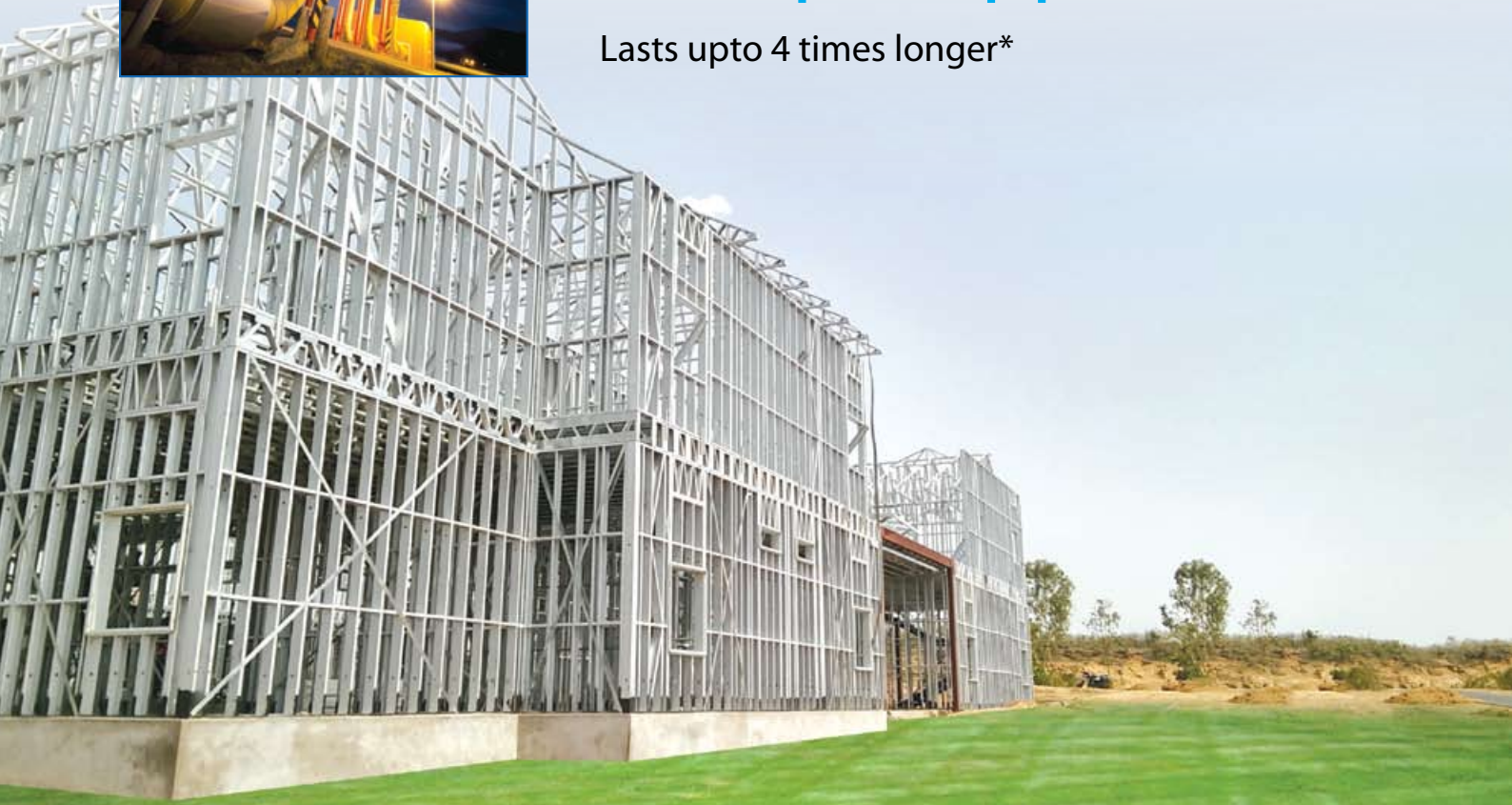


Zincalume®



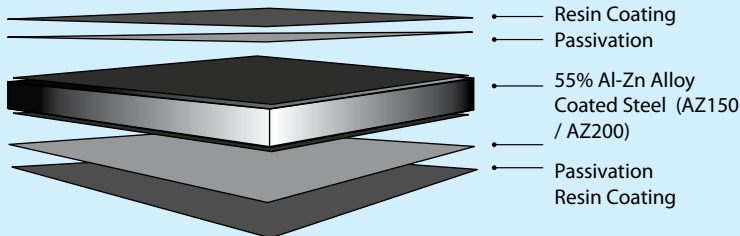
## Ideal Product for Multiple Applications

Lasts upto 4 times longer\*



# Zincalume®

Launched in 1976, ZINCALUME® steel, the world's leading 55% Al-Zn alloy coated steel product (55% Aluminium, 43.4% Zinc and 1.6% Silicon), is an outcome of extensive research and continues to set standards for corrosion resistance and long life. It has been proven to stand the test of time as it is designed to withstand the rigors of various climatic conditions. In fact, for two decades the product's performance has been monitored across a wide range of climatic conditions using exposure test sites and infield inspections.



Cross Section View of ZINCALUME® steel

ZINCALUME® steel has a minimum 150 g/m<sup>2</sup> to 200 g/m<sup>2</sup> metallic coating distributed equally on both surfaces. It is available in Base Metal Thickness (BMT) ranging between 0.30 mm to 1.30 mm and coil widths of 900mm to 1250 mm. It is offered with yield strength of minimum 300 MPa to minimum 550 MPa depending on the application. ZINCALUME® steel complies with AS1397, ASTM A792M, IS 15961 and ISO 9364 standards.

## Excellence in Fabrication

### Easy To Paint

The surface of ZINCALUME® steel can be easily field-painted without using a primer also. The best way is to use water-based acrylic paint. Other paints can also be used such as alkyd, polyurethane, to ensure that the surface is clean and dry before painting directly on it. As with all paints, follow the manufacturer's instructions.

### Excellent Formability

ZINCALUME® steel has specific steel grade usage for formability and is suitable for most forming operations. Without sacrificing coating adhesion, ZINCALUME® steel can be readily bent, roll-formed.

### Bending

Laboratory tests performed on ZINCALUME® steel confirm excellent adherence of the metallic coating to the steel substrate during bending, folding and brake pressing.

### Roll-Forming

ZINCALUME® steel can be readily roll-formed due to the excellent lubricating qualities of the resin coating so roll-formers rarely need additional lubricants (which can be potentially hazardous). The resin coating also reduces wear and tear on rolls and dies, and reduces risk of marks on the roll surface during the process.

### Lock Seaming

ZINCALUME® steel can be easily lock seamed for different applications.

### Welding

ZINCALUME® steel is suitable for resistance spot-welding using machine adjustments similar to those used for Galvanised steel. Observe the correct method for cooling water, tip configuration settings and re-conditioning to maximize the tip life of welding equipment.

### Integral Fastening

Integral fastening refers to joining pieces without using additional fasteners or welding. ZINCALUME® steel can be bent, folded, stamped, punched or crimped without screws, rivets or other mechanical fasteners.

### Joining

The fasteners used should be compatible with ZINCALUME® steel. In exterior applications, fasteners should have corrosion resistance at least equivalent to the life of the steel.

Remember:

- Electroplated zinc fasteners with washers are suitable.
- Blind rivets should be waterproof or sealed and made of aluminium.
- Electro-galvanised zinc-coated steel rivets lack sufficient metallic coating for long-term exposure.
- Stainless steel, copper, brass and monel metal rivets are not recommended.
- Sealing washers must be graphite free.

The best sealed joints for rainwater products are made by using neutral cure silicon rubber sealants (amine and acetic acid free) together with mechanical fasteners such as blind rivets.

# Remarkable Corrosion Resistance

ZINCALUME® steel combines both the galvanic protection of Zinc and barrier protection of Aluminium. The Zinc-rich region is locked in tiny pockets within the Aluminium-rich matrix (Figure 1).

The Aluminium in the coating complements the corrosion resistance process by providing barrier protection, reducing the rate of dissolution of the Zinc from the Zinc-rich areas of the alloy layer.

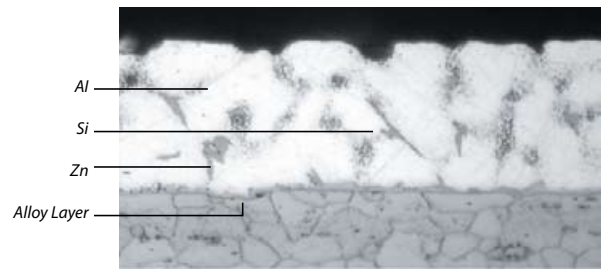


Figure 1: Microstructure Cross Section of ZINCALUME® steel

The Zinc-rich areas are important as they provide the product with galvanic protection. 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 down 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. 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 0.40mm to 4.0mm in width. When exposed to the atmosphere, the differences in the samples are slight, particularly at the thinner scribe marks (Figure 2). At the cut edge, ZINCALUME® steel provides similar protection to galvanized coatings.

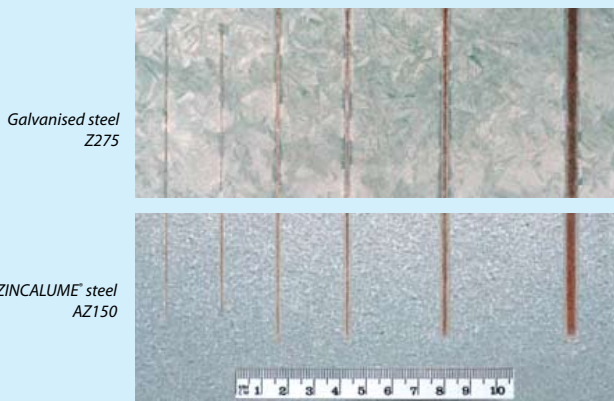


Figure 2: Cut Edge Performance

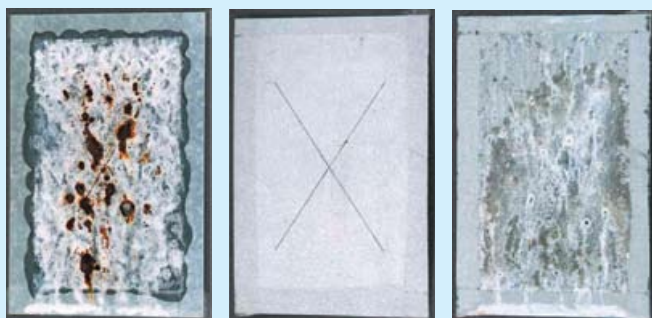
The adjacent pockets of the Zinc-rich phase, which are in electrical contact with the steel, provide continual galvanic protection. Thus, steel at any point is not readily available for corrosion.

\*On an average ZINCALUME® steel (AZ150) lasts up to four times longer than Galvanised steel (Z275) in similar environmental conditions. (Figure 3)



Galvanised steel Z275 (Heavy sign of Rust)      ZINCALUME® steel (No Sign of Rust)

Figure 3: Outdoor Exposure Test and Product Performance after 6 years at severe marine environment



Galvanised steel (G.I.) Z275 after 240 hrs      ZINCALUME® steel AZ150 after 240 hrs      ZINCALUME® steel AZ150 after 2000 hrs

Figure 4: Salt Spray Performance of Galvanised steel v/s ZINCALUME® steel

## Accelerated Laboratory Testing

The superior formulation of the alloy coating of ZINCALUME® steel, coupled with its up-to-date manufacturing technology has greatly enhanced its corrosion resistance properties. It has been rigorously tested by experts for quality assurance. Edge protected panels of Galvanised steel & ZINCALUME® steel were tested in the salt spray cabinet. After 240 hours the Galvanised steel panel shows significant white corrosion and red rust, but ZINCALUME® steel panels were found in excellent condition with virtually no corrosion. Even after 2000 hours, the ZINCALUME® steel panels showed only dark staining and some white-black corrosion product, but no red rust (Figure 4).



# Benefits & Applications

## Product Benefits

- Outstanding corrosion resistance performance
- Lightweight & strong
- Excellent heat resistance
- High thermal reflectivity
- Uniform quality, does not warp or split
- Requires no painting and post treatment\*\*
- Termite resistant

\*\*Can be post painted if required



Light Gauge Framing Systems



Grain Silos



Water Tanks



Drywall Partitions



Solar Water Heaters





Solar Power Structures



Door and Window Frames



Rolling Shutters

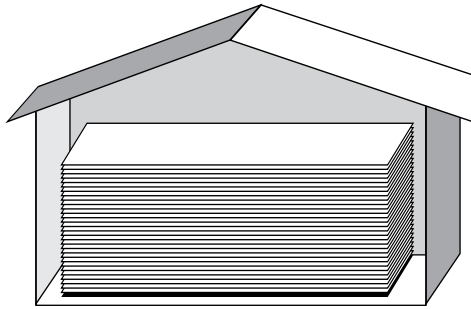


Electrical Panels



Pipe Insulation

# Usage Guidelines for ZINCALUME® steel



Example: Correct Storage

## Storing ZINCALUME® steel

ZINCALUME® steel has passivation to minimise staining problems associated with wet storage. However, it is recommended practice to keep the sheets stored indoors and to keep it dry in transit and in storage. Where outdoor storage is unavoidable, the standard sheets should be fully covered and kept off the ground to prevent water or condensation from being trapped in between surfaces. If packs become wet, separate the sheets, wipe them with a clean, dry cloth and allow to air-dry.

## Forming ZINCALUME® steel

The clear resin film on the surface of ZINCALUME® steel acts as a lubricant during forming operations. Roll-forming lubricant is usually not needed. However, if a lubricant is deemed essential due to the severity of the profile being formed, then Shellsol-T, Solvent 11 or an equivalent formulation is recommended. Kerosene-based lubricants must not be used.

The benefits of not using lubricants while forming ZINCALUME® steel include:

- Reduced clean-up after processing
- Improved final appearance
- Less slippery surface
- Reduces roll wear

## Field Painting

ZINCALUME® steel offers distinct advantage as it can be readily over-painted with water-based acrylic topcoat even without primer, provided the surface is clean and dry. Other paints such as alkyd, polyurethane, etc. can also be used. A primer would be recommended in a limited number of circumstances where solvent-based decorative or high build protective paint systems are necessary, for enhanced corrosion protection in industrial or severe environment applications.

Recommendations for post painting of ZINCALUME® steel can be summarised as following:

Where a painting system is to be chosen for aesthetic or minimal additional corrosion resistance:

Surface Preparation - Wash surface with a 5% solution of a non-ionic detergent.

Coating - Apply two coats of water-based acrylic.

## High Temperature Oxidation Resistance:

ZINCALUME® outlasts regular galvanized steel in marine salt spray and industrial atmospheres for a longer lasting installation. It is recommended that resin coated ZINCALUME® steel not be heated above 200° C. The acrylic resin coating of ZINCALUME® steel is prone to degradation above 200° C and can generate fumes above 250° C. These

fumes are associated with heavy odour and discoloration of metal surface. The non-resin coated steel should not be heated above 350° C. Non Resin coated steel product is known to perform satisfactory up to 350° C, however some embitterment of the base steel may occur at this temperature and component should therefore not be of load bearing nature. Above 350° C complete alloying of the Al-Zn coating with steel base occurs, resulting in dulling of the surface. Above 375° C coating detachment and / or embitterment of the base steel occurs.

## Adverse Conditions

The performance of ZINCALUME® steel is superior to Galvanised steel (G.I.) in the vast majority of environments. However, there are specific end use applications in which ZINCALUME® steel should be placed after careful consideration, such as:

- Intensive animal shelters
- Buried in soils (e.g. culverts)
- Contact with lead or other dissimilar metals
- Contact with green hardwood or treated timber
- Extreme severe industrial environment (e.g. refineries)
- Composite panel applications in coolrooms.

## Spot-Welding

Typical spot-welding schedules for ZINCALUME® steel are as following:

Material Thickness (mm)	Welding Current (Ampere)	Electrode Force (N)	Welding Time, Cycles (1/60 sec.)	Electrode Face Diameter (mm)
0.56	11,000	350	10	4.75
0.71	11,000	400	12	4.75
0.91	12,500	500	14	6.35
1.02	12,800	500	14	6.35

Actual requirement will vary depending on the job conditions.

High volume welding industries require simple and cost effective technology for thin steel. Resistance spot-welding meets these requirements and is also adaptable in that it can be easily incorporated with robotics systems. In the past, spot-welding parameter selection was considered relatively simple for uncoated steel but the range of metallic coated steel now available as superior replacement products mean parameter selection is far more critical.

While it is possible to achieve many thousands of welds from one set of electrodes employed on an uncoated steel before replacement or redressing of electrodes is necessary, features of individual metallic coated steel means as little as 250 welds may only be possible if inappropriate parameters are chosen.

## The Mechanism of Electrode Degradation

The rate of degradation of resistance spot-welding electrodes during welding of metallic coated steel is far greater than those experienced during welding of uncoated steel. Due to the lower contact resistance of zinc coatings, welding times and current levels are required to be higher in order to produce satisfactory weld sizes. This provides the driving force for alloying to take place between the electrode working face and the metallic coating.



The conventional truncated cone electrode tip diameter (Figure 5) increases as welding progresses due to alloy build-up around the periphery of the electrode. If incremental increases are not made to the applied current in order to compensate for this, then current density will fall off resulting in production of smaller and smaller welds. The metallic coating alloys to the electrode working face and forms metallic alloy phases. These phases can be stripped away from the electrode when the electrode is removed from the sheet surface after completion of each weld.

### The Effect of Welding Current Upslope

Upsloping is the term given to gradually increasing the welding current to the maximum preset level during spot welding rather than instantaneously applying the maximum preset current. Upsloping has the tendency to remove some of the metallic coating prior to the application of the maximum preset current. This assists the electrode to bed-in to the sheet surface which means that less coating is available for alloying to take place. There is no added benefit in using upsloping when welding ZINCALUME® steel.

### The Effect of Electrode Tip Angle

Decreasing the electrode tip included angle (Figure 5) benefits electrode life when welding ZINCALUME® steel. Decreasing the included angle from the commonly employed 120° angle to 90° is believed to assist in removing the alloy build-up around the periphery of the electrode tip due to the sharper angle of incidence with the surface. It is not recommended that included angle less than this be employed since mechanical strength of the electrode tip may be lost.

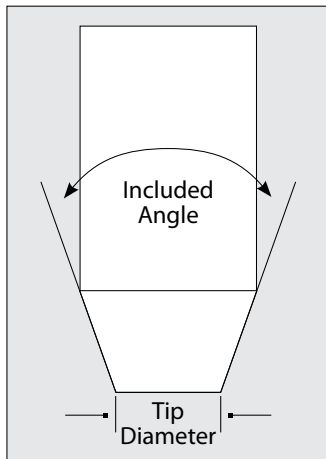


Figure 5: Truncated cone electrode tip profile

### The Effect of Electrode Tip Diameter

Selection of the electrode tip face diameter depends on the weld size, desired sheet thickness and, in some cases, design of the component (flange widths etc.). It should be noted that electrode alignment becomes more difficult with the increase of tip diameter and that even the slightest misalignment may result in metal expulsion from the sheet surface scarring the workplace and damaging the electrodes. It is important then not to employ electrode tip diameters way beyond recommended sizes.

Only electrodes that are used to weld ZINCALUME® steel may benefit by way of increased life with the increasing tip diameters. With larger tip diameters the increase in life can be up to four times.

### The Effect of Electrode Chemistries

Resistance Welder Manufacturers Association Class II (Cu-0.8% -Cr) electrode composition also referred to as J47 alloy, is most suitable for spot-welding ZINCALUME® steel. The more aggressive nature of the electrode erosion process encountered during welding of ZINCALUME® steel appears

to outweigh any influence that electrode alloying elements may have on electrode life.

These features are summarised below:

Steel Type	Use Current Upslope	Use 90° Included Tip Angle	Use Increased Tip Diameters	Electrode Chemistry
ZINCALUME® steel	No	Yes	Yes	Cu/Cr

## Some Dos and Don'ts for spot welding ZINCALUME® steel

- Do** Take care in machining of electrode working faces. Ensure they are relatively flat and smooth.
- Do** Take care to accurately align electrodes in the welding machine to avoid producing undersized welds, damaging electrodes and scarring of workpiece surface through metal expulsion. Carbon paper placed between blank sheets of paper can be used to obtain an impression of electrode faces. Once in the welding machine, the electrodes can be brought together using the paper in between. The resulting impression will indicate alignment.
- Do** Employ automatic electrode tip redressing tools.
- Do** Try and work within the welding lobe window for the particular steel type, but stay just below the point of metal expulsion.
- Do** Conduct regular inspection of weld quality and replace or redress electrodes where necessary. A simple peel test on offcuts should suffice.
- Don't** Use hand files to redress worn electrodes. This will promote electrode misalignment.
- Don't** Use excessive welding current. Electrode/metallic coating alloying rates will be accelerated and metal expulsion will further degrade the electrode.
- Don't** Use excessively long welding times. It is far better to use short weld times and to adjust the welding current to achieve the optimum weld size.
- Don't** Use radiused electrodes unless part fit-up is a problem. Radiused electrodes degrade more quickly than truncated electrodes when used on metallic-coated steels.

# Assured Quality

Fully Equipped Laboratory for testing Coated Steel Products



Tensile Testing (UTS, YS & % E)



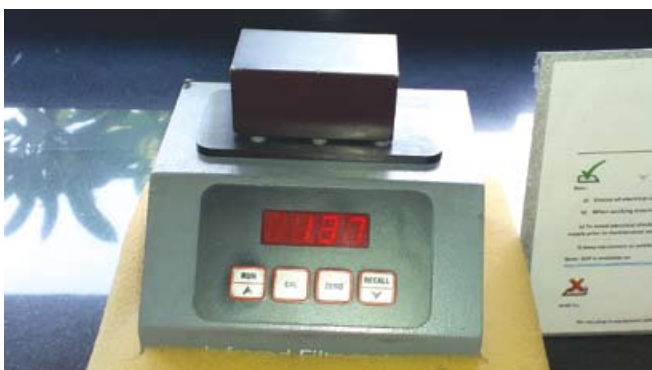
Base Steel Hardness



Corrosion Resistance (Q-Fog Salt Spray Tester)



Lock Seam – Coating Adhesion & Flexibility



Resin Thickness Measurement (Infrared Filtometer)



Microscopic Examination (Stereo Microscope)

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