Technical Bulletin 10

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# Cut edge and bend protection of next generation ZINCALUME® steel and COLORBOND® steel

## INTRODUCTION

In 2013, after 17 years of testing and development, BlueScope introduced its patented Activate® technology.

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. This Technical Bulletin provides some comparison between next generation ZINCALUME® steel, next generation COLORBOND® steel and their respective predecessors.

Next generation ZINCALUME® steel with Activate® technology (AM) and aluminium/zinc coated steel (AZ) are 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 controlled according to coating class required.

The coating class is a designation describing the coating type and amount of coating applied. The coating type describes the elemental makeup of the coating and, generally speaking, is described by the capital letters of the chemical symbols of the metals in the coating. The amount of coating is indicated by the minimum "coating mass" in grams per square metre (total of both surfaces), measured by the triple spot test specified in Australian Standard AS1397:2011 - *Continuous hot-dip metallic coated steel sheet and strip –*

**Figure 1: Schematic of a cut edge (not to scale)**

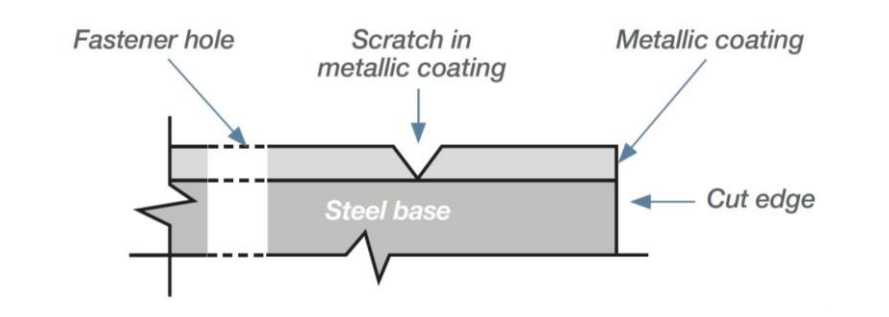
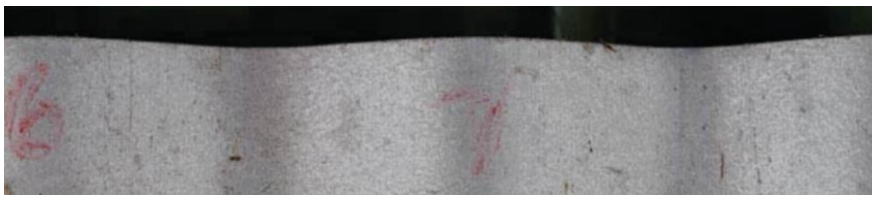



**Figure 2: Unpainted sheltered walling (i.e. unwashed) in a severe marine environment after 50 months.**

**AZ150**

**Dark areas indicate metallic coating originating from the cut-edge**



**AM125**

NOTE: The samples shown in Figure 2 have been tested in a severe environment to accelerate corrosion rates. Use of the product in this location is not recommended by BlueScope.

*Coatings of zinc and zinc alloyed with aluminium and magnesium.*

Examples: Coating Classes AZ150, AM125

AZ = aluminium/zinc;
AM = aluminium/zinc/magnesium
150 = 150 grams per m2
(minimum, total of both surfaces)
125 = 125 grams per m2
(minimum, total of both surfaces)

## CUT EDGES

Unprotected edges are created on coated steel products when the sheet is cut or pierced. Examples include when roofing or walling is cut to length or when holes are made in the steel to accommodate fasteners. It is normal practice to have edges that have been slit, sheared, drilled or cut on site using a cold cutting saw. *Figure 1* shows a schematic of a cut edge.

When AM is in service, galvanic action of the metallic coating causes zinc, aluminium and magnesium to sacrificially corrode in order to protect the exposed steel at cut edges. These corrosion compounds build up at cut edges and scratches and slow the rate at which the surrounding coating is consumed. This effect is sometimes referred to as the "self-healing" property of metallic coatings containing zinc.

### ZINCALUME® steel with Activate® technology

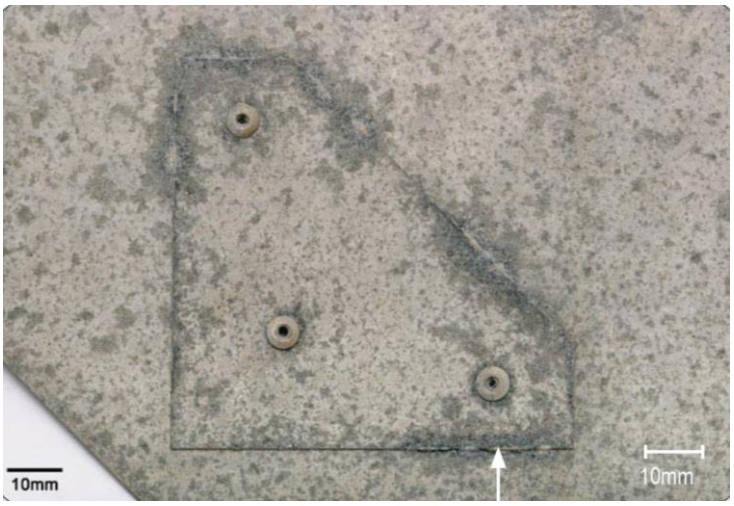
For unpainted products, a combination of both coating mass and coating type determine how effectively a metallic coating is able to protect cut edges. In general, within a particular coating type, it can be said that the higher the coating mass, the greater the level of protection (e.g. AM150 provides a greater level of protection than AM125). However, different coating types can also have significantly different levels of protection. For example, next generation ZINCALUME® steel with Activate® technology provides a more effective means for protecting cut edges, and research demonstrates that AM125 is capable of providing better cut edge protection than AZ150. For further details about corrosion protection mechanisms, see Corrosion Technical Bulletin CTB-6 Development of aluminium/zinc/ magnesium alloy coating for next generation ZINCALUME® steel with Activate® technology. Figures 2 and 3 demonstrate the greater effectiveness of cut edge protection by using AM125 metallic coating compared to AZ150 metallic coating.

### COLORBOND® steel with Activate® technology

Combinations of metallic coating mass and type are the primary factors in determining the effectiveness of cut edge protection of prepainted metallic coated steel products. A by-product of cut edge protection is the development of metal oxides beneath the paint surface resulting in small paint blisters. This is known as "edge undercutting".

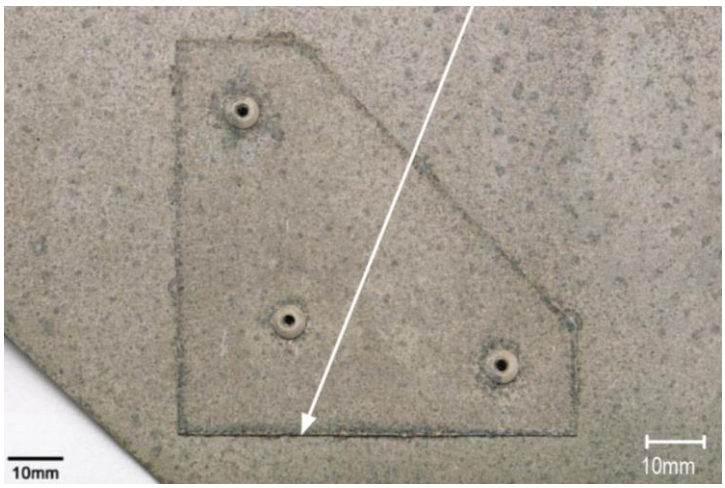
While prepainted AZ150 provides excellent cut edge protection, next generation COLORBOND®

**Figure 3: Unpainted panels tested in a sheltered (i.e. unwashed) position in a severe marine environment after 66 months.**




**AZ150**

**Dark areas indicate metallic coating corrosion originating from the cut-edge.**




**AM125**

NOTE: The samples shown in Figure 3 have been tested in a severe environment to accelerate corrosion rates. Use of the product in this location is not recommended by BlueScope.

steel with Activate® technology provides an even more effective means for protecting cut edges. A reduction in metallic coating is able to be achieved without compromising the corrosion resistance at the cut edges of the prepainted product. This is illustrated in Figure 4.

**BENDS**

COLORBOND® steel and ZINCALUME® steel are manufactured by BlueScope as flat sheet (in coil form) and are subsequently processed by rollforming, or pressing, to produce the final product. Rollforming and pressing requires bending to produce the final product, during which the metallic coating and paint (in the case of COLORBOND® steel) is stretched across the outside surface of the bend. This can result in cracking of the metal coating if the bend is sufficiently severe. AM coatings are harder, and have less ductility than AZ coatings, which can result in increased cracking on tight bends. Provided the limits on the relevant product data sheet are adhered to, and the product is installed and maintained as per BlueScope's published guidelines, this cracking generally does not impact the service life of the product. For information on installation and maintenance good practice, please refer to:

Technical Bulletin TB-13
General guide to good practice in the use of steel roofing and walling products.

**ZINCALUME® steel with Activate® technology**

Extensive test programs have shown that the enhanced corrosion protection provided by the AM coating maintains either equivalent or superior field corrosion performance compared with AZ, even if the surface has superficial cracking. Figures 5 and 6 show samples that have been tested outdoors in marine environments to determine the difference in bend corrosion performance between AZ and AM.

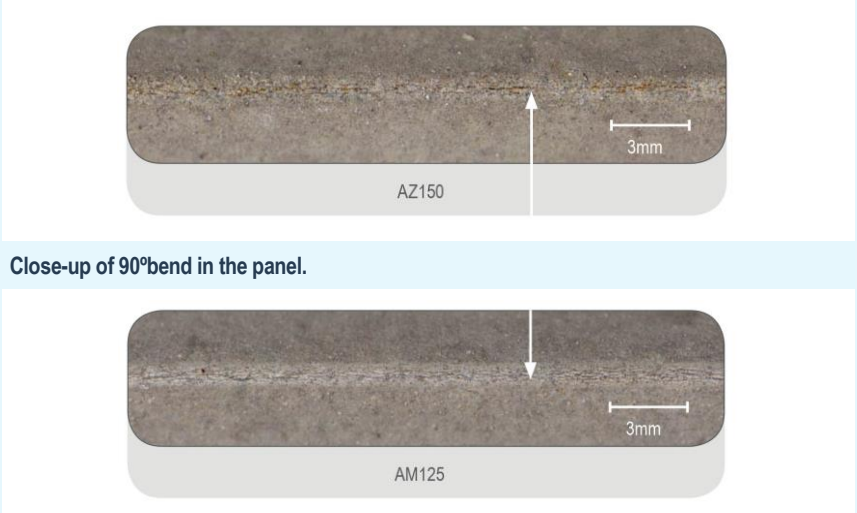
**COLORBOND® steel with Activate® technology**

Bend corrosion performance on prepainted products is most relevant to applications with relatively tight bends that are also in unwashed areas. Figure 7 shows fascia samples of prepainted AZ150 and AM100 that have been tested in a severe marine environment for 57 months. Both samples show a number of very small blisters (visible at 10x magnification), with additional intermittent larger blisters on the AZ150 product. It is important to note that the level of blistering seen in Figure 7 is not typically observed on either AZ or AM alloy coated steels in less severe environments. Figure 8 shows the results of a test to determine the corrosion performance of prepainted AZ150 and AM100 with a range of bend radii, exposed for 51 months in an unwashed marine environment. Whilst there is slightly more cracking on the AM100 product, there is a minimal corrosion on either the AZ150 or AM100.

**Figure 4: Prepainted sheltered walling (i.e. unwashed) in a severe marine environment after 50 months.**

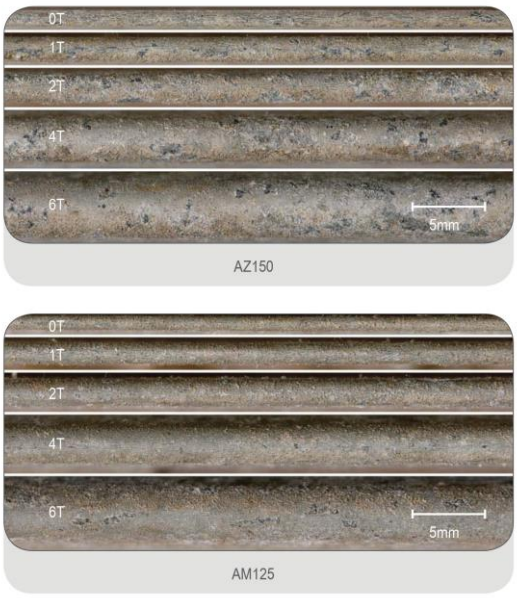

NOTE: The samples shown in Figure 4 have been tested in a severe environment to accelerate corrosion rates. Use of the product in this location is not recommended by BlueScope.

**Figure 5: Close-up photographs of the 90l' bend of unpainted samples exposed in a marine environment after 18 months (washed).**




NOTE: The samples shown in Figure 5 have been tested in a severe environment to accelerate corrosion rates. Use of the product in this location is not recommended by BlueScope.

**Figure 6: Unpainted samples of AZ and AM with various bend diameters, exposed in a sheltered (i.e. unwashed) severe marine environment for 45 months.**




NOTE: The samples shown in Figure 6 have been tested in a severe environment to accelerate corrosion rates. Use of the product in this location is not recommended by BlueScope.

**Figure 7: Prepainted, sheltered fascia bends (i.e. unwashed) after 57 months exposure within 100m from breaking surf on an outdoor test facility.**


NOTE: The samples shown in Figure 7 have been tested in a severe environment to accelerate corrosion rates. Use of the product in this location is not recommended by BlueScope.

**Figure 8: Prepainted bend samples exposed in an unwashed marine environment for 51 months.**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**SUMMARY**

BlueScope produce COLORBOND® steel and ZINCALUME® steel in coil form which is subsequently cut and formed in the process of manufacturing usable products. Cut edges and bends are an inherent characteristic of these manufactured products.

Since its introduction in 1976, the metallic coating on the established ZINCALUME® steel and COLORBOND® steel products has been effective in protecting the base steel at cut edges and bends. The metallic coating of next generation ZINCALUME® steel with Activate® technology and next generation COLORBOND® steel with Activate® technology, protects the base steel at cut edges and bends in an even more effective manner than the original product.

**RELATED BLUESCOPE TECHNICAL BULLETINS**

Technical Bulletin TB-13
General guide to good practice in the use of steel roofing and walling products

Corrosion Technical Bulletin CTB-6
Development of aluminium/zinc/magnesium alloy coating for next generation ZINCALUME® steel with Activate® technology

**REFERENCED AUSTRALIAN STANDARDS**

AS 1397:2011 - *Continuous hot-dip metallic coated steel sheet and strip – Coatings of zinc and zinc alloyed with aluminium and magnesium.*

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