in order to ensure the coating pot is in a stable condition. Thus, for the purpose of production efficiency, a coating pot or a continuous coating line is usually designated and intended for the production of only a certain coating type of the goods. As such, even though the production process and raw material inputs of the exemption goods may like similar to those of the AZ/AM steel on the surface, the difference is still significant because the coating process simply cannot be switched over to produce from one coating type to another without incurring substantial retooling costs or shutdown losses.[14]

III. Conclusion

In light of the above, the exemption goods are not alike to BlueScope's AZ/AM steel in terms of the physical, commercial, functional and production likeness. Again, we respectfully request the Commission to conduct a product exemption inquiry during the course of this investigation and exempt the 5% aluminium-zinc coated steel exported by Yieh Phui to Australia should the anti-dumping duty measures be imposed on the subject goods exported by Yieh Phui to Australia in the final phase of this proceeding.

Please let us know if you have any questions regarding this submission.

Very truly yours,



Jay Y. Nee

[14] BlueScope's choice of producing only one coating type of the goods under investigation in Australia (either AZ or AM) certainly helps to maximize its production efficiency and capacity but this choice comes with a price, a price of being unable to provide its customers with complete lines of the goods under investigation.

Attachment 1

Corrosion Technical Bulletin 6

June 2019. Revision 5.
This issue supersedes all previous issues.

Development of aluminium/zinc/magnesium alloy-coating for next generation ZINCALUME® steel with Activate® technology

INTRODUCTION

In 2013, after 17 years of testing and development, BlueScope introduced its patented Activate® technology[1]. This technology is used in the coating of next generation ZINCALUME® aluminium/zinc/magnesium alloy coated steel ("AM") and next generation COLORBOND® prepainted steel to make them more durable and more resilient than the established ZINCALUME® aluminium/zinc alloy coated steel ("AZ") and the established COLORBOND® steel products.

PURPOSE

As AM superseded AZ from August 2013, the purpose of this Technical Bulletin is to outline the primary differences between AM and its predecessor AZ. A wide variety of test methodologies have been used for assessing and understanding accelerated and long-term coated steel performance and durability. These methods are also briefly introduced.

AM vs. AZ

AZ had been manufactured by BlueScope since 1976. The coating composition of AZ was approximately 55% aluminium, 1.5% silicon and the balance zinc.

AM provides performance benefits as a result of coating structure and composition changes that facilitate enhanced durability in most environments. The coating composition of AM is approximately 55% aluminium, 2% magnesium, 1.5% silicon and the balance zinc.

COATING STRUCTURE

The microstructure of the AZ coating (Figure 1a) typically consists of aluminium-rich areas (dendrites) in a zinc-rich matrix (interdendritic regions). Needle-like particles of silicon are also present within the zinc-rich regions. A thin alloy layer of Zn-Al-Si-Fe is formed at the steel interface which bonds the coating to the base steel.

Figure 1: Typical microstructures of AZ and AM coatings in cross-section.

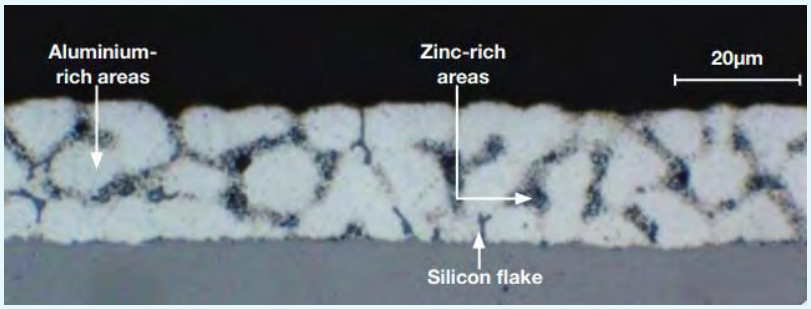


Figure 1a: ZINCALUME® steel AZ150 (superseded)

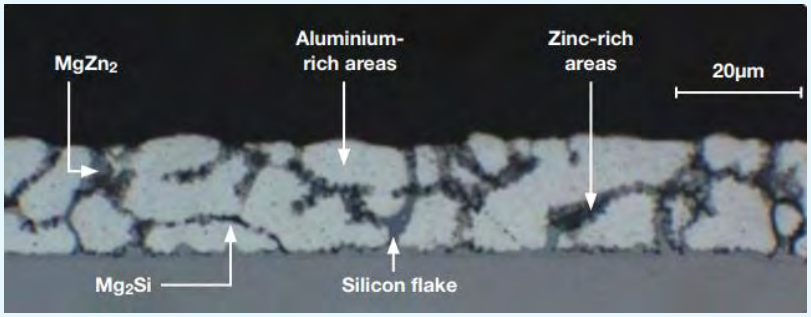


Figure 1b: Next generation ZINCALUME® steel AM125

The microstructure of the AM alloy coating (Figure 1b) also contains aluminium-rich areas in a zinc-rich matrix. However, the zinc-rich region also contains fine particles of magnesium-zinc ($MgZn_2$) and magnesium silicide (Mg_2Si). Careful process control ensures that most of the magnesium silicide is positioned towards the bottom portion of the coating layer (close to the base steel), while most of the magnesium-zinc is positioned towards the top portion of the coating layer. This positioning is an important factor in enabling the improved corrosion resistance of the AM coating.

CORROSION PROTECTION MECHANISMS

The key purpose of the metallic coating on any coated steel product is to protect the base steel against corrosion. The AM coating protects the base steel more effectively than AZ because it uses more efficient corrosion protection mechanisms. This is illustrated in Table 1 (next page).

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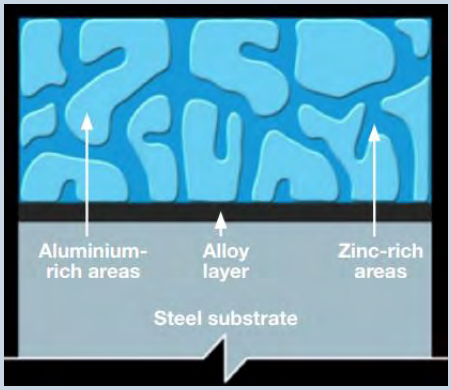
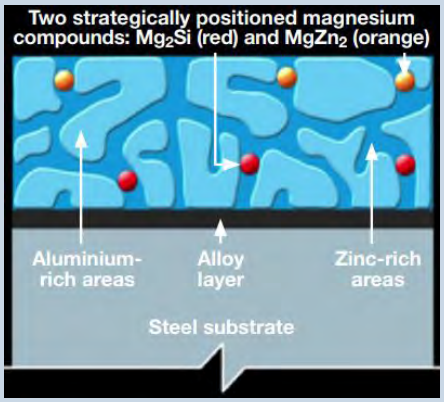
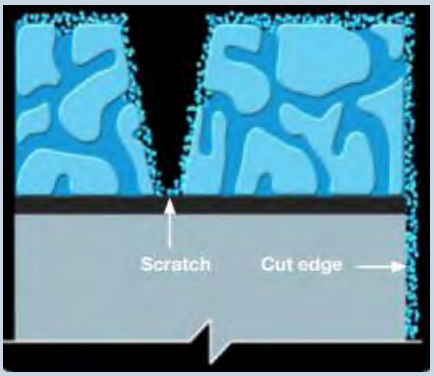
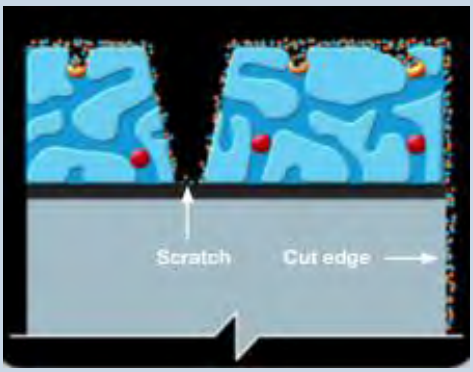
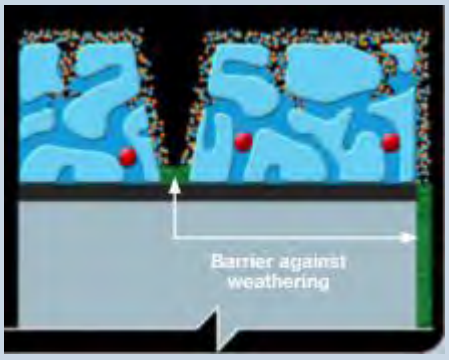
Table 1: Comparison between corrosion protection mechanisms of the AZ coating and the AM coating over normal service life.

Superseded ZINCALUME® aluminium/zinc alloy-coated steel	Next generation ZINCALUME® aluminium/zinc/magnesium alloy-coated steel
1. The entire metallic coating firstly provides barrier protection to the steel.	1. The entire metallic coating firstly provides barrier protection to the steel. Magnesium compounds ($MgZn_2$) are positioned in the metallic coating to activate at the start of weathering, when they are most vital for sacrificial protection.
	
2. At cut edges and scratches, the zinc-rich interdendritic region, which is exposed to the atmosphere, corrodes preferentially providing sacrificial protection to the steel base. The resulting corrosion product then fills the cavities in the coating and inhibits further corrosion.	2. At cut edges and scratches, corrosion of the zinc-rich interdendritic region provides improved sacrificial protection to the steel base due to the presence of the magnesium compound $MgZn_2$. Magnesium silicide (Mg_2Si) particles in the interdendritic channels act as additional barriers to slow corrosion and restrict corrosion pathways to the steel substrate.
	
3. The aluminium-rich dendrites provide barrier protection while the zinc-rich region corrodes. Once the zinc-rich region has been exhausted, the aluminium-rich dendrites corrode slowly to provide some sacrificial protection.	3. The aluminium-rich region is modified to provide improved sacrificial protection of the steel base and resist red rusting for longer in more severe environments. It is also more efficient, so less aluminium-rich region is consumed to provide the improved sacrificial protection.
	

Corrosion Technical Bulletin 6

June 2019. Revision 5.
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SUMMARY
BlueScope has undertaken extensive research and testing in order to develop the AM coating for next generation ZINCALUME® steel with Activate® technology and next generation COLORBOND® steel with Activate® technology. The development process has resulted in a thorough understanding of the fundamental corrosion protection mechanisms of AM as well as its performance in a variety of service conditions and building applications.

RELATED BLUESCOPE TECHNICAL BULLETINS
For more information on the performance of AM in service, please refer to:

Technical Bulletin TB-10
Cut edge and bend protection of next generation ZINCALUME® steel and COLORBOND® steel

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To ensure you have the most current Technical Bulletin

1800 800 789
steeldirect@bluescopesteel.com
If you have any questions regarding this Bulletin, contact Steel Direct

Attachment 2

PUBLIC RECORD

TECHNICAL BULLETINS

steelscape

JULY 2018 I Rev 2

This issue supersedes all previous issues

Index of Technical Bulletins

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12	Guidelines for the Installation of Photovoltaic Panels with ZINCALUME® Steel	July 2018
13	Hawaiian Islands: Exceptions to Standard Limited Warranty, Cleaning and Panel Design Recommendations	July 2018

For more information or other questions not addressed by these bulletins please contact Steelscape's Technical Service Department or your Steelscape Account Manager.

TECHNICAL BULLETIN 1

PUBLIC RECORD

steelscape

JULY 2018 I Rev 2

This issue supersedes all previous issues

ZINCALUME® Steel

General Guide to Good Practice in the Use of ZINCALUME® Steel for Roofing and Siding Products

INTRODUCTION

Panels fabricated from ZINCALUME® Steel will provide many years of trouble-free service when properly designed, installed and maintained. The key to obtaining all of the benefits of the corrosion resistant coatings applied to steel used in roofing, siding and rainwater items lies in correct material selection, good handling and installation practice, and sensible maintenance.

Few roofing or siding products are replaced because of an overall breakdown or general corrosion. Replacement is generally due to isolated component failure which could have been avoided by following a few simple rules. This Technical Bulletin sets out the general principles to follow. Attention to the following factors should ensure satisfactory performance and good service life. Manufacturers' specific recommendations about their particular products should be followed.

Correct Selection of Materials

The correct selection of roofing and siding materials is the first step to ensuring a building's long life. The range of products manufactured by Steelscape is designed to provide good performance under normal environments from benign rural areas to corrosive industrial or salt-laden coastal atmospheres. Correct selection is a matter of choosing the right product for its intended use.

A roofing installation in a coastal environment has a completely different demand upon it than one in a benign rural location. Our experienced sales and technical personnel should be consulted if there is any doubt as to the correct metallic coated or painted product for a specific structure. This is especially true for the special requirements of severe coastal and industrial as well as animal confinement environments.

Designs for Durability

There are many factors that should be considered in the design phase of any building to ensure the maximum trouble-free service life. The following factors are some of the primary considerations.

Minimum Roof Pitch

The pitch must be designated/designed so that standing water conditions are not created. Water or condensate must freely drain from the roof panels. Where a roof includes several slopes, a valley gutter or other device should be installed to ensure adequate drainage. Specified minimum pitch will vary according to the depth of the roof profile and the means of fastening. Many standing seam roofing systems with deep profiles (i.e. panel seams ranging from 2-3 inches), fastened with concealed clips which do not penetrate the steel weathering membrane, may be installed down to a minimum slope.

Regardless of roof pitch, the cut ends of panels should be burr down, or designed with a rolled, or hemmed edge to prevent moisture from being held at the edge.

A properly installed standing seam roofing system will allow the roof to drain effectively without "flooding" the laps. The concealed clips ensure the drainage part of the panel membrane is not breached by fastening holes through which water may leak. Perimeter detailing and flashing is also an important component of such a system.

A roof fixed to its minimum pitch must observe all of the criteria for correct installation. Supports must be carefully aligned to avoid creating low spots in the roof where ponding will occur, leading ultimately to reduce service life.

Correct Support Spacing

Correct spacing of supports is important. Not only do the purlins, battens, etc., support the weight of the roof and the weight of the roofer during installation, they must be strong enough to prevent the sheets of decking from blowing away in high winds.

Support spacing near the eaves and the ridge is usually less than the intermediate spacings. This allows the roof to handle the increased lift and forces created by wind turbulence. The supports hold the roof down and they must themselves be restrained. It is possible for a roof to be blown off with the purlins or pieces of poor quality lumber battens attached to the sheets.

Steel Thickness - Base Metal

To protect steel sheet from the corrosive effects of the elements, a layer of metallic aluminum/zinc alloy is applied to the steel base in the hot-dip process. To enhance this protection as well as provide an attractive appearance, a pre-painted steel finish is also an option. These protective finishes are the major determinants of long service life and lasting good looks. The structural strength of the roofing or siding profile is derived entirely from the steel base and the profile of the particular steel panel.

An important consideration in the spanning capacity of a steel profile is its base metal thickness, which is used to determine support spacings. The total thickness of pre-painted steel sheet (the base metal steel plus an aluminum/zinc hot-dipped coating, plus pre-painted finish) is, at best, a very imprecise indicator of the base metal thickness which provides the strength of the roof sheeting.

The ability of the roof sheeting to span recommended distances without severe deflection, to support the installer, and to resist tearing away from fixing clips or screws largely depends on the base metal strength. Always ensure that the base metal thickness specified is according to recommendations. Most metal panel manufacturers provide load tables to assist in the selection of an appropriate profile for spanning conditions.

Fume Extractors & Vents

Corrosive dust and particles can be released through roof vents and discharged onto the roof surface. The immediate area of the roof adjacent to the vent is then at increased risk of corrosion. The following design guidelines should be considered to avoid problems.

- Locate vents on the corner of the windward side of the building.
- Install filter elements to trap hazardous material.
- Specify pre-painted product or apply a protective coating to the affected area of the roof.
- Maintain coal or oil fired boilers or incinerators so they do not discharge sulfur compounds over the roof surface.
- Avoid condensate from copper tubing.

Foot Traffic

Repeated foot traffic and the dragging of maintenance or cleaning equipment over the roof surface may damage the roof which will reduce its life expectancy. Catwalks and platforms should be designed and installed where necessary.

Roof Structures

Equipment such as air conditioning units are often secured to uncoated steel channels. Uncoated steel used on a ZINCALUME Steel roof should be cleaned, primed and given a suitable finish coating. If left unprotected the rust may bleed onto the ZINCALUME Steel panels and stain the surface. For guidelines on the installation of photovoltaic panels see **Technical Bulletin #12 "Guidelines for the Use of Photovoltaic Panels with ZINCALUME® Steel"**.

Site Storage Before Erection

Where possible do not leave uncovered coils or stacks of sheets lying in the open. Install finished material as quickly as possible. Store materials indoors and away from openings to the outside. On arrival at site, ensure the steel sheets are dry. If wet, open the pack

immediately, separate the sheets and allow them to dry.

If it is absolutely necessary to store ZINCALUME Steel outdoors please follow the following guidelines:

- Erect simple scaffolding around the material and cover it with a waterproof sheet or tarp. Ensure space is allowed between the cover and the material to allow air to circulate.
- Store material off the ground and on an incline so that if rain should penetrate the covering, water will drain away.
- Use only dry, untreated lumber spacers for block stacking.
- The storage site should be inspected regularly to ensure moisture has not penetrated the stack. If moisture has gotten between panels they should be separated and dried immediately. ZINCALUME Steel must not ot come in contact with wet cement or concrete. If contact occurs remove immediately.

INSTALLATION GUIDELINES

Allowance for Expansion

All roofing and cladding will expand and contract with changes in temperature. Fastening/Fastener attachment systems used must accommodate the expansion to avoid problems of “canning”, ponding or roof noise. Expansion tables are usually available from the panel manufacturer.

Handling

Handle panels carefully. Do not drag or slide sheets over other products or rough surfaces. Equipment and materials placed on to the roof should be clean and care taken to prevent damage to the surface.

Long panels are best lifted with the aid of a lifting boom. Flat, rubber soled footwear should be worn when walking on a roof. Shoes should be cleaned before going up on the roof.

Bare ZINCALUME Steel is prone to fingerprinting and hand printing. ZINCALUME Plus Steel, which has a clear acrylic resin applied, is recommended for unpainted applications. The clear resin prevents finger and hand prints and aids in forming. If bare ZINCALUME Steel is utilized, clean gloves should be worn when handling.

Laying

Pierced sheets should be installed with overlaps away from the weather. End laps in profiled metal roofing should be avoided where possible. The end lap of ZINCALUME Steel and painted profiles should be sealed with a double bead of sealant.

Marking, Cutting & Drilling

Black lead pencils should never be used for marking ZINCALUME Steel products as the carbon in the pencil will promote corrosion which will etch the surface leaving a permanent mark. Use any other color pencil but black. Cut and drill pre-painted steel with care to avoid marking the high quality surface. Use a hand shear or nibbler instead of a friction blade to avoid damaging the ZINCALUME Steel or paint coating. Remove all debris and metal filings as soon as possible.

Fasteners - Placement, Size, Type, Life Expectancy & Compatibility

The security of a roof is no better than its fasteners. Correct choice and placement ensures fasteners are placed in effective positions. The use of nails is not advised for roofing and siding profiles. Screw type fasteners with washers are recommended and have been proven to have 2 to 3 times the holding power of nails. Care should be taken not to under-drive, or over-drive screws. Large washers are necessary when hurricane conditions apply to the location. This prevents screws being pulled through sheeting under high lift forces.

Fasteners used for external fixing of roofing and siding products must be compatible with ZINCALUME Steel and have a life expectancy comparable with the ZINCALUME Steel panel.

Our recommendations on type and compatibility of fasteners are published in **Technical Bulletin #3 “Fastener Selection for ZINCALUME Steel Roof & Siding Products”.**

There are some fasteners on the market with only minimal corrosion protection. These will quickly rust

and present an unsightly appearance. Fasteners made of some alloy materials are highly corrosion resistant in their own right but a galvanic couple may occur when they are in contact with ZINCALUME Steel. This may cause an increased rate of corrosion of the steel around the fasteners. Screw manufacturers/suppliers should be consulted to ensure correct usage.

Clean-up

After erection has been completed the roof panels and gutters should be swept to remove dirt and debris such as unused fasteners, metal filings, pop-rivet stems, and pieces of flashing. The shank of a fastener left lying on a roof will rust very quickly and will run down onto the panel causing an unsightly stain. The process of cutting roof and wall sheeting to size with discs, or drilling to fix with fasteners, can create debris which is unsightly and can create localized corrosion and shorten the service life. **Technical Bulletin #4 "Prevention of Damage to Steel Roof & Siding Products from Metal Filings"** covers this in greater detail.

Mud and dirt tracked onto the roof panels, and greasy hand and footprints, can be removed by washing with a cleaner consisting of 1/3 cup mild detergent in one gallon of water applied with a mop or soft broom. The roof should then be thoroughly rinsed with water. High pressure spray applications and strong alkaline detergents should not be used. If washing with a detergent solution is found to be inadequate, solvents such as mineral spirits can be used to remove more stubborn stains. More aggressive and highly volatile solvents such as acetone or toluene should be avoided for safety reasons, as well as their incompatibility with many paint systems used on building panels. The compatibility of any solvent on paint should be tested or known prior to its use. Tri-sodium phosphate (TSP) cleaners should not be used.

Compatibility of Accessories Including Flashing & Sealants

There are basic facts regarding compatibility of metal products that are usually predictable and well documented. These have been summarized into a few simple rules for roof installers in **Technical Bulletin #2 "Flashing Materials for Bare & Pre-painted ZINCALUME Steel"** which covers this topic in much more detail. The mix of incompatible metals or materials with dissimilar service life is poor practice and will significantly affect service life. Correct choice of sealants to suit materials and location is important. Sealants containing amine or acidic acid should never be used. High quality sealants, such as neutral cure silicones, provide good performance in most applications. They may cost a little extra but are a good investment. Recommendations on sealant selection are covered in **Technical Bulletin #5 "Sealants for ZINCALUME Steel."**

222 West Kalama River Road, Kalama, WA 98625-9420 USA I Phone 360-673-8200 I Fax 360-673-8250

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ZINCALUME® Steel

Flashing Materials for Bare & Pre-painted ZINCALUME® Steel

INTRODUCTION

The preferred flashing material for ZINCALUME® Steel is either bare or painted ZINCALUME Steel. The following guidelines have been provided to assist in the informed use of other materials where necessary.

COMPATIBILITY

Galvanic Corrosion

Due to a phenomenon known as galvanic or bi-metallic corrosion, some commonly used metals can cause accelerated corrosion when used with ZINCALUME Steel zinc/aluminum alloy-coated and pre- painted sheet. The field of corrosion study has defined an "activity" scale shown in Table 1 which shows zinc and aluminum more active than copper, lead or stainless steel. The farther apart on the scale, the more dissimilar and the stronger the potential for reaction between the metals. When a galvanic "couple" is formed by electrical contact the more active metal will sacrifice itself (or dissolve) to protect the less active component of the couple.

ZINCALUME Steel will experience accelerated corrosion when in contact with copper (including copper treated lumber) or lead. Leeching from copper will result in especially high levels of corrosion. The protective oxide film which naturally forms on aluminum surfaces is broken down by copper or lead in localized areas. Pitting corrosion ensues which is a highly accelerated form of attack. Zinc coatings are not generally subject to pitting when in contact with the same materials.

Rainwater Runoff

The galvanic scale in Table 1 is also important when considering runoff from one material to another. If any two of these materials are in damp contact or a runoff situation, the metal higher on the table will sacrifice itself to protect the lower. A simple guideline to follow is to remember that water can flow downhill but not uphill. Zinc to copper is acceptable but copper to zinc is not.

Catchment (Caution When Combining Different Roofing Systems)

Care should be taken when combining products on a roof system. If products are combined incorrectly severe localized corrosion may occur as a result of "inert catchment."

The zinc coating on galvanized steel products develops a protective surface film as a result of natural weathering. This provides the longevity of performance which is typically known of galvanized products. When flowing over galvanized roofing rainwater dissolves small amounts of minerals and salts from the zinc surface. These minerals and salts promote and maintain the protective film and enhance the corrosion resistance of other galvanized steel products such as gutters and valleys.

When rainwater flows over or is collected from roofing materials which do not promote this protective film (inert materials) accelerated corrosion of unpainted galvanized steel roofs and gutters can occur. Examples of inert materials include ZINCALUME Steel, pre-painted steel, acrylic, glazed tiles, aluminum, fiberglass and PVC.

- Unpainted galvanized steel must not be used for roofing or rainwater goods (including valleys and gutters) to collect water runoff from ZINCALUME Steel or any other inert material.

- ZINCALUME Steel and painted ZINCALUME Steel can be used to collect water from galvanized or

any inert catchment material. ZINCALUME Steel gutters will typically give a longer service life than traditional galvanized steel.

Standing Water

New applications for standing seam metal roofing have required roof slopes be minimized to as low as 1/4:12. An area of a roof can be almost flat depending on the particular building. These conditions can create areas where water can collect and remain for extended periods of time with possibility of accelerated corrosion. Where an unfavorable galvanic couple exists, the presence of standing water for prolonged periods will allow the corrosion reaction to continue for a longer time than it normally would. In cases where an adverse couple does not exist, enough water can complete the necessary electrical contact and corrosion will proceed as long as the water maintains the circuit.

The appearance of roofing panels can suffer even when all materials within a water-ponding area are compatible. Aluminum-coated steel panels are not as resistant to standing water as ZINCALUME Steel. When the aluminum-coated panel begins to rust, the standing water can disperse and deposit rust particles on an adjacent ZINCALUME Steel sheet panel, resulting in an unsightly stain.

Table 1- The Electromotive (Galvanic) Series of Metallic Activity

More Active Metals	Zinc
↓	ZINCALUME® Steel
	Aluminum
	Steel
	Lead
	Copper
More Noble Metals	Stainless Steel

COMPATIBILITY of COMMONLY USED FLASHING MATERIALS

Copper

Copper is incompatible with both bare and pre-painted ZINCALUME Steel, either in contact with or where water can flow from it, such as is often experienced with hot water system overflows. Painting the outside of the copper pipe is recommended. ZINCALUME Steel must should not come in either direct contact with or water runoff from copper treated lumber. Hot water discharge pipes should be extended beyond the roof, preferably to ground. Every effort must be made to prevent the overflow of water from copper pipes onto the roof and gutter material.

Lead

Lead is the only metal generally considered to be compatible with zinc-coated steel but not with bare or pre-painted ZINCALUME Steel. ZINCALUME Steel, in contact with or receiving run-off water from lead is prone to corrosion. In the event of roof retrofit where lead already exists and its re-use is desirable, the ZINCALUME Steel must be insulated from the lead by a suitable barrier. This can be achieved by painting the underside of the lead or preferably both surfaces to ensure complete electrical separation. Plastic film can also be used provided it is robust enough and will not tear, e.g., polyethylene damp course placed between the lead and ZINCALUME Steel sheet (with paint on top), is a better alternative.

Lead in the water run-off should be avoided by painting the top surface of the lead flashing. The lead supplier should be contacted for advice as to a suitable finish coat barrier system and the ongoing maintenance requirements. Applying two or three coats of water-based acrylic is generally suitable but any painting must be maintained so it will not break down and expose any of the lead surfaces.

Galvanized Steel

Galvanized flashing materials and accessories may be used with bare and pre-painted ZINCALUME Steel. However, galvanized products may have a shorter life span and thus eventually makes them impractical in the long term. Conditions detailed above with unpainted galvanized subject to water runoff from ZINCALUME Steel panels should be avoided.

Aluminum Coated Type II

Flashings fabricated from this material may be used although inferior resistance of aluminum coated steel to standing water and cut edge corrosion may result in rust staining of adjacent bare and pre-painted ZINCALUME Steel.

Graphite

All materials containing graphite should not be used with or adjacent to ZINCALUME Steel. This includes washers and also graphite from pencils used to mark ZINCALUME Steel components.

Stainless Steel

300 series grades are suitable, 400 series grades with >1.0 mil. zinc or cadmium coating may be used. Other grades should be avoided. Our sales and technical personnel should be consulted where any questions exist.

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ZINCALUME® Steel

Fastener Selection for ZINCALUME® Steel Roof & Siding Products

INTRODUCTION

Roofing, siding and accessory products manufactured from ZINCALUME® Steel will give long, trouble- free service when exposed to the atmosphere in environments ranging from benign to severe in terms of corrosive effect. The selection of the appropriate form of fastener is a task, however, which should not be solely influenced by cost. Fastener costs are minimal relative to the overall cost of a project and there is little benefit gained through the use of inferior fasteners.

Guidelines for Appropriate Fasteners

The expected service life of the fastener should meet or exceed that of the ZINCALUME Steel components used in the construction. The severity of environmental conditions and the corrosion resistance of the fastener should be considered.

The fastener must be compatible with the ZINCALUME Steel components. When a more active metal is placed in direct electrical contact with another less active material the more active component will sacrifice itself to prevent the other from corroding. This is known as dissimilar metal contact or galvanic corrosion and can be extremely aggressive under certain conditions. Galvanic corrosion can be much faster in corrosive environments such as acid rain due to the increased conductivity of the electrolyte or rainwater. **For this reason lead, copper and copper containing alloys (such as Monel) should not be used in conjunction with ZINCALUME Steel.** Stainless steel should not be used in severe environments as the ZINCALUME Steel alloy coating can corrode sacrificially. Refer to Table 3 to ensure the fastener of your choice is compatible and has sufficient durability.

Careful consideration should be given not only to the expected performance of the head of the fastener, but the shank as well. This applies particularly if the shank of the fastener could be subject to the effects of aggressive substances, such as acid or chemical fumes or to prolonged humidity and condensation for example, within the confines of a building.

Fastener size, strength and correct fastening pattern are critical and are recommended by the panel manufacturer.

Guidelines for Installation of Fasteners

Do not overdrive screws or drive at an angle. This can result in the washer piercing the steel panel or no longer mating with the area around the hole. The ZINCALUME Steel coating will protect the damaged area for some time; however, rust may prematurely occur depending on how much steel is exposed and on the local environment. Overdriving a fastener can also cause a depression in the panel which can collect water and create localized ponding. Driving tools equipped with depth sensing nose pieces and suitable RPM speeds can assist in avoiding these problems. Impact type tools should not be used.

Washers - The rubber washer component of self-drilling screws must be manufactured from materials compatible with the roofing material. Washers containing significant levels of conductive carbon black fillers should not be used with ZINCALUME Steel products. The use of carbon or graphite washers may lead to galvanic corrosion, especially in corrosive atmospheres. Black neoprene rubber is not recommended in any environment as they contain carbon pigmentation which can also cause galvanic corrosion. Neoprene rubber other than black is acceptable.

TABLE 1 Fastener Performance Rating

A	Provides Excellent Long-term Durability and Compatibility
B	Provides Good Long-term Durability and Compatibility
C	Provides Acceptable Durability and Compatibility
NR	Not Recommended

TABLE 2 Guide to Atmospheric Exposure Conditions & Distance From Corrosive Source

Atmosphere	Typical Exterior Atmosphere	Marine	Industrial
Benign	Outer Urban, Semi Rural, Rural	More than 3/4 Mile	More than 1/2 Mile
Moderate	No Obvious Marine/Indust. Influence	1/2 Mile – 3/4 Mile	1/3 Mile - 1/2 Mile
Severe/Very	Surf, Indust. Pollution & Fumes	Up to 1/2 Mile	Up to 1/3 Mile

Note: Marine as a corrosive source is characterized by salt laden, moist air. Industrial as a corrosive source is characterized by fallout, acid laden air. Some commercial or agricultural applications may create internal environments in which the buildup of pollutants, fumes or humidity is a potential source of corrosion. Fastener selection in such cases should be made after careful evaluation of building design, nature of corrosive source.

TABLE 3 Fastener Guidelines for use with ZINCALUME Steel

Fastener Type and External Atmosphere	Benign	Moderate	Severe - Very Severe (Coastal/Industrial)
300 series stainless (self-drill screws not available in this alloy)	A	A	Not Recommended in very severe environments – the ZINCALUME Steel coating around fastener head may corrode sacrificially.
Zinc/Aluminum Alloy Cast Head (ZAC)	A	A	A
Solid Plastic/Nylon Molded Head2	A	A	A
Aluminum	A	A	A
Electroplated Zinc/Mechanically Coated Zinc (5.0 mil min.)	B	C	NR
Baked-On Organic Polymer Barrier Coat Over 5.0 Mil Plated Zinc Coating	A	A	B
400 Series Stainless Steel (1.0 mil Zinc coating)	A	A	C
Lead Head Nails and Washers	NR	NR	NR

1. Internal atmosphere should also be considered.

2. Subject to breakdown due to U.V. and heat; may fade at a different rate than pre-painted steel panel.

Note: Push or crimped-on caps can allow moisture to collect beneath them, causing corrosion of the head.

222 West Kalama River Road, Kalama, WA 98625-9420 USA I Phone 360-673-8200 I Fax 360-673-8250

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ZINCALUME® Steel

Prevention of Damage to ZINCALUME® Steel Roofing & Siding Products from Metal Filings

INTRODUCTION

Steel filings, or swarf, are typically created from cutting or piercing operations when using friction saws, abrasive discs, drills etc., on steel roofing and siding products. This debris in addition to other discarded steel objects such as rivet shanks, nails, screws and nuts, which may come in contact with coated products; (i.e. pre-painted steel, ZINCALUME® Steel) are the subject of this bulletin.

These particles, if left on the surface, will corrode and cause rust stains which will detract from the finished appearance of a project. These stains are often mistaken for early deterioration of the roofing or siding itself. Prevention of such staining is the responsibility of the installer and it is strongly suggested that the recommendations contained in this bulletin be followed.

Metal debris will come in contact with coated steel sheet products in three ways.

- Loose particles left after cutting, drilling and riveting operations.
- Hot metal filings from disc cutting or drilling operations which may adhere to the finished surface.
- Loose particles which may be ground in underfoot or become embedded in the surface film of pre- painted products under pressure from adjacent equipment or materials.

PREVENTION

Cutting

Use of a power saw with a metal cutting steel blade is the best way to cut sheets on site. This method generates larger and cooler particles than abrasive discs.

Where possible, cutting should be minimized by using factory supplied cut-to-length sheets.

Sheets cut on site should, where practical, be cut on the ground, with the exterior color finish of pre- painted sheet facing down. Care should be taken to ensure hot filings do not come into contact with nearby pre-paint steel sheets. Do not cut over the top of other coated products, where debris may fall onto other sheets. Where cutting must be carried out near sheets already installed, the area around the cut must be covered and the stream of hot particles directed away from completed work. Field cut edges should be concealed under ridge caps or gable flashings whenever possible.

Drilling

The area around the hole should be covered to shield the product from hot metal filings.

Installation

Smooth soled shoes should be worn when working on a roof; avoid the ribbed type which will carry metal filings and other objects.

Clean Up

Metal debris/filings should be swept or hosed from the job progressively and certainly at the end of each day. This action will remove loose particles. Maximum care should be taken when attempting to detach filings which have become stuck; this can be done, but no action which is likely to remove paint or metal coatings should be attempted. Any damage to these coatings will lead to reduced life of the material. When sweeping or hosing into a gutter, clean out the gutter before leaving the job in order to prevent premature corrosion.

On completion of the job give a final wash or sweep down. For critical applications, inspection of the job should be made after two weeks when rain or condensation will have caused any remaining filings or debris to rust, and will highlight affected areas.

Note: *Many staining problems arise not from installers, but from other contractors working in the vicinity. Architects and builders need to be aware of this possibility and warn contractors accordingly.*

Identification

Fresh stains are characterized by small red-brown colored areas with a central dark spot (the remains of the steel particles). The surface will feel like sandpaper, and the particle may be lifted with a fingernail. An old stain will appear as a localized red-brown stain, the steel particle having corroded away, and the surface will be smoother.

Effect on Performance

The effect of staining itself on Steelscape prefinished products is generally aesthetic, and may not be detrimental to the performance of the product. The product life will be severely affected where attached metal particles have penetrated the pre-painted film and are in contact with the protective metallic coating, although this only occurs in severe cases. This is because on pre-painted surfaces red oxides of iron are normally inert substances and do not attack the finish; the stain is merely absorbed by the finish. Red oxides of iron are insoluble in water and the stain will take considerable time to weather away.

On metallic coatings, concentrated corrosion can occur over a small area as the zinc in the coating sacrifices itself to prevent oxidation of both the debris and, if allowed to continue, exposed areas of the steel base.

Repair of ZINCALUME Steel Sheet

Brush the surface with a stiff bristle (not metallic wire) brush to dislodge particles which must then be completely removed. Wire brushing will mar the appearance of the sheet if brushing is not followed by painting. If the coating is severely damaged by corrosion, the area should be painted. Please contact Steelscape to discuss the correct coating to repair the damaged area.

REPAIR OF PRE-PAINTED SHEET

Mild Staining

A household cream cleanser, used according to directions, will remove most mild staining from metal debris (one cup of mild, common detergent which contain less than 0.5% phosphate, dissolved in warm water are usually effective). Avoid the use of aggressive cleaners such as TSP.

Severe Staining

- Clean the surface by washing with a nonionic industrial or household detergent and water in proportions as recommended by the detergent manufacturer. Wash well with clean water.
- Remove the corrosion product by using a stiff nylon brush and washing off completely. More heavily affected areas may need a light rub with a Scotch guard tape pad (not steel wool). Abrasive papers should only be used if repainting is to be carried out.
- Great care must be taken not to cause damage to the paint film.
- Hose down the affected area completely after treatment.
- This treatment will normally leave only very mild stains.

222 West Kalama River Road, Kalama, WA 98625-9420 USA I Phone 360-673-8200 I Fax 360-673-8250

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ZINCALUME® Steel

Sealants for ZINCALUME® Steel

INTRODUCTION

This bulletin provides background information relating to sealants and their application when used in conjunction with the range of exterior ZINCALUME® Steel products produced by Steelscape. The sealant industry in the US produces a wide variety of building sealants which together embrace a multitude of end user applications and an even greater range of specific conditions.

Sealant Selection

The decision on which sealant is the most effective for ZINCALUME Steel products in a specific application should be based on several performance characteristics.

Neutral cure silicone rubber sealants will typically meet the performance characteristics outlined above for most applications. Other generic types of sealant such as polyurethane and butyl elastomers are readily available in tape, hot melt and cartridge forms. Once again the performance of these systems should be evaluated with your sealant supplier based on service condition and performance characteristics. The use of sealants means fastening, whether by integral forming or by individual fasteners is necessary where metal to metal joining is involved. For more information on fasteners and **ZINCALUME Steel, please refer to Technical Bulletin #3, "Fastener Selection for ZINCALUME Steel Roof & Siding Products."**

Physical Property of Sealant	Performance Characteristic
Adhesion	Good adhesion to bare and pre-painted ZINCALUME Steel, without pre-priming except in extreme service conditions.
Flexibility	No cracking or loss of adhesion during required bending at specified service temps.
Weatherability	No cracking, chalking, bleeding or loss of rubber characteristics after exposure to the damaging effects of ultra-violet rays (sunlight) and humidity.
Water Resistance	Adhesion to metal surface will not deteriorate after immersion in water.
Chemical Resistance	Good resistance to water, ozone, water vapor, and other chemicals that may be exposed to the sealant in service.
Non Corrosive*	Will not deteriorate, darken, etch or salt deposit bare or pre-painted ZINCALUME steel.
Staining	No contact or migratory staining of the bare or pre-painted ZINCALUME steel surface.
Non Sagging	Will retain original shape within the joint at specified service temperatures w/o sagging.
Printability	Over paintable if required.

***Note:** Sealants containing acetic acid or amines should not be used on ZINCALUME Steel; wet conditions during early stages of sealant cure can liberate by-products potentially corrosive towards protective coatings. These often smell of vinegar or ammonia.

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ZINCALUME® Steel

Cut Edge Protection of ZINCALUME® Steel

INTRODUCTION

The single aspect most frequently vexing prospective users of zinc-coated and zinc/aluminum alloy- coated steel sheet is cut edge performance. It is an established fact the sacrificial protection afforded to the steel at cut edges will delay corrosion while there is zinc or zinc/aluminum alloy left in the vicinity of the edges. Almost every metal coated steel product has cut edges and when piercing occurs within the area of the sheet a further "cut" edge is generated.

Prime examples of such products are roofing, guttering and spouting. These items are first slit-to-width then cut-to-length. Holes are often pierced to accommodate fasteners; however corrosion in these areas has never constituted a problem. Regardless of the environment, when more metallic coating is present, the steel has more protection both on flat unmarked surfaces and at cut edges.

Measure of Protection

Zinc/aluminum alloy hot dip metallic coated steel sheet is produced by passing continuous steel strip through a bath of molten metal. As the strip emerges from the bath the thickness of the coating is precisely adjusted according to the coating class required. The coating class is a designation describing the coating type and amount of coating applied.

The coating type is generally described by the capital letter of the chemical symbols of the metals in the coating. The amount of coating is indicated by the minimum "coating mass" measured by the triple spot test specified in ASTM A792/A792M– 06.

The severity of the intended application should dictate the coating class specified. Heavier coating thicknesses should be used in more severe environments.

Two Way Protection

The zinc/aluminum alloy metallic coating performs in two ways:

- The aluminum acts as a barrier when the steel base is completely enclosed by the coating. Protection is afforded by the corrosion resistance of the coating itself.
- As a sacrificial coating at edges when the barrier is broken by slitting, shearing, piercing or scratching. The barrier effect is universally recognized. However, it is the sacrificial protection this bulletin addresses.

Protection is Automatic

Complete coating of steel sheet products is not practical, economical or generally necessary. It is normal practice and has been since zinc-coated sheet has been produced, to have slit, sheared, drilled or sawn edges.

In service, galvanic action causes zinc compounds to automatically build up at cut edges and scratches by an electrolytic reaction when water or moisture is present. These slow the rate at which the surrounding coating is consumed around damaged areas. This effect is sometimes referred to as the "self-healing" property of coatings containing zinc.

Examples: Coating Classes AZ50 AZ = Aluminum/Zinc
50 = Minimum of .50oz./ft², the total on both sides.

Comparison of Zinc and Zinc/Aluminum Coatings

It is natural with the wide spread use of ZINCALUME® Steel sheet in traditional zinc-coated building applications, the question of comparative cut edge performance should be raised. Unpainted ZINCALUME Steel will perform in a very similar manner to zinc-coated sheet in the relatively thin range of thickness associated with roofing, wall cladding, gutters and down-pipes.

This has been tested by removing coating of similar thickness from ZINCALUME Steel and galvanized sheet down to the steel base, using scribe marks ranging from .016" to .16" in width. When exposed to the atmosphere, the differences in the samples are slight, particularly at the thinner scribe marks.

222 West Kalama River Road, Kalama, WA 98625-9420 USA I Phone 360-673-8200 I Fax 360-673-8250

ZINCALUME® Steel

Guidelines for Welding ZINCALUME® Steel

INTRODUCTION

ZINCALUME® Steel can be readily welded using resistance and arc welding techniques. Utilizing conventional welding techniques along with the guidelines given below, ZINCALUME Steel can be as easily welded as other coated sheet products. In general, the Al/Zn coating is soft and conductive compared to uncoated sheet steel and, therefore, requires higher welding currents, welding times and electrode forces for resistance welding. The parameters used for successfully welding ZINCALUME Steel sheet are very similar to those for galvanized sheet.

Spot Welding

The optimum tip geometry which provides the longest electrode tip life when spot welding ZINCALUME Steel sheet is the truncated cone with either a 90° or 120° included angle. Pointed, domed or radius electrodes should be used only where necessary for reasons of access or alignment.

Testing has shown that a dispersion-strengthened copper alloy electrode will provide superior electrode life and welding characteristics when compared to RWMA Class 2 Cu-Cr or Cu-Zr alloys. Typical spot welding schedules for ZINCALUME Steel sheet are given below:

Electrode maintenance is also important in spot welding coated sheet steels. The parameters given above will cause gradual deformation of the contact surfaces as well as the coating alloying with the electrode material. These factors require the electrodes be redressed more frequently than is the case with uncoated steel. The electrode tips should be redressed periodically, but the time between re- dressings depends on the sheet thickness and conditions of use. Additional factors influencing electrode life are proper tip alignment and sufficient water cooling (minimum 2 gal/min) to the electrode.

The peel test, which is commonly used as a measure of nugget size and weld soundness, can be used to test the quality of spot welds on ZINCALUME Steel sheet. Test specifications vary among manufacturers, but in general, two coupons are welded together and then peeled apart. Under proper welding conditions, failure should occur around the weld, not through the weld. The nugget diameter should approximate the diameter of the electrodes.

Seam Welding

The conditions for seam welding ZINCALUME Steel sheet are similar to those for galvanized steel in that higher currents and closer control of welding schedules are required than for uncoated sheet steel. Intermittent current feed is preferred over continuous current and 0.5-inch radius faced electrodes can be used for all sheet thicknesses if desired.

Schedules for seam welding ZINCALUME Steel sheet are

Material Thickness (in.)	Welding Current (amperes)	Electrode Force (lb)	Welding Time, Cycles (1/60 second)	Electrode Face Diameter (in.)
0.028	11,300	400	12	0.187
0.036	12,500	500	14	0.250
0.040	12,800	500	14	0.250
0.053	13,000	550	14	0.250
0.065	13,400	650	18	0.250

Actual requirements will vary depending on the job conditions.

Material Thickness (in.)	Electrode Face Type	Electrode Thickness (in.)	Electrode Force (lb.)	Welding Current (amperes)	Weld Time Cycles Heat	Weld Time Cycles Cool	Welding Speeds (in./min)
0.017	1/2" Radius	3/8	700	14,500	2	2	60
0.022	1/2" Radius	3/8	850	16,000	3	2	60
0.034	1/4" Flat	1/2	1,000	21,500	4	2	60
0.049	1/4" Flat	1/2	1,100	22,000	4	2	60
	1/4" Flat	1/2	1,100	23,000	4	1	90
0.083	5/16" Flat	5/8	1,600	27,000	10	6	30

suggested in the table above. As with the spot welding schedules, the conditions below may need alteration depending on the job.

Seam welding wheels should be RWMA Class 2 copper alloy. Knurled wheels are preferred because the knurled drive rollers continuously remove pick-up from the sheet coating and maintain a constant face width, thus eliminating the need for redressing. The electrode wheels in the weld area should be flushed with water during welding to provide adequate cooling.

High/Low-Frequency Welding

ZINCALUME Steel has been fabricated into products such as tubing using both high-frequency and low frequency welding techniques. Standard procedures similar to those employed for galvanized or aluminum coated steels are used. Since the coating may smear at sheared or slit edges, it may be necessary to scrape the sheet edges prior to welding.

Arc Welding

Gas tungsten-arc (TIG) welding of ZINCALUME Steel is not recommended because, as with galvanized sheet steel, fumes generated during welding tend to contaminate the tungsten electrode and cause instability of the arc. Shielded metal-arc welding is best accomplished using E60XX electrodes, such as E6010, E6011 or E6012. A whipping technique is often used to burn off the coating ahead of the puddle. For gas metal-arc (MIG) welding, a mild steel wire should be used with Ar/1% 02 or Ar/CO2 shielding gas. Gas containing Ar provides a more stable arc resulting in better bead appearance and significantly less weld spatter. When a backup plate is used, the plate should be grooved under the weld to provide better penetration and venting of fumes from the underside of the weld.

Fuming

In arc welding, the total weight of evolved fumes per unit weld area for ZINCALUME Steel sheet is 25 percent of the amount for galvanized. The ratio of the amount of zinc oxide released from ZINCALUME Steel is only 20 percent of the amount released from galvanized sheet. The decreased fuming of ZINCALUME Steel represents a reduced fume hazard to welders, but the extent of fuming is still sufficient to require the use of fume hoods and/or forced exhaust systems. Fuming during resistance welding is very slight and special exhaust systems should not be needed.

Corrosion Resistance of Welds

As is the case with other coated sheet steels, spot and seam welding may remove the coating from ZINCALUME Steel sheet exposing the base steel. These areas may be too large to be galvanically protected by the adjacent coating and should be covered with metal-sprayed zinc or aluminum, zinc-rich paint or organic coating. Covering the weld area of arc welds is especially important because the damage to the coating is even more severe.

222 West Kalama River Road, Kalama, WA 98625-9420 USA I Phone 360-673-8200 I Fax 360-673-8250

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ZINCALUME® Steel

Unsuitable Applications for ZINCALUME® Steel

INTRODUCTION

ZINCALUME® Steel has proven to exhibit superior corrosion resistance in a diverse range of environments including those in rural, industrial, marine and severe marine regions of the country.
Atmospheric corrosion testing for more than 30 years has clearly shown that ZINCALUME Steel has at least 2-4 times the life span of galvanized G90 in these environments. However, with even the most revolutionary materials there are specific end user applications into which ZINCALUME Steel should not be placed without careful consideration as to the ultimate performance.

These applications, and issues to be considered within these applications, are summarized in this Technical Bulletin to assist in the correct selection of materials.

Animal Confinement

Structures erected to house the intensive farming activities of pigs, cattle, turkeys and chickens can present problems for ZINCALUME Steel. This form of animal confinement can result in the creation of animal waste and waste decomposition by-products which can be extremely aggressive towards ZINCALUME Steel, creating significant corrosion problems.

Waste decomposition gases such as methane, hydrogen sulfate and ammonia can combine with water vapor to form a highly corrosive compound which condenses on the bottom side of the steel roof panel, resulting in an extremely corrosive attack. Direct contact with animal wastes should be avoided regardless of the type of material employed in the construction of the building. Good panel insulation, ventilation and frequent waste removal will assist in maintaining the longevity of such a structure; however we recommend the following guidelines

- ZINCALUME Steel (bare or painted) should not be used for cattle, pig or poultry confinement due to the risk of the corrosive process outlined above. Heavy zinc coated galvanized or aluminum products should be used for these applications.
- ZINCALUME Steel will perform favorably in the majority of other agricultural applications. Such structures include storage sheds, silos, grain bins and other utility farm buildings.

Concrete

ZINCALUME Steel is not suitable for use with wet concrete mixtures (including mortar or stucco). It is not recommended for use in framework and floor deck applications. The aluminum in the ZINCALUME Steel coating will react with the wet concrete leaving the coating porous and prone to corrosion. Adhesion between the concrete and ZINCALUME Steel is poor and the concrete itself can expand and lose strength. Small splashes of concrete onto ZINCALUME Steel are damaging, and should be removed when wet.

Culverts

ZINCALUME Steel is not recommended for applications involving burial in the earth or soil. Soils vary widely in moisture content, acidity or alkalinity. Objects buried in the soil can be subject to bacterial activity and oxygen levels can be highly variable. ZINCALUME Steel is more sensitive to low oxygen levels and lack of passivity than galvanized products, hence heavy coating mass galvanized would be the recommended product under these conditions.

Miscellaneous Sources of Aggressive Substances

The following specific applications should also be treated with caution. Contact Steelscape to seek advice on the correct material to use in these instances.

- Some chemical, food processing and acid pickling plants where chemicals, acids and alkalis are present such that when combined with water vapor and dew point effect.
- Direct contact with or runoff from green lumber or chemically treated lumber containing copper. A white paper on ZINCALUME Steel contact with pressure-treated wood is available upon request. **Where copper/chrome/arsenate treated lumber is specified it must be well dried after treatment and insulated from the roof.**
- Copper containing mildew inhibitors, such as copper oxychlorate, should not come in contact with ZINCALUME Steel. Rinse immediately if contact occurs.
- Dirt, leaves and build-up of organic matter.
- Avoid direct contact with the ground/soil, foundations or sills.
- Food or beverage container or contact should be avoided. The surface treatments used in ZINCALUME Steel can become soluble when in contact with food acids.
- Sustained or frequent temperatures in excess of 390°F should be avoided with ZINCALUME Plus Steel (acrylic coated).

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ZINCALUME® Steel

Guidelines to the Effective Use of ZINCALUME® Plus Steel

INTRODUCTION

The standard ZINCALUME Plus Steel coating is a specially formulated water-based resin film, which is factory applied over the ZINCALUME Steel surface. In the cured state the coating is colorless, odorless and imparts a satin finish to the surface of the product. It aids in the roll forming process often eliminating the need for lubricants and also prevents fingerprinting.

The clear resin film is applied wet, using state-of-the-art roll coaters installed between the chromate application station and the delivery section. The roll coaters are similar in design and operation to those used on a coil coating line. The film is cured using computer controlled ovens. This ensures that optimum coating properties are achieved prior to rewinding and shipping.

The resin film has excellent adhesion to the substrate with very good impact resistance and flexibility. When it is used without post painting, the natural weathering process will gradually erode the clear coating from the surface over a period of 12-18 months, without powdering, peeling or cracking. No significant changes in surface appearance will be evident.

In addition to the standard ZINCALUME Plus coating, we also offer a resin film designed specifically for end-use applications that involve adhesives such as plywood sandwich panels and foam insulation. A Steelscape Sales Representatives can help to determine which resin film is right for any specific end-use application.

FIELD PAINTING GUIDELINES

Wet Painting

Both ZINCALUME Steel and ZINCALUME Plus Steel are readily over painted provided paint manufacturer's recommendations are followed and appropriate consideration is given to environmental conditions, end use, location and product application. Traditionally ZINCALUME Steel requires the surface to be painted also be washed with a suitable solvent to remove traces of residual roll forming lubricant, and suitable metal primer be applied before the application of a decorative topcoat.

ZINCALUME Plus Steel removes the requirement to use solvent to clean up surfaces. A simple detergent wash is satisfactory, and eliminates the need to prime the surface. Solvents or harsh chemical cleaners should not be used. ZINCALUME Plus Steel can be readily over-painted with a high quality water based acrylic topcoat without priming, provided a lubricant has not been used in the forming process and the surface is clean and dry.

Solvent based finish coat systems may be used, however, these must be applied after the material has been primed with a water based, solvent resistant primer. If the material is correctly primed a number of coats may be applied. Surface preparation and priming must be in accordance with the paint manufacturer's instructions.

Additional cleaning recommendations and field painting guidelines can be found in **Technical Bulletin #11 "Guidelines for General Field Maintenance of ZINCALUME Steel Roofing and Siding"**

Powder Coating

ZINCALUME Plus Steel is suitable for direct powder coating, provided the surface to be coated is clean and powders requiring a peak metal temperature in excess of 390°F are not used. It is recommended a brief

water wash serve as the only pretreatment step, rather than another form of solvent-based cleaning solution. Condensation can also occur on tightly bundled stacks of sheets or panels of ZINCALUME 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 ZINCALUME Steel sheet is not immune to this type of oxidation.

Roll forming Characteristics

Lubricants are rarely required during the roll forming of ZINCALUME Plus Steel because the clear resin film acts as a solid lubricant. The need for additional lubricant must be determined, however, on a case by case basis. Variables to be considered include roll former design, (number of stands and severity of each incremental shape change) speed, surface condition of rolls and general machine maintenance.

Most common roof and sidewall trapezoidal shapes do not require additional lubrication if the roll former is well maintained and correctly set up. Very severe profiles may require a small amount of spot lubricant at the heaviest worked points.

BENEFITS OF USING ZINCALUME PLUS STEEL:

- **No Pickup** - The reduction or absence of pickup during forming due to the resin film means the reduction or elimination of time-consuming cleanup.
- **Increased Tool Life** - Reduced pickup combined with the lubricating benefits of the resin film will contribute to improved tool life in manufacturing and roll forming applications.
- **Scheduling Flexibility** - ZINCALUME Plus Steel can typically be roll formed interchangeably with pre-painted feed avoiding the need for intermediate roll cleaning. This provides greater scheduling flexibility.
- **Removal of Hazardous Work Place Chemicals** - Hazardous substances such as kerosene and other lubricants can be removed from the work environment improving occupational health and safety practices.
- **Less Slippery** - The resin film is less slippery than a lubricated steel surface particularly with the absence of residual lubricant left over from roll forming. This will make the product safer to walk on while installing, particularly in wet conditions.
- **Improved Final Appearance** - Residual lubricants can often create a patchy visual appearance as the result of uneven drying off of the lubricant. This problem can usually be avoided with ZINCALUME Plus Steel.

Resistance to Marking

ZINCALUME Plus Steel resists marking and stains occurring during manufacturing, handling or fixing. The coating acts as a surface sealant, protecting the metal surface from hand and boot prints. **CAUTION** - during transportation of coil, sheets or formed panels, galling or abrasion of the resin coating can occur when one resin surface vibrates, or rubs, excessively against another resin surface. It will present as black marks, which are often mistaken for black rust, but it is not rust. Galling of the resin surface is strictly aesthetic in nature; the long term performance of the product is unaffected.

Wet Stack Storage Stain Resistance

The resin coating has an increased resistance to wet stack storage stain. Such stains appear black, and are caused when the material is packaged and subjected to moisture ingress between production and final use. The coating acts as a barrier coat, preventing any chemical action from occurring. Recommended storage should still be followed as outlined in **Technical Bulletin #1 "General Guide to Good Practice in the Use of ZINCALUME® Steel for Roofing & Siding Products" and Technical Bulletin #10 "Prevention of Oxide Formation (Black Rust) on ZINCALUME Steel During Transportation, Processing and Storage".**

INSTALLATION OF ZINCALUME PLUS STEEL

Flashings

The recommendations for flashing ZINCALUME Plus Steel are the same as for ZINCALUME Steel. Copper and lead are incompatible with ZINCALUME Steel and neither of these metals should be used in contact with

ZINCALUME Plus Steel. For further information refer to **Technical Bulletin #2 "Flashing Materials for Bare & Pre-painted ZINCALUME Steel."**

Sealants

Tests show common neutral cure silicon sealants will adhere to the resin film. The adhesion properties of the resin film are the same as ZINCALUME Steel. Refer to **Technical Bulletin #5 for "Sealants for ZINCALUME Steel" for additional information.**

Fasteners

Recommended fasteners for ZINCALUME Plus Steel are the same as for ZINCALUME Steel. Refer to **Technical Bulletin #3 for further information on "Fastener Selection for ZINCALUME Steel Roof & Siding Products."**

Slitting ZINCALUME Plus Steel

Where friction drag pads are used to maintain processing tension during slitting/recoiling, pickup of the resin can occur. Some chromate is present in this pickup, as it is with most ZINCALUME Steel, therefore, the following guidelines are recommended:

- Use minimal frictional forces on pads.
- Set minimum pad width 6" to minimize frictional forces if drag pads are used.
- Encourage use of an appropriate respiratory device for personnel working in close proximity (4-6 Feet) if dust is produced by the drag pad.
- Remove pickup from drag device and adjacent areas using appropriately designed apparatus.
- Dispose of drag pads in accordance with environmental or local regulations.

Welding

Spot, seam or gas metal arc welding can be carried out successfully on ZINCALUME Plus Steel. Fume generation may be slightly higher than ZINCALUME Steel without the coating. All welding should be carried out in well ventilated areas.

High Temperatures

The maximum recommended continuous service temperature is 390°F. Service temperatures exceeding 390°F will be detrimental to the coating. Applications requiring operating temperatures up to the 600°F safe limit for ZINCALUME Steel should be specified without the resin film.

General Corrosion Characteristics

The ZINCALUME Plus coating does not improve the general corrosion characteristics of ZINCALUME Steel. As discussed in the introduction the coating degrades when exposed to ultra violet light. The resin film will not negatively impact the superior corrosion performance of ZINCALUME Steel.

Product Mixing

ZINCALUME Steel and ZINCALUME Plus Steel should not be mixed in adjacent areas on the same building. The different surface finishes, both in the new and weathered conditions, will result in a contrasting appearance which may be objectionable.

Visual Reflectivity

ZINCALUME Plus Steel is no more reflective than ZINCALUME Steel.

Electrical Conductivity

The resin film applied to ZINCALUME Plus Steel can potentially cause an insulating effect between panels in electrical appliance applications. The insulating effect would normally be overcome with welding or mechanical fastening of components. Manufacturers should be advised to ensure products are adequately grounded.

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ZINCALUME® Steel

Prevention of Oxide Formation (Black Rust) on ZINCALUME® Steel During Transportation, Processing and Storage

INTRODUCTION

ZINCALUME® 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 ZINCALUME 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 ZINCALUME 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.

SOURCES OF OXIDE FORMATION ON ZINCALUME STEEL

Oxide stains can occur on either coils or tightly bundled sheets of ZINCALUME 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 ZINCALUME Steel is water or moisture interacting with the metallic coating in an oxygen-deficient environment. Under normal service conditions, ZINCALUME 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.

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 ZINCALUME 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 ZINCALUME 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 ZINCALUME Steel sheet is not immune to this type of oxidation.

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 ZINCALUME Steel is not immune to wet storage oxidation.

Other sources of oxidation could evolve during processing of the ZINCALUME Steel itself. Inadequately cured surface treatments 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.

PREVENTION OF OXIDE FORMATION ON ZINCALUME STEEL

The Steelscape ZINCALUME 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. Steelscape recommends, depending on what treatment an order has received, coils should be properly stored no longer than the periods listed below.

Product Ordered	Max. Storage Period after Ship Date
ZINCALUME Steel - Oiled/No Chem.-treat	3 months
ZINCALUME Steel - Chem.-treat/Dry	4 months
ZINCALUME Steel - Chem.-treat/Oil	6 months
ZINCALUME Plus Steel	6 months

Responsibility of the Steel Fabricator

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

- Order ZINCALUME Steel product with an optimum combination of surface treatment, oil and coil packaging.
- Verify any transit carriers adhere to shipping instructions and provide optimum protection to the steel coils during transit to the fabrication plant.
- Inspect ZINCALUME Steel coils for moisture upon arrival and stock ZINCALUME Steel coils indoors in a clean, dry area away from any sources of chemical pollution.
- Establish defined coil receiving inspection procedures which establish carrier responsibility.
- Document transit-related water damage on the manifest. Photos or video must be taken of any questionable condition.

  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.).
- **Notify Steelscape as quickly as possible when oxidation of the surface is confirmed.**
- Store ZINCALUME Steel product at an even temperature above the dew point with adequate air circulation to prevent condensation problems.
- 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.

- Inspect the storage site regularly to ensure standing moisture has not penetrated the ZINCALUME Steel coils.
- 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.
- Ensure ZINCALUME Steel roll formed sheets are paper-wrapped when the sheets are not scheduled for erection on the day of delivery.
- Avoid using plastic material for covering. Non-breathing materials should not be used to shroud bundles because they tend to trap moisture.
- 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 ZINCALUME 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.*

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.

Removal of Oxide Stains on ZINCALUME Steel.

The oxide stain (black rust) that forms on ZINCALUME 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 ZINCALUME 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 ZINCALUME 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.

222 West Kalama River Road, Kalama, WA 98625-9420 USA I Phone 360-673-8200 I Fax 360-673-8250

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ZINCALUME® Steel

Guidelines for General Field Maintenance of ZINCALUME® Steel Roofing and Siding

INTRODUCTION

Minimum maintenance of ZINCALUME® Steel, whether bare or pre-painted, is required. Both are highly durable and simple maintenance by regular washing with clean water will enhance the service life of the product and maintain the appearance.

"Unwashed areas" are areas on a building that are sheltered from general rainfall and are therefore not naturally washed. Condensation can be absorbed by the dust and dirt that build up in these areas, leading to an increase in the time that the material is in contact with sufficient moisture to initiate corrosion. The associated affect is exacerbated in the vicinity of a salt marine influence, where the build-up includes marine salts and/or other pollutants. Regular cleaning of ZINCALUME Steel products in unwashed areas is required. Examples include, but are not limited to, fascia, wall cladding under eaves, garage doors, and the underside of eave gutters, carports and patios.

Washing should be done six monthly as a minimum. More frequent washing may be necessary in coastal areas or where high levels of industrial fallout/pollution occurs.

Cleaning

While factory-applied finishes for metal building panels are so durable that they will last many years longer than ordinary paints, it is desirable to clean them thoroughly on a routine basis whenever the finish is not washed by rain. Cleaning will generally restore the appearance of these buildings and render repainting unnecessary. An occasional light cleaning will also help maintain an aesthetically pleasing appearance.

In cases where regular maintenance using fresh water does not remove all dirt from the surface of the product the following procedure should be used;

- Wash the surface with a mild solution of pure soap or non-abrasive dish washing detergent in warm water. Washing should be conducted with a sponge, soft cloth or soft bristle nylon brush (no abrasive scourers, steel wood, etc). Care should be taken not to scuff the surface of the product.

Note: *The use of detergents containing greater than 0.5% phosphate is not recommended for use in general cleaning of building panels.* ***NEVER BLEND CLEANERS AND BLEACH.***

- As an alternative one cup of household ammonia dissolved into five gallons of water (room temperature) could also be used.
- Using either solution work from the top to the bottom of the panels, gently removing dirt and debris. A low pressure spray washer may aid in removing dirt deposits. Solvent-containing cleaners, such as Fantastic®, are effective and can be used without concern.
- If mildew or other fungal growth is a problem and cannot be removed, a mix of household bleach, one gallon to five gallons water, together with one cup of mild soap (Ivory® is recommended), can be used.
- The surface should be thoroughly rinsed with freshwater immediately after cleaning to remove traces of any detergent or cleaner.

Additional Maintenance

The long term performance of ZINCALUME Steel can at

times be impacted by the durability of the accessories which are in contact with the product. For example, the deterioration of the fasteners used can result in sacrificial corrosion of the product in the areas immediately adjacent to the fasteners. It is a good practice to;

- Ensure that fasteners used comply with **Technical Bulletin #3 "Fastener Selection for ZINCALUME Steel Roof and Siding Products"**
- Regularly inspect the fasteners and consider replacing any showing evidence of red rusting.

FIELD PAINTING

Pre-painted ZINCALUME Steel and ZINCALUME Plus Steel are both coated with factory applied, oven cured coatings. While both are intended to be installed as is and will have long term durability and performance, there may be instances when field painting over the factory finish is required. The guidelines presented here are also applicable to bare ZINCALUME Steel. The following should be considered;

- Air drying paints have different weathering characteristics to pre-painted ZINCALUME Steel and are typically not as durable. Areas field painted with air dry paints to match adjacent factory applied areas may weather different over time and therefore vary in appearance.
- The color and gloss of air dry paints may not exactly match that of the factory applied paint.
- Field painting over the factory applied finish voids any originally issued paint warranties.

Surface Preparation

It is normal practice to ensure that any surface to be painted is in a suitable condition for painting. The most appropriate preparation is dependent on the age and condition of the surface.

Any dirt, debris or mildew must be removed; follow the cleaning guidelines outlined above in this bulletin. Rinse the surface thoroughly as residual cleaners or detergent left on the surface could result in poor adhesion of the field applied coating.

Bare ZINCALUME Steel product should be cleaned with solvent to remove any rolling oils or lubricants. Rinse thoroughly and allowed to dry completely.

Minor scratches which have not left the metal substrate exposed can be lightly sanded or buffed to create a smoother surface. Care must be taken to avoid exposing the substrate.

To prevent rust from forming on exposed metal, sand the general area lightly and use a high-quality primer to protect the exposed metal from corrosion. Allow sufficient time (normally 24 hours) for the primer to dry before applying the topcoat. If either red or white rust is evident, remove as much rust as possible with a wire brush, and then sand lightly to remove all rust. Wipe the exposed area with mineral spirits before priming.

Field Paint Types

The most suitable field paint type is generally water-based acrylic. However, in more corrosive salt marine locations, or for severely rusted material, it may be necessary to choose a paint system that has enhanced corrosion resistance such as a zinc-rich primer.

Due to ongoing improvements in paint technologies, at any given time there are numerous potentially suitable paint products available. It is therefore recommended that a reputable paint supplier or contractor be consulted to determine the most appropriate paint system for your particular applications and environment.

- Read manufacturer's instructions and observe them explicitly. Thorough mixing is essential.
- It is not advisable to use different brands of primers and finishing coats in conjunction with one another. Do not over paint water-based paints with oil or organic solvent-type paints.
- At all times, avoid excessive paint film thickness such as may occur in the valleys of formed roofing panels.
- When extensive areas are to be covered, spray painting can lower cost while giving acceptable results. The paints used, however, must be formulated for this purpose.
- Work safely. Wear proper safety equipment; ensure good ventilation in paint handling; avoid unnecessary contamination of the skin.

TOUCH-UP PAINT

Scratches and very minor damage may occur during handling and installation of painted roofing and walling. In these instances, it may be desirable to use touch-up paint to repair the blemishes. Keep in mind touchup paints are quick fixes and when used properly will result in satisfactory appearance. Misuse or over-use can result in spoiling the overall appearance.

Small scratches that do not penetrate through the metallic coating of the ZINCALUME Steel and are not noticeable from 6ft. should be left alone as the metallic coating will protect against corrosion.

Surface Preparation

Edges of deep scratches should be lightly sanded or "feathered" with 400 grit sandpaper. If a scratch extends through the paint and the protective metal layer exposing raw steel, it should be treated with a zinc rich or similar primer before touch-up application. If feathering and/or priming are not necessary, areas to be touched-up should at least be wiped with mineral spirits to remove dirt, wax or other contaminants before colored touch-up is applied.

Paint Application

The recommended paint type for touch-ups is an acrylic silicone paint which can be found at local paint stores. Many panel fabricators have touch-up paint available in their standard colors as well.

Special attention should be paid to the manufacturer's instructions, including direct skin or eye contact, ventilation and potential flammability. Aerosol or spray applications are not recommended for blemish or scratch repairs. The best tool for this type of repair is a good quality, 1/4-in. artist brush or a pen tip type applicator; only the narrow edge of the applicator should actually contact the scratch or blemish. Use touch-up paint sparingly and only to cover up those areas where paint has been removed. Excessive use of touch-up paint will result in a blotchy, uneven, appearance.

222 West Kalama River Road, Kalama, WA 98625-9420 USA I Phone 360-673-8200 I Fax 360-673-8250

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ZINCALUME® Steel

Guidelines to Installation of Photovoltaic Panels on ZINCALUME Steel

INTRODUCTION

When installing photovoltaic (PV or solar) panels to roofing made from ZINCALUME Steel the following installation and maintenance practices will assist in maintaining the water tightness and durability of the roof. This technical bulletin relates to the installation of framed PV/solar panels mounted above ZINCALUME Steel roofing.

INSTALLATION CONSIDERATIONS

Clearance Between the Panels and the Roof

PV/solar panels installed on a ZINCALUME Steel roof shield the roof from the sun and prevent beneficial washing from rainfall. Areas on the roof directly beneath the panels are considered to be unwashed and may be subject to accelerated corrosion due the accumulation of dirt, salt and other airborne contaminants which may retain moisture for extended periods due to condensation or high humidity. The provision of adequate clearance between PV/solar panels and roofing will help to:

- Facilitate self-cleaning and limit the build-up of leaves and other debris.
- Provide sufficient access for the cleaning, inspection and maintenance of the roofing material, including removal of any accumulated contaminants, and fasteners beneath the panels.
- Allow air flow to quickly dry areas beneath the PV/solar panels. This may also be beneficial to the performance of the PV/solar panels as electrical output is usually temperature dependent.

Compatibility of Materials with Roofing Made from ZINCALUME Steel

Dissimilar metals, such as stainless steel, lead, brass, copper and copper containing alloys should not be used in direct contact, or contact that could create an electrical connection, with roofing made from ZINCALUME Steel. This also includes conductive seals, washers and gaskets. Refer to **Technical Bulletin #2 "Flashing Materials for Bare and Pre-painted ZINCALUME Steel"** and **Technical Bulletin #3 "Fastener Selection for ZINCALUME Steel Roof and Siding Products**" for additional information on dissimilar metals and galvanic corrosion.

Avoid PV/solar panels, or any introduced flashings, which utilize materials such as copper and lead as these materials have the potential to create water run-off onto roofing made from ZINCALUME Steel resulting in galvanic corrosion.

Ensure any sealant in contact with ZINCALUME Steel is "neutral cure" silicone.

Timber used in direct contact with roofing made from ZINCALUME Steel that has the potential to become damp can result in accelerated corrosion of the roofing. Furthermore, treated lumber has the potential to leach and drip corrosive substances onto the roof. Use of lumber on the top surface of the roof should be avoided.

Avoiding Potential Damage to the Roof

Foot traffic can dent, scuff, or scratch the ZINCALUME Steel roof.

Dents may need to be rectified to avoid water ponding, which is more likely on low pitch roofs. Ponded water

exposes ZINCALUME Steel to an extended period of wetness which may increase the potential for corrosion or water ingress.

Scuffing is typically an aesthetic issue that is unlikely to have any detrimental effect on the performance of roofing made with ZINCALUME Steel.

Maintaining Water Tightness of the Existing Roof

The installation of PV/solar panels should allow for free drainage of moisture from all surfaces. Avoid ponding water.

Any penetrations through the roof should be placed in such a manner so as to minimize the risk of water ingress. Penetrations through the roofing should be properly sealed using appropriate flashings, sleeves and/or sealants. Non-penetrating attachment clamps are recommended if the design allows.

Avoid valley fixing or valley holes for electrical cables.

PV/solar panel fasteners and brackets should be installed away from sheet side laps as they may distort the profile and interfere with the specifically designed anti-capillary laps, leading to water ingress.

Rainwater Collection

If rainwater is collected from the roof, check with the PV/solar panel supplier to ensure it does not adversely affect water qualify.

Fasteners and Brackets

Fasteners and brackets used in the installation of PV/solar panels should have a service life comparable to the expected performance of the ZINCALUME Steel. This includes the replacement of any corroded roofing fasteners that will be located beneath the new PV/solar panels.

Swarf

During installation swarf should be removed daily. Refer to **Technical Bulletin #4 "Prevention of Damage to ZINCALUME Steel Roof and Siding Products from Metal Filings"** for additional information.

Electrical Cables

Electrical cables should not sit directly on the roof panels as this may lead to the accumulation of dirt, salt and other contaminants. Cables should be affixed to the PV/solar panel support structure.

Grounding

Ensure appropriate grounding of the PV/solar system. Stray currents to the roof made with ZINCALUME Steel may accelerate corrosion.

MAINTENANCE

Unwashed areas have an increased risk of corrosion compared to washed areas, regular cleaning is recommended. Generally, unwashed areas should be cleaned with fresh, potable water, at least every 3 months for coastal or industrial areas, and at least every 6 months in other applications. This may coincide with periodic PV/solar panel cleaning. Maintenance should also include an inspection of the roofing fasteners, as well as the surface condition of the ZINCALUME Steel. For further guidance on maintenance refer for **Technical Bulletin #11 "Guidelines for General Field Maintenance of ZINCALUME Steel Roofing and Siding".**

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ZINCALUME® Steel

Hawaiian Islands: Exceptions to Standard Limited Warranty, Cleaning and Panel Design Recommendations

INTRODUCTION

The volcanic activity on the big island of Hawaii is a unique but well understood natural feature. Two of the primary emissions from the vents located at Kilauea are hydrogen sulfide and sulfur dioxide. These particulates often result in the well known island haze called VOG. These two components when mixed with water droplets in the surrounding air can result in the formation of sulfuric acid which can become acid rain. Acid has long been known to cause corrosion on ZINCALUME® steel, both painted and bare, but historically the levels of sulfur on the island of Hawaii has been such that routine rainfall provided enough cleaning of roof panels to prevent any type of premature corrosion.

Unfortunately, the situation at the Kilauea summit has changed dramatically over recent years and even months. The opening of a vent at the Halema`uma`u crater in December 2007 resulted in much higher levels of sulfur dioxide being released into the environment; an estimated 750-2,000 tons/day. In May 2018 numerous new fissures opened along the Eastern Rift generating large, continuous lava flows as well as significant volumes of corrosive gases and ash. Due to the increased corrosiveness on Hawaii, Steelscape is undertaking a large scale exposure study to determine the best substrate, paint and panel design to minimize pre- mature corrosion. Until the results of this study are available, the following limited warranty exceptions and recommendations have been developed.

LIMITED WARRANTY GUIDELINES AND EXCEPTIONS

Big Island of Hawaii

For orders accepted after December 1, 2010, the below ZINCALUME® steel limited warranty durations and distances will be in effect. All the standard and current ZINCALUME® steel limited warranty conditions and provisions will apply.

Distance from Halema'uma'u and/or Pu'u O'o Vents*	Limited Warranty Duration
0 – 30 miles	Site Exception Review Required
>30 miles	Standard 25 years

*Halema'uma'u Vent 19°24"24.19'N 155°17'01.02"W
Pu'u O'o Vent 19°23'21.47"N 155°06'20.51" W

Other Hawaiian Islands

The other Hawaiian Islands will be subject to the current standard ZINCALUME® steel limited warranty.

An exception to our limited warranty should be requested for any sites, Hawaiian or otherwise, located within one mile of the ocean as this zone is defined as aggressive marine. Failure to submit a limited warranty request for aggressive marine locations may result in a voided warranty.

RECOMMENDING CLEANING PRACTICES

Big Island

Roof panels should be washed down with fresh water for a period of time sufficient to remove any debris, dirt or pooled water from the surface. Fresh water for the purposes of this technical bulletin is defined as potable, or drinkable with a 6-9pH. It is especially important that no dirt or debris be left at the drip edges

of the roof panels. No cleaning solutions are necessary and panels should not be scrubbed. Recommended cleaning frequency is below.

During periods of active eruptions cleaning should be more frequent. Ash and debris should not be allowed to accumulate on panel surfaces for long periods.

Distance from Halema'uma'u and/or Pu'u O'o Vents*	Recommended Cleaning Frequency
0 – 10 miles	Monthly
11 – 20 miles	Every Two Months
21 – 30 miles	Every Four Months
>30 miles	Every Six months

*Halema'uma'u Vent 19°24"24.19'N 155°17'01.02"W
Pu'u O'o Vent 19°23'21.47"N 155°06'20.51" W

PANEL DESIGN

Panel Design and Effect on Corrosion

Our field inspections conducted to date indicate that panel design may play a significant role in the rate of corrosion due to acid rainfall and VOG from the volcano. Panels with an exposed cut edge and corrugated profile tend to hold small amounts of water and debris at the very edge due to capillary action. Over time this concentration of acidic water and particulate matter begins to corrode the paint and eventually the substrate.

Silt accumulation on a panel without a drip edge. Blistering of the paint is an early sign of corrosion.

Profiles with a hemmed drip edge allow water and debris to flow off the panel, thus providing better long-term corrosion performance.

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