

# Corrosion

## Exclusively

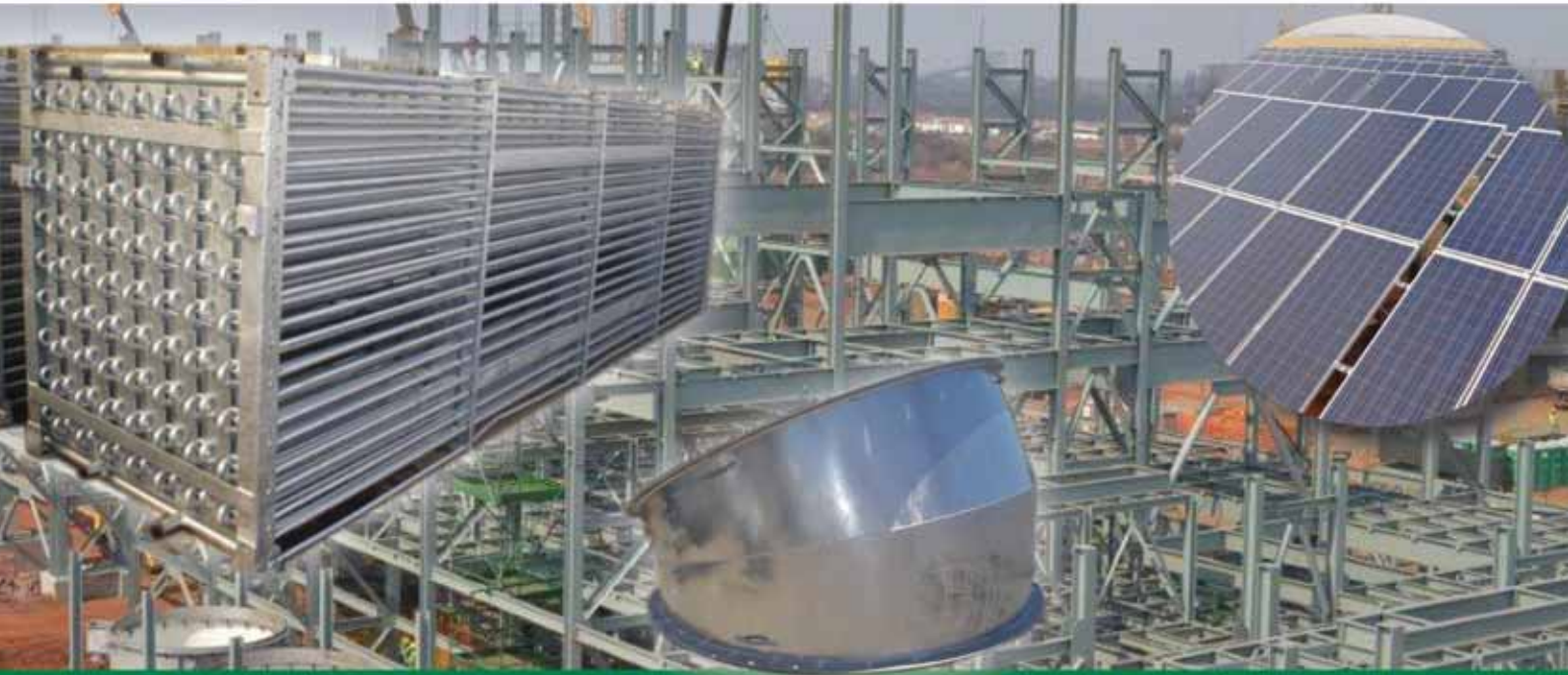
### INSIDE:

- Metal Cladding and the Environment and the introduction of SANS 10267 & SANS 1273
- Higher blast profile the better the adhesion – Myth or Fact?
- Our industries aversion to risk
- Subsea pipeline corrosion
- Why motor car bodies no longer rust
- The Bristle Blaster
- From the KETTLE
- Institute News and Activities
- Education and Training
- The RUST Spot



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## President's Comment

Although winter is now in full swing, the cold weather has not limited the enthusiasm at the various regions specifically around our informative and social technical evenings.

Our drive in promoting our local courses is paying off with our first Corrosion Engineering Course being successfully run in Ghana earlier this year.

AfriCORR 2016 is going to be a great success due to resounding support from our invited plenary speakers, our presenters, the sponsors and all of our delegates. Congresses do not happen without a mammoth amount of effort and commitment and therefore a special thank you from me to the organising committee and sponsors for their unrelenting efforts. I am proud to be able to say that we have our own Corrosion Congress.

The surprise I mentioned I would share in this edition is that the President's Challenge is been heard and National Urethane Industries has, in conjunction with the Corrosion Institute of Southern Africa, established the NUI-CorrISO (Corrosion Institute Student Organisation) Bursary scheme in which funding will be made available to eligible CorrISO members. This will not only aid them with funds to pay their tuition fees but can also benefit these individuals in getting much needed experiential training and industry exposure. It also ties up with an important function of the institute and that is to ensure sustainability and growth of corrosion awareness to the future "owners" of industry.

With Europe looking lighter with the loss of a "couple of pounds", we must thank our members and their associated organisations that continue providing financial support to our endeavours to keep on training and to develop much needed practical exposure. There is so much still to do so please feel free to approach us in other initiatives to combat corrosion!

*Edward Livesey*  
*President*

### OBJECTIVE OF THE MAGAZINE

"The objective of '*Corrosion Exclusively*' is to highlight CORRISA activities, raise and debate corrosion related issues, including circumstances where inappropriate material and/or coatings have been incorrectly specified, or have degraded due to excessive service life. Furthermore, it shall ensure that appropriate materials or coatings, be they metallic or otherwise, get equal exposure opportunity to the selected readers, provided these are appropriate for the specified exposure conditions on hand."



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#### The Corrosion Institute of Southern Africa

38 Allan Road, Glen Austin, Midrand, South Africa

PO Box 5656 Halfway House 1685  
International Tel: +27 (0)10 224 0761  
Local Tel: 086 026 7772 (CORRSA)  
[www.corrosioninstitute.org.za](http://www.corrosioninstitute.org.za)  
[manager@corrisa.org.za](mailto:manager@corrisa.org.za)

### Editor

#### Terry Smith

Tel: 021 797 4735  
Fax: 086 612 7284  
Cell: 082 893 3911  
Email: [editor@corrisa.org.za](mailto:editor@corrisa.org.za)

### Advertising and Sales

#### Terry Smith

Tel: 021 797 4735  
Fax: 086 612 7284  
Cell: 082 893 3911  
Email: [editor@corrisa.org.za](mailto:editor@corrisa.org.za)

### Design and Layout

#### Sandra Addinall

Tel: 011 868 3408  
Email: [cbtdesign@adcot.co.za](mailto:cbtdesign@adcot.co.za)

### Reproduction and Printing

#### Camera Press

Tel: 011 334 3815  
Fax: 011 334 3912  
Email: [ntp@camerapress.co.za](mailto:ntp@camerapress.co.za)

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Cover: A collage of corroded components at the coast.



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## Editorial Comment

The third edition of *Corrosion Exclusively* has finally arrived and I must apologise to our supporters and readers for the fact it is well beyond the anticipated publication date.

I guess the main reason for this was a long term planned trip to Bayuquan in China where I presented a course on Hot Dip Galvanizing to a Transmission Steel Company, AIC Steel. After the initial four days of intensive work and evening entertainment by hosts Khaled El Ramili (MD) and Ayman El Malah (Quality Manager), we managed to "sort of relax" and visit some exciting places including the Great Wall of China and historical Beijing, the beautiful city of Shanghai with its numerous skyscrapers, Huangshan and its finely chiselled steps up to about 2 000 metres of granite mountain was amazing, the small town (or so we thought) of Hangzhou took us about 90 minutes on freeways to arrive at the airport and finally Hong Kong before returning home after three weeks. Travelled in fast bullet trains up to 300kph, visited many varied markets, ate many strange foods, drank only bottled water and met many interesting people.



While we were away my friend Spencer Erling the Education Director of the Institute of Steel Construction decided to retire after 50 years in the steel construction industry. Having been introduced to Spencer in 1996 by my previous colleague and friend, Walter Barnett, our paths were destined to overlap, particularly in my former position at the HDGASA as I needed to be seen in good light amongst SAISC's members and steelwork contractors for the purpose of flying the "galvanizing" flag.

Spencer, I wish to thank you for always taking the time no matter how limited, to assist me with my requests for articles in HDGT and the many steelwork queries I posed over the last 20 years.

Sandie and I wish you and Hazel many healthy happy years of retirement.

Having always recognised the tremendous value of using appropriate standards and correct specifications for quality fabrications prior to hot dip galvanizing components, the feature on "Metal Cladding and the Environment" by Dennis White of SAMCRA gets my full support. SAMCRA and its members have painstakingly compiled a new standard SANS 10267 which together with SANS 1273 addresses applicable roofing and cladding materials and coating types, including appropriate fasteners for buildings in varying corrosion categories of South Africa.

We have three international contributions, one from Jim Gooden of Blast-One International who discusses a substrate preparation issue "Higher blast profile the better the adhesion", myth or fact? Warren Brand our previous Guest Writer and now in his Blog discusses "Our industries aversion to risk" and Wesley Fawaz EO of ACA contributes their article "Subsea pipeline corrosion".

"Why motor car bodies no longer rust" – final article.

Additionally, Blastrite's new "Bristle Blaster" article continues the discussion on substrate preparation, for successful painting.

"From the Kettle" a regular column continues supporting the hot dip galvanizing industry. The "Rust Spot" introduces another well-known personality of the corrosion and protective coatings industry, Mr Graeme Stead.

An update on Africor our local bi-annual corrosion conference, which starts on 25 to 29 July in Midrand, Johannesburg.

Graham Duk and Ryan van Wyk the Western Cape and KZN Chairmen give account of their activities.

Other activities of the Institute include the Corrosion Awareness day held in Midrand, the annual fishing day, the many NACE and Corrosion Engineering Courses held throughout South Africa including a trip to Ghana plus many interesting technical evenings held both in Johannesburg and Cape Town.

Terry Smith

## Myth or Fact: Higher blast profile increases coating adhesion (Part 1)

By Jim Gooden, January 25, 2016

**As the corrosion control industry adopts new coating technologies, the debate continues regarding best practices in steel surface preparation requirements and profile height for new, thicker coatings.**

Driven by a need for increased coating life where new ultra-high-build (UHB) coating technologies are used, surface profile is a regular topic of conversation with contractors and inspectors. There are many inconsistencies in the industry with profile requirements for these super-thick coatings.

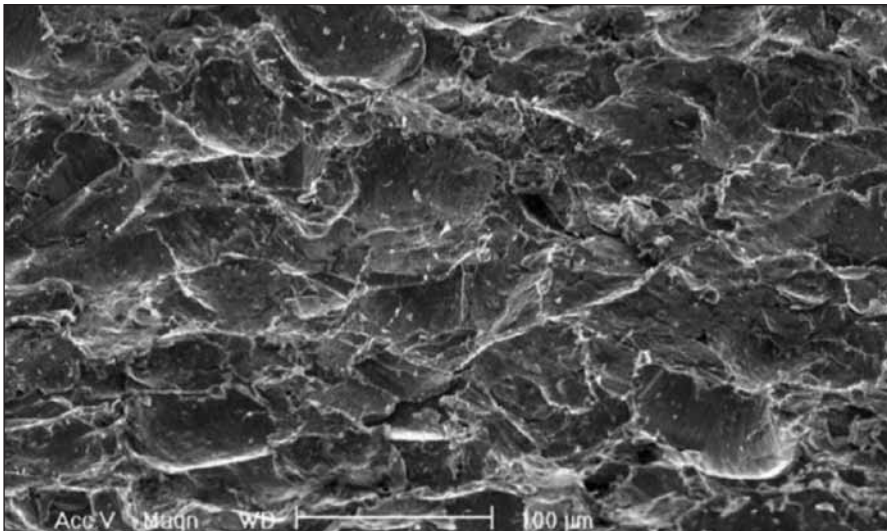
The traditional thought has been: "The thicker the coating, the higher the profile required." On the other hand, the rule of thumb is to have no more than one-third surface profile height compared to the total coating thickness. Coating data sheets and customer specifications often conflict, and there seems to be little understanding of what is best practice.

In an attempt to understand the effect of surface profile height on the adhesion of UHB epoxies, Blast-One International conducted testing of one coating on steel panels with different profile heights and different total coating thicknesses. This research is described below.

By looking at the findings of this and other studies, and comparing them with traditions in the industry, it is easy to see where misunderstandings can occur with protective coatings contractors. Coatings contractors have much on their minds while on project sites. Surface profile and surface cleanliness are so important; the old saying goes that "a coating is only as good as the surface preparation." With that in mind, it is time to pay attention to the surface preparation as a whole.

### Surface profile measurement

We have some evidence to clarify the effect of high or low surface profile and to clear up



A magnified steel surface that has been prepared by blasting. (Source: Blast-One International)

the myth that a higher surface profile is necessary to increase coating adhesion. This study is a start to increase our understanding and reduce confusion on best practices for surface profile.

Many coating product data sheets call for surface profiles of 75 – 100 $\mu$ m. Others call for 38 – 50 $\mu$ m surface profile for a very similar coating type. Why should this be? To start to understand this, we need to first look at why we create and measure surface profile on steel surfaces. It comes down to two main reasons:

1. Abrasive blasting creates peaks and valleys, thereby increasing the surface area to provide a better bond between the coating and steel substrate. We have always thought that an acceptable increase in surface area was about 33%. More recent studies have shown that it is more likely to be 16 – 18%, but this is still being verified by independent testing.
2. The assumption is that by blasting the surface, some cleaning will take place, which will remove contaminants that would impede adhesion between the coating and the substrate.

Surface profile is also known by other names, such as anchor pattern and surface roughness. Classifications of surface roughness include maximum roughness depth (R-max); roughness average (R-a); and total peak to valley profile height (R-t). For the technically minded, the coatings industry has typically measured R-t, which is the total height from the lowest valley to the highest peak in a given area.

The R-t measurement has some limitations because it is affected by rogue peaks, but it is a generally accepted method of measuring the surface profile in the coatings industry. (Figure 1)

The author experienced these issues firsthand, early in his career, on a new-build

project for an unmanned offshore gas platform. The specification called for a 75 – 100 micron profile based on a specification of a 3 000 micron UHB epoxy coating to be applied to the splash zone. Their client's representative said, "If the range in the specification is 75 – 100 microns, I want closer to 100 microns." In other words, more is better. Of course the contractor said, "Yes, sir!"

Incidentally, the inspector had his own measurement challenges and insisted that the profile was only 33 microns. I witnessed the client spending tens of thousands of dollars to achieve a profile that appeared to be unnecessary to achieve the right surface for the coating to be applied.

Another confusing aspect of surface profile is units of measurement. For example, some coatings suppliers in Australia ask for a profile of 88 microns. Eighty-eight microns is an unusual number, which appeared simply from the conversion from mils or thous (thousands of an inch) to microns. In other words, 3.5 mils equals 88 microns.

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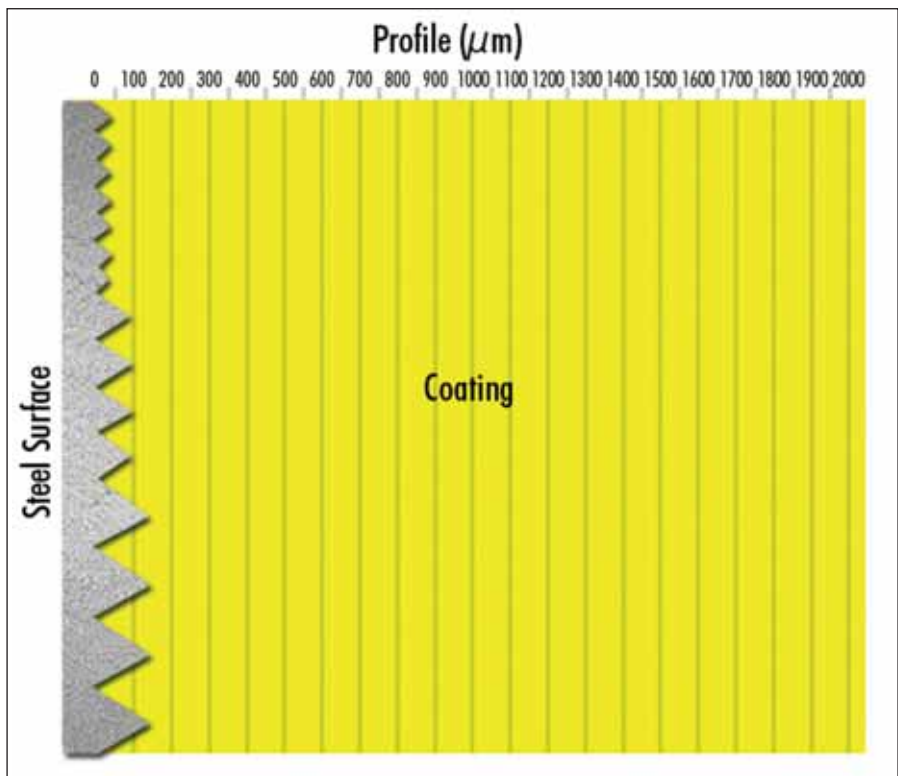


Figure 1: Surface profile.



Figure 2: Lost in Translation?

**Imperial vs. Metric**

Many of the specifications and data sheets that we use today are converted from the United States, where Imperial units like mils/thous (1/1 000 of an inch = 25.4 microns) are commonly used. When we measure profile and the specification has been converted from an Imperial standard (for example 2.5 mils) to the equivalent metric standard (i.e. 63 microns), it's a little bit like comparing analogue time with digital time. (Figure 2)

If we say, "I'll see you at half past 2," and in reality the meeting started at 2:26 or 2:34,

no one would really mind. But if it is digital and you say the meeting starts at 2:30, in that case 2:29 is early, and 2:31 is late.

Applying that rationale, one of the most common methods for measuring surface profile is Testex replica tape. If the specification calls for 3 mils and the actual reading is 2.75 mils, it is only 1 increment away on the gauge face and the inspector may say, "It is close enough; I'll pass it."

But if you have the same reading in microns, and the specification says it must be 75 microns (3 mils is about 75 microns), and a reading of only 69 microns is achieved (the equivalent to 2.75 mils), that reading hasn't even got a 7 on the front and the inspector may be likely to say, "No, it's a fail. It needs to be re-blasted to get a higher profile."

These challenges that confront the industry are merely pointed out as areas that leave clients, contractors and inspectors in a position where they feel that they need to make their own interpretation. They are making on-the-spot decisions, all with good intent, but these decisions may have the hidden effect of unnecessarily costing someone, often the contractor, a lot of money.

*In Part 2 of this article series, the author explores five independent studies with relevance to whether higher surface profile increases coating adhesion. In addition, results of a test conducted by Blast-One are presented along with interpretations that have bearing on determining best practices for surface preparation.*



**Technical Director – Corrosion Control, Blast-One International**

Jim Gooden has been involved with the corrosion control industry since 1989. He aspires to improve the quality of corrosion prevention projects through educating the various players involved. As technical director with the Blast-One International Group, he leads the global project team responsible for reducing the cost of corrosion control.

Starting out as a cathodic protection and coatings inspector, Gooden has authored papers and how-to guides on surface preparation and reducing costs in the protective coatings industry. Jim visits hundreds of protective coatings projects, primarily for the mining, oil & gas, marine and utilities sectors in North America, Europe and Asia/Pacific.

The Blast-One team advises painting contractors in many of the oil refineries in North America and almost all of the major North American shipyards, and have consulted to some of the world's largest ship builders including Hyundai Heavy Industries in Korea. Gooden spends his time working with teams in offices in Australia, the UK and the USA.



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**Western Cape**  
Tel: +27 (0)21 510 6385  
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# Bristle Blaster® – patented technology for surface preparation

Bristle Blasting is an innovative technology for surface preparation developed by the German-based manufacturer MONTI – Werkzeuge GmbH and distributed in South Africa solely by Blastrite. The Bristle Blaster® tool has the ability to quickly remove corrosion, scale and coatings from steel surfaces. Simultaneously a surface cleanliness comparable to Sa 2½ – Sa 3 (SSPC-SP 10/NACE No.2–SSPC-SP 5/NACE No.1) and a roughness profile of up to 120 µm (4.7 mil) is generated. The grit-free Bristle Blasting process eliminates the need for complex abrasive blast equipment, encasing of the working area and recycling, or disposal of shot. Both, the electrically and the pneumatically powered tools provide short set-up times as well as a flexible and safe application. All these characteristics qualify the Bristle Blaster® as an economical solution for spot repairs, touch-up jobs and weld seam preparation.

## Function

The hand-held drive unit powers the with special wires equipped polyamide belt – the Bristle Blaster® belt. The U-shaped anchored bristles are sharpened and bent against the rotation direction in a precisely defined manner. During the rotation of the belt the wire bristles are tensioned by an accelerator bar. It suspends every single bristle and accelerates it to increase the kinetic energy of the bristle tips impacting the surface.

With the impact of the bristles, corrosion and coating is removed and a tiny deepening is hit into the surface. Also resistant coatings

as well as scale, temper colors or other oxidation products, which are difficult to strip with a grinding tool, can be removed effectively and thoroughly. The special construction of the belt causes the wire tips to immediately bounce back after the impact by which a rough surface emerges, characterized by a variety of micro-craters. The cleanliness level as well as the roughness depth and tensile strength which result from this procedure are comparable to a surface prepared by conventional blasting. Furthermore, studies conducted by the Marquette University in Milwaukee / USA show that a material compression is generated along the Bristle Blaster® treated surface which in turn increases the resistance towards cracks, fatigue and stress corrosion.

The Bristle Blaster® achieves a surface roughness of up to 120 µm (4.7 mil) depending on the grade and condition of the treated material. Average values range between 65 – 90 µm on carbon steel and between 25 µm – 35 µm on high grade steel. When testing the tool on an API 5L X42 steel, a roughness profile of 65 µm - 83 µm has been generated.

While working on the surface, the base material, i.e. the steel surface itself is spared. The wire tips impact nearly vertically on the surface and at the same time "blasting" rust or coating off. From the steel itself hardly any material is stripped.

Since the generated frictional heat is negligible in contrast to grinding tools, the work surface does not get hot either. Due to the fact that the bristle tips hit the surface individually and selectively, unlike sanding, it doesn't lead to a rubbing of rust particles or smearing of coatings on the surface.

## Fields of application

Bristle Blasting is used in various industries mainly for spot repairs, touch-up jobs and weld seam preparation. Combining the ability to produce an abrasive blast finish with the high mobility and flexibility of a portable hand-held tool, the Bristle Blaster® is the ideal solution for, maintenance work, inspections, and treating small areas.

The compact and flexible equipment is ideally suited for portable and rope access projects, i.e. in the wind energy sector. Typical applications include spot repairs and weld seam preparation on tower segments as well as repairs of transport and handling damages prior to on-site assembly. Furthermore, specially designed accessories including the Remote Access Grip, ensuring a secure carabiner connection, and the Quick Add® adaptor hub assembly, allowing a fast change of Bristle Blaster® Belts without additional tools, are available.

The Bristle Blaster® Pneumatic is ATEX approved (Ex II 2G c IIA T4 X) and therefore can be safely used in zone 1 applications. This is particularly interesting in the construction and maintenance of pipelines, refineries, chemical plants, pump stations, tanks and oil rigs. Even pipelines and plants in operation can be treated where conventional blasting is often prohibited.

As an ABS Type Approved product, the Bristle Blaster® is widely used in shipbuilding and maintenance. High mobility, a short setup time as well as a dust-free operation allow for an application in narrow, hard-to-reach areas such as ballast water tanks. Additionally, no surrounding surfaces are damaged during the working process.

The Bristle Blaster® combines the advantages of abrasive blasting with the advantage of a hand-held tool allowing for an application in various industries such as the offshore field, steel construction and the hydraulic engineering - to name just a few. In Addition numerous coating manufactures around the world have approved and specified the Bristle Blasting process as a surface preparation method for their industrial coatings.





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# Turnkey protective coating solutions for the mining industry

Despite an ongoing slump in the mining sector, Kansai Plascon has maintained its competitive edge as a leading paint supplier to the industry, thanks to the fact that it offers a 360-degree turnkey solution that is comprised of decorative products, mine marking products and protective coating products – all backed up by dedicated after-sales support.

Kansai Plascon is the market-leader in supplying decorative coatings and aerosol marking paint to the mining industry. Decorative paint products are used on mining properties, which include staff housing, hostels and offices, while marking paint products are used at operational level in shafts. Kansai Plascon brand manager for industrial coatings, Mareta le Roux, says although the company boasts majority market share in these areas, there is still room for growth.

“One area of mining that holds considerable growth potential for us is corrosion protection for processing plants such as smelters and concentrators. We are a relatively minor player in this field at present. However, the strategic five-year plan in terms of resourcing, is to put a focus on corrosion protection for the processing plants in the mining industry. Our protective coating products meet all

industry requirements, and it is now a matter of driving them forward,” she states.

Over the years, Kansai Plascon has developed fundamentally strong relationships with some of the largest names in the global mining industry. Le Roux believes that this will work to the company’s advantage, when promoting its protective coating range. “This is already bearing fruit, as a large gold mining operation with mines in East, West and Central Africa now specifies Plascon Protective coatings for all of its processing plants. We have also been

supplying products to mines in the Zambian copper belt for a number of years. Further expansion in Africa holds the potential for measurable growth.”

## One-stop-shop reputation sets Kansai Plascon apart from the competition

“We are by far the biggest coatings manufacturer in Southern Africa, and we offer a one-stop shopping experience that our competitors cannot,” reveals Kansai Plascon national market manager for mining & minerals/roadmarking, Rolf Redelinghuys.



*Kansai Plascon is the market-leader in supplying decorative coatings and aerosol marking paint to the mining industry.*



*Over the years, Kansai Plascon has developed fundamentally strong relationships with some of the largest names in the global mining industry.*



*Mareta le Roux, Brand Manager for Plascon Industrial.*

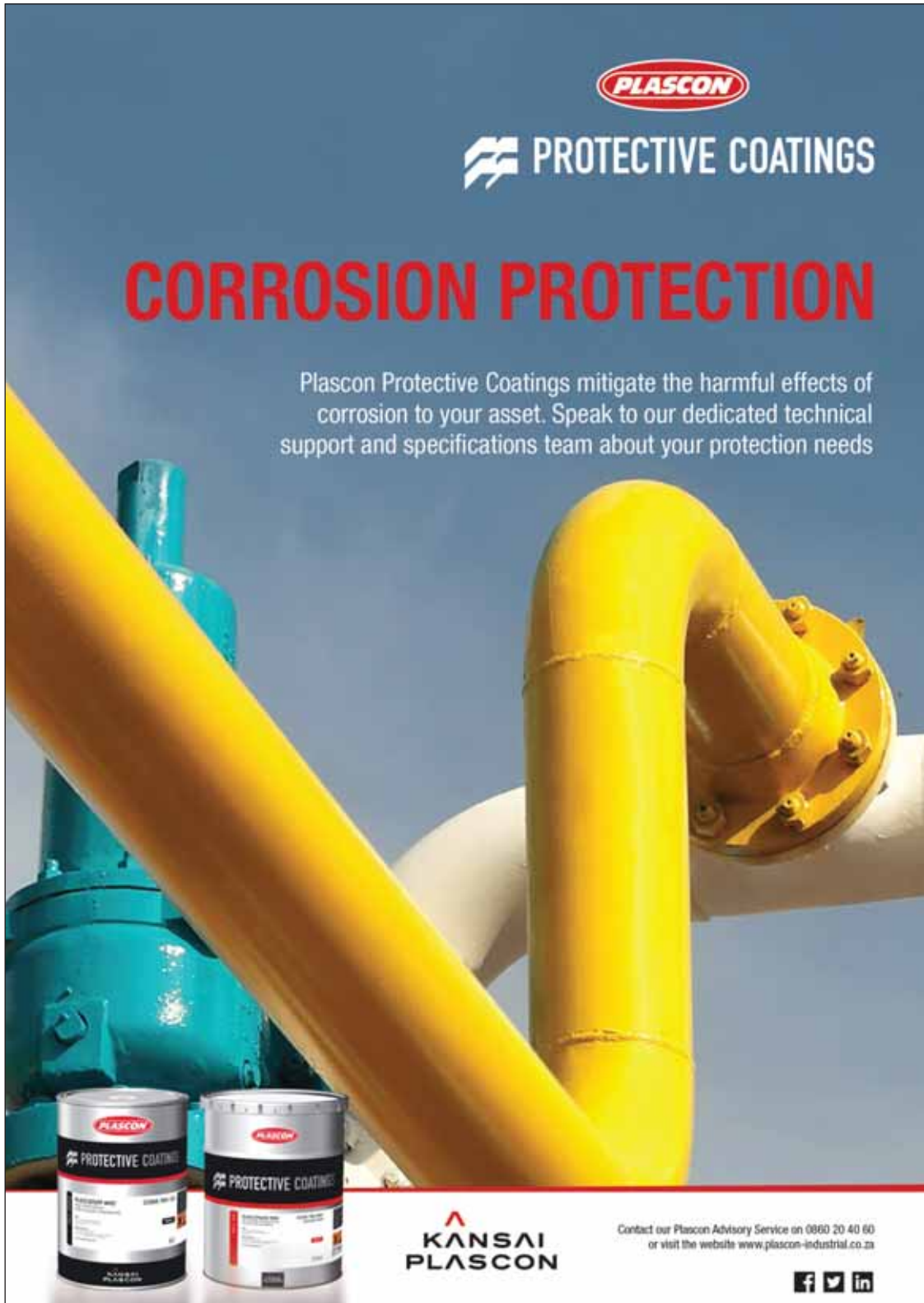
He adds that technical strength and capability also places Plascon ahead of the competition.

“Our service is not just selling protective coatings, but doing specifications. We are experts as far as that is concerned. We do not just sell the paint and walk away – there is

support provided throughout the process. Our technical teams undertake site visits to check if the product is applied correctly, especially when it comes to the corrosion protection,” he elaborates.

Corrosion protection is expensive to apply, and le Roux indicates that it is essential to

successfully complete the application of the coating on the first attempt. “Bearing this in mind, we provide extensive training to mining contractors at no additional charge. It’s all about the customers’ bottom line at the end of the day, and we are there to ensure that everything goes according to plan.”



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With regards to research and development, Kansai Plascon boasts a state-of-the-art laboratory in Durban, KZN which features dedicated teams working solely on industrial and protective coatings. "Our laboratory is world-class, therefore, most of our research and development is done locally, based on local customer requirements," says le Roux.

Kansai Plascon also boasts a strong network of distributors in Sub-Saharan African regions such as Namibia, Botswana, Zambia, Malawi, Zimbabwe, Mozambique, with plans to expand the network in East Africa and West Africa. This network will enable the company to deliver its range of products in the quickest turnaround times.

In challenging economic times, the current industry trend is to prioritise maintenance. Redelinghuys believes that this works to Kansai Plascon's advantage. "Mining companies are moving towards optimising and conserving their assets, rather than replacing them with new ones. As a result, our sector sales have improved, and I am confident we will gain market share in the foreseeable future."

**About Kansai Plascon**

In 2012, the company formerly known as Plascon South Africa was renamed Kansai Plascon, after a merger with Japanese company Kansai Paint, the world's sixth largest coatings company. Kansai Plascon continues to champion the Plascon brand as it expands into Africa as one of the continent's top coatings companies.

**Kansai Plascon contacts**

Mareta le Roux, Brand Manager for Industrial Coatings  
 Phone: (011) 861 0300  
 Email: MleRoux@kansaiplascon.co.za  
 Web: www.plascon-industrial.co.za

**Media Contact**

Jana Klut, NGAGE Public Relations  
 Phone: (011) 867-7763  
 Cell: 074 111 4900  
 Email: jana@ngage.co.za  
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# Why motor car bodies no longer rust – Final

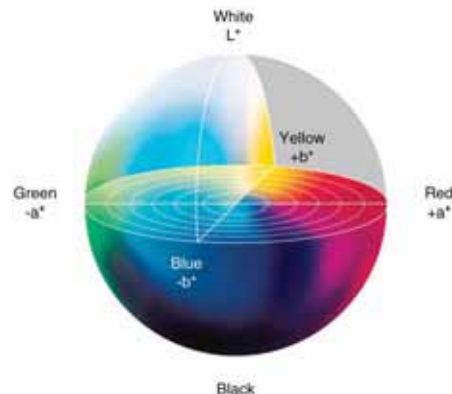
Mark Terblanche, Prime Inspection (Pty) Ltd

Towards the end of Part II of this series (see *Corrosion Exclusively*, Vol. 2 Issue 1: 2016, Pg 13) I briefly discussed the use of ESTA spray application and the use of this technology in the application of the basecoat to achieve the desired colour, gloss and smoothness of film. It has been through the technological advancements achieved in robotic spray application and the modern formulations of complex resin/pigment systems that have allowed the modern consumer to choose vehicles from the widest colour palette possible.

This article will look at the concepts surrounding colour management within the automotive industry. Even though the "colour" of a car has little to do with the corrosion protection of the coatings system, we choose the vehicle we drive based on a colour perception. Once the decision has been made concerning the make and model, we find ourselves spending a significant amount of time considering the colour.

**Colour basics – what do we see?**

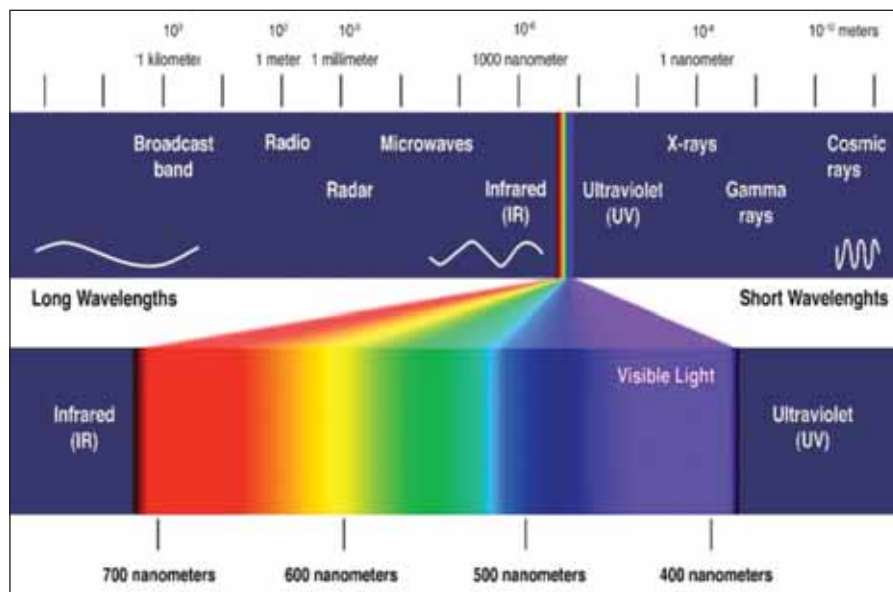
We are surrounded by an infinite variety of colours in our daily lives. Every time we look around different colours "play" on our eyes and we are influenced by these to varying degrees.



International Commission of Illumination Colour Standard (CIELAB) – Colour space model.

We perceive colour differently and one person's judgement of sky-blue will be totally different from that of the next person. We allow our past experiences, current moods and our inherent colour sensitivity to sway these perceptions. And herein lies the challenge...

Sir Isaac Newton (1642 – 1727) stated that colour is the observer's perception and not a property of the physical nature of light and therefore falls under the sensory sciences. What is true is that we need light to see colour. The human eye can only see light in the 360 to 780 nm (visible) range. It is within these wavelengths that we perceive the colour spectrum.



Human Visual Spectrum as part of the known energy waves.

So what do we see? With specific reference to the automotive industry, the colour of the object (the car) is judged by an International Commission of Illumination (CIE) colour standard known as the CIELAB  $L^*a^*b$ .

Under a given light source - and this also significantly influences our perception of the colour - we will observe the reflected light in a combination of three distinct attributes, viz. the brightness ( $L$  + light to  $L$  - dark), green to red ( $-a$  to  $+a$ ) and blue to yellow ( $-b$  to  $+b$ ).

The advantage of this system is that the colour model is a three axis colour system and  $L^*a^*b$  colours are absolute, meaning that the colour is exact. It's what's known as *device independent*; meaning that the  $L^*a^*b$  colour space is the only way to communicate different colours across different devices. An object's colour is measured in  $L^*a^*b$  colour with a spectrophotometer.

### The role of the pigment

The NACE CIP Level 1 Manual (1) defines a pigment as "a discrete particulate solid used to impart specific properties to the coating in a liquid or solid state". The three main functions of the pigment are:

1. To provide colour, opacity and gloss
2. To provide a protective function to the surface underneath the paint system
3. To provide a reinforcing function and assist the paint with adhesive and cohesive strength.

For the purposes of this article we will only focus on the colour aspect. A wide variety of natural and synthetic pigments are used in automotive paints and are broadly classified as either organic or inorganic.

It is the organic pigments that are usually preferred for colour development as they are generally brighter, stronger, more transparent (this is not always an advantage) and more stable. In addition, they have greater tinting strength (i.e. less pigment is required to get an equally strong colour), better gloss development and some absorb UV light, thus preventing it from damaging the binder.

The science that drives the perceived colour of an organic pigment is a complex relationship between the light energy absorbed and the degree of conjugation of the pigment. Light energy is absorbed by the delocalised B electrons of a conjugated system. These electrons do not usually absorb all wavelengths of light, so some frequencies are allowed to pass through - it is this unabsorbed light that we see.

The greater the number of conjugated bonds in a system, the lower the energy of light that is absorbed. Therefore, a molecule with little or no conjugation will absorb in the UV spectrum (and hence appear white), while a molecule with more conjugation will absorb in the blue spectrum (and appear yellow) or in the green spectrum (and appear red). The



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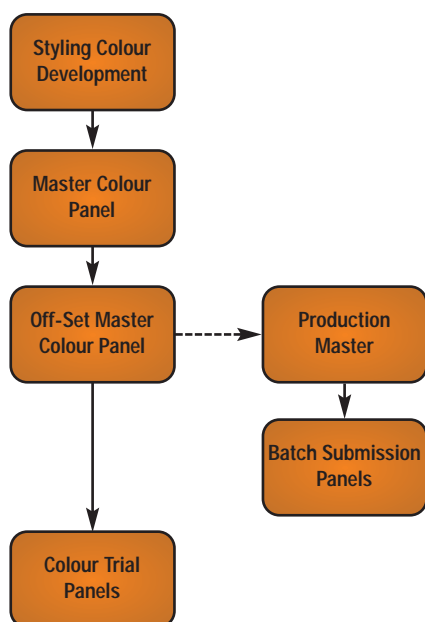
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Interference Mica pigments "twisting" light.



*New Colour Introduction Process Flow*

different conjugated functional groups that absorb visible light, known as chromophores, are commonly: —N=N—, —C=C—, —C=O, —C=S, —C=NH, —N=O and/or —NO<sub>2</sub>. (2)

Two of the most common inorganic pigments of interest are Carbon Black and Titanium Dioxide (TiO<sub>2</sub>). Together with other inorganic pigments they are widely used as they do not bleed, are heat and light stable and are much cheaper than organic pigments. TiO<sub>2</sub> is the strongest known pigment in terms of both opacity and tinting power. When coupled with its pure white tint and its fine particle size, it can be used as an “opacifier” (strong hiding power) to prepare films with a high hiding power and reduced pigment content. This has resulted in paints with much improved elasticity and hence improved durability.

The use of *Aluminium Flakes* and specialised *Interference Micac*s in the automotive industry has given modern cars a colour “twist” that was not available even in the recent past.

The sparkle effect through the use of modified aluminium oxide flakes and/or the ability of the colour to “change colour”, depending on the light source or viewing angle, is a highly desired and debated advantage of certain inorganic pigments.

**The colour match process**

Some will argue that the ability to match colour, in either a wet form (to tint a production batch) or as a solid component (bumper part to body), is more an art than a science. The ability to “see” the subtle shifts in the L\*a\*b scale does not come naturally to all. A good colourist has the ability to judge the perceived colour accurately and consistently and thereby achieve a colour match that would meet the stringent requirements of the automotive industry.

Once a new **Styling Colour** has been agreed upon, in discussion between various marketing, technical and sales forecasting departments, the **Master Panel** will be released to the automotive production facility and the chosen paint supplier. This is then the start of a “New Colour” introduction project. The paint manufacturer will then commence with the development of the new colour (sometimes even changing the actual binder technology to accommodate this) and once satisfied, a “Colour Trial” will be initiated at the automotive plant – the successful outcome of which will result in an **Off-Set Master** panel being created. This panel, which is unique to the automotive production facility and the colour on trial, becomes the panel against which all future work is judged. The paint supplier will then ramp-up to full production capability and for the first batch submission issue a **Production Master** – subsequent batches will be submitted with their appropriate **Batch Submission** panels. This entire process can take anything from 1 year (for minor colour changes) to several years (if

new technology changes require workability studies).

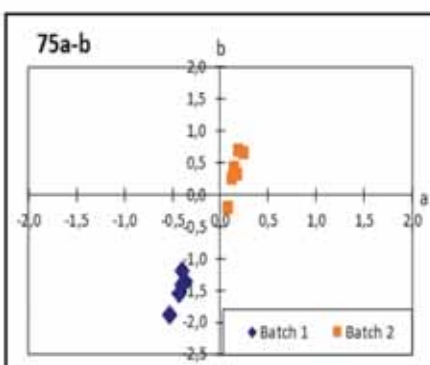
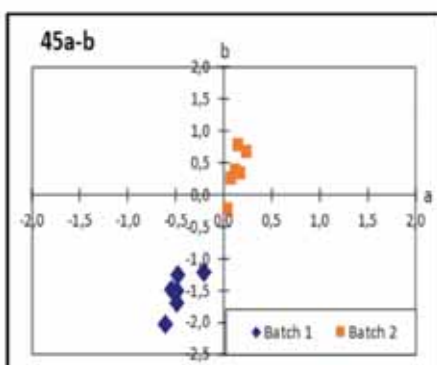
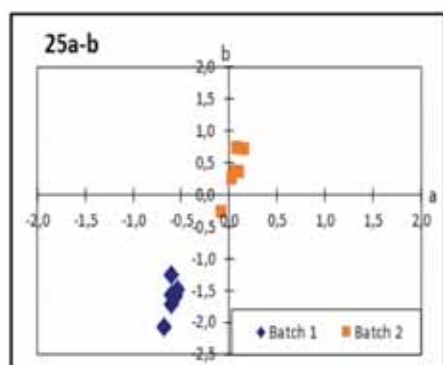
Throughout this entire process constant evaluation of the colour, by both spectrophotometric and visual comparison, is being made. Within the South African automotive market there are two main players supplying quality spectrophotometric instruments, viz. Konica Minolta (CM-512 range of instruments) and X-Rite (MA9X instruments). These two brands have captured this market for many years and remain leaders in the field of colour measurement and management.

**Colour management – instrumentation vs eye...**

There are two opposing concepts to measuring colour in the automotive industry - instrumentation vs eye. I believe both have a place in this somewhat subjective world and through the correct use of these “tools”, a near-perfect colour match can be achieved.

The instrumental measurement of colour relies upon the CIELAB principles to derive numbers for the different colours – these numbers can then be tabulated to produce a variety of graphical displays as shown below.

Two batches are compared for their colour harmony. Using a spectrophotometer able to capture light at defined angles (25o, 45o and 75o) to the incident beam, we are able to compare how the colour would present upon viewing. At all three angles Batch 1 is more green/blue vs the red/yellow of Batch 2. The question that is then asked is: “Would an ‘untrained’ eye see this?” Experience would suggest that (looking at the 45o graph), the extreme -2.0 b\* (blue) of Batch 1 would be noticeable against the +1.0 b\* (yellow) of batch 2 – the a\* (red/green) shift is negligible.



*Application of CIELAB principles derive numbers for colour-matching – the so called “match by numbers principle”.*



Rating	1	2	3-	3+	4	5
Meaning	Reject		Must Improve	Monitor	Acceptable Match	No Colour Difference Detected
Judgement	All Customers Reject	Most Customers Reject	Some Customers Will Reject ←—————→ More                      Few		Customer Will Accept	All Customers Will Accept

Courtesy of Hugh Norman - TSAM: QD

Visual judgement concept was pioneered by Mr. Hugh Norman at Toyota Manufacturing South Africa.

To help overcome the subjectivity in colour perception, a visual judgement concept was pioneered by Mr. Hugh Norman at Toyota Manufacturing South Africa.

The use of this table asks the obvious question: "What would the customer see?" The concept is successfully used to judge both incoming batch colour submissions and body to component part colour matching.

**Conclusion**

In 1909 Henry Ford stated that "Any customer can have a car painted any colour so long as it was black." At the time Ford's

comment was not directly related to colour development, but to enhance the productivity of his production capability and manufacture more cars.

In today's market this type of rationale would be ludicrous. We have become spoilt for choice and place a significant "value" to the colour of our cars.

Colour is a sensory science. We use it to display our personalities and, to an extent, our status. It influences our moods and sometimes allows us to get lost in our thoughts... We cannot live it... We are to enjoy it...



Henry Ford stated that "Any customer can have a car painted any colour so long as it was black."

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2. Waldie, John M, Surface Coatings. Volume 1 - Raw Materials and Their Usage, Oil and Colour Chemists' Association, Australia, 1974, 1983

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CORROSION PREVENTION AND SEALING TECHNOLOGY



I was 18 and SCUBA diving off a pristine, white, sandy beach in the Red Sea. My dive-buddy was a highly experienced world-traveling flight attendant who was roughly 15 feet in front of me as we were gliding down a gentle sandy slope. The slope was teeming with sand-eels, whose skinny bodies stuck up from the white bottom like blades of grass swaying in a breeze. As we slid over them, they would duck down and disappear, parting in our path.

When we hit about 45 feet, I felt the first indication that my regulator was malfunctioning. I had trouble taking a breath. My second breath was more difficult, as was the third. There would be no fifth breath.

At this point, my training kicked in. I was calm and focused. I had two choices.

1. Sprint-swim to reach my partner, who was now roughly 20 feet in front of me and 5 feet deeper. This was risky, as I was running out of air, and the sprint would make me breathe harder.
2. Commit a free-ascent – that is, swimming to the surface while exhaling the entire way. The risk here is in the need to exhale the entire way; the trick is to make a “zee” sound the entire time, which forces your throat open. If you hold your breath ascending, all it takes is 4 feet of ascent for you to rupture one or both of your lungs – and die a particularly slow and painful death from an embolism.

I made the decision in a split second and decided to swim to her. I was concerned that she would not know where I went, and would frantically have to look for me, putting her at risk.

I kicked my flippers and shot forward and grabbed her fin. I made the universal sign of being out of air (by the time I reached her I

could no longer take a breath) by running my finger across my neck.

I faced her and we grabbed each other's vests. She looked straight into my eyes and handed me her regulator.

So far so good... until I forgot to press the purge valve, which clears out the saltwater so you can take a breath.

I had been holding my breath, at what was now 50 feet, for more than half a minute. Yet when I took a deep breath for air, I inhaled saltwater instead.

As you can imagine, I started coughing uncontrollably. She was monitoring our ascent for both of us and I was fighting off the panic, which was creeping over me and which I knew could kill us both.

As my coughing slowly subsided, I was able to take one short sip of air when she ripped the regulator out of my mouth. I had not been paying attention to the time, or her pleas for the regulator.

The panic I had fought off reappeared as I waited patiently for her to finish her two breaths and hand the regulator back to me. What, you might ask, does this have to do with anything?

Well, it has to do with managing risk.

### The presence of risk

This post started after I read an apt question in JPCL, which read as follows:

***What criteria should an owner use to determine whether to specify full removal or spot- or zone-repair on a maintenance project?***

I started responding to the question and became overwhelmed – the answer is far too

complex from a technical perspective. And the real question – the meat of the question – is how one manages risk.

That, my friends, has to do with judgment, which is subjective. It is based on facts and data, but at the end of the day, it's subjective.

When NASA was in the midst of the Space Shuttle program, arguably the most complex machine ever made, the go/no-go decision was based on data (facts), but the risk was never ever zero. They launched when there was an acceptable level of risk.

I suspect that most of you reading this blog are beginning to shake your heads in the negative. My advice is: Loosen up your necks – they're going to get a lot more exercise.

### Advising clients on risk

I am repeatedly stunned at vendors' attitudes in advising their clients on technical issues.

I attended a conference a few weeks ago where the owner of a small engineering firm related the following story. He said his firm had inspected an elevated water tank that had been lined roughly 12 years earlier. The



*The author, years after the story described here, carries out an underwater repair coating application on one of the highest swimming pools in the world in a skyscraper in downtown Chicago.*



The following photos above display a proof of concept developed by the author's firm for a fountain at one of the most prestigious hotels in downtown Chicago. There was an existing bitumen elastomeric on the fountain. The cost for removal would have been exceedingly high, so the firm developed an overcoating operation and conducted a proof of concept. Left: Vapor blasting lightly abrades the existing coating; Centre: Coating was applied to bare exposed concrete and feathered onto existing coating system; Right: Four taped-off areas were set off to evaluate different surface preparations and materials.

## "Risk comes from not knowing what you're doing." – Warren Buffett

coating, in his own words, "looked good"; that is, there was nothing wrong with it. Still, he recommended completely removing it and reapplying a new one. And he honestly thought (so he led me to believe) that advice was in the best interest of his client.

While he believed that, he was wrong. It wasn't in the best interest of the client – it was in his and his firm's best interest. He simply didn't know enough about coatings to advise his client about the risks associated with doing nothing. And, in this case, the risk to leaving the existing coating in place was pretty darn close to zero.

The question about how to touch up a coating system is technically simple – if the existing remaining coating is well adhered, and it makes financial sense, do proper surface prep to the bare and rusted areas and feather in.

Yes, of course there are many other variables (aesthetics, ease of access to the areas, type of material remaining, environmental, etc.), but those are the basics.

### Aversion to risk

There is an overarching, endemic aversion to risk in our industry which:

- Is technically not warranted or justified;
- Puts lots and lots and lots of money in some vendors' pockets; and/or
- Is due to a lack of understanding.

I have been on dozens of jobs where I have recommended touchups or leaving coatings in place, when all of the other vendors involved are shaking their heads "no" and pointing out, rightfully, that there are risks.

Right now, in just these past few weeks in fact, my firm is consulting with a large chemical company that lined the interior of a new concrete trench. The existing coating is failing; while some of it is completely disbonded, much of it remains bonded, though poorly.

The cost to remove and replace would be staggering. The owner asked/directed us to devise a repair plan. So tomorrow I will crawl on my hands and knees (literally) and tap the entire trench, marking off areas that I think need to be removed and areas I believe can stay in place. (I can picture heads shaking "no" already).

In this case, the client is aware of the risk. However, the trench is readily visible and the client understands the need to monitor it. The client also understands that the existing coating may continue to disbond – or it may not.

Every other vendor I have spoken to about this project disagrees with me. The contractor, the various coating companies and other professionals I've spoken with universally think it's wrong.

But I cannot in good conscience advise my client to completely remove and replace the existing material when there's a reasonable chance that repair will work.

If I'm wrong, the client's inspections will catch it, and my client can conduct repairs as required or, at a later date, completely remove and replace. If I'm right, however, the client will save a fortune.

### Act in the interest of clients

Why am I frequently a voice of one? Because I'm more concerned with my client's best interest than my own.

While many are overly concerned with CYA (and, coincidentally, putting more of their client's money in their own pockets), I'm more concerned with doing what's in the best interest of my clients. I also know what I'm doing.

I study, and teach, a martial art closely aligned with what the Samurai practiced. Samurai means "those who serve," and that's not only how I practice traditional combat jujitsu, but it's how I parent, try to be a good husband (coming up on 25 years this Memorial Day) and how I run my business.

I took a risk when I sprinted to the fin of my diving buddy. But I made a mistake. I forgot to press the purge valve and it very nearly cost me my life.

That lesson taught me a great many things, one of which is straight from the most successful investor in the world, Warren Buffett: "Risk comes from not knowing what you're doing."

While I know what I'm doing, at some point, I will make a mistake. It is inevitable. However, we cannot in good conscience have our knee-jerk response to every corrosion mitigation issue be, "blast it off and recoat it."

It's not in the best interest of the client, and it's not ethically correct unless it is absolutely technically justified.

# Metal cladding and the environment

At present there is a degree of uncertainty within the metal cladding industry with regard to which legislation and national standards apply which stems mainly from the disparity between the NHBRC Home Building Manual, the National Building Regulations and SANS 10400 Part-L plus SANS 1273 and SABS 1200 HB. The NHBRC recently published its Home Building Manual and Guide which is fully aligned with the requirements of the draft for the revised Part-L of SANS 10400 as is the soon to be released SANS 10237 'the Design, Testing and Installation of Self-supporting Metal Cladding.' SANS 1273 'Fasteners for Roof and Wall Coverings in the form of Sheetting' is currently under review and will also be aligned with the above trilogy. SABS 1200 HB has been withdrawn. This should both simplify and clarify the requirements of the National Building Regulations, the overarching legislation for all buildings.

When choosing metal cladding for a structure there are a number of factors that have to be considered in order to derive maximum performance from a cladding system. The foremost of which are structural integrity, weathertightness, durability and aesthetics. Structural integrity is derived largely from geometry and to a lesser degree the combination of material strength and thickness. Likewise weathertightness is a combination of geometry, anchoring system and workmanship. Durability is dependent on the corrosion

resistance of the coatings applied to steel based materials or the metal itself in the case of aluminium, stainless steel, titanium zinc and copper alloys. However, workmanship, mechanical damage from transport, handling or following trades plus incorrect storage can all have a detrimental effect.

Currently in South Africa we have a choice of two metallic coatings together with their organic colour coated alternatives, three aluminium alloys, four grades of stainless steel, a titanium-zinc alloy and copper. Simplistically speaking the metallic coatings provide a sacrificial barrier against corrosion of steel based cladding, whereas the paint systems provide a barrier.

## Galvanized

Approximately eighty percent of all metal cladding sold in SADC countries has a galvanized or more correctly a zinc coating. This coating was first applied on wrought iron cladding in the 1820's. It is an economical, simply applied malleable coating which can withstand a fair amount of mechanical abuse, making it ideally suited to the rigors of unsophisticated construction sites in developing countries. Unfortunately it is susceptible to wet storage stain (white rust), as well as marine environments together with those containing concentrations of acidic gasses and fertilizers. Conversely it performs better than other metallic coatings in highly alkaline and animal husbandry environments. Durability in a given environment is basically proportional to its thickness so a Z275 coating will last almost 40% longer than a Z200 coating.

One often hears the remark that galvanized cladding does not seem to last as well as it used to. The answer lies in the thickness of coating. The original galvanized coating of the early nineteen hundreds was manually hot-dipped which resulted in a coating thickness of 80 – 100 micron whereas the modern continuous hot-dip process can provide a range of coating thicknesses varying between 4 and 52 micron.

Prior to the early 1990's most galvanized cladding had a Z275 coating ( $\pm 17$  micron/side) and a Z600 coating ( $\pm 42$  micron/side) in coastal areas. Since then there has been an ever accelerating



*Metal corrosion at sheeting overlap.*



*Discoloration in galvanized gutter from roof sheeting.*



*Failure of sheeting at fastener due to bi-metallic corrosion.*

progression, lead mainly by the larger builders' merchants and unscrupulous contractors, to thinner coatings with price, rather than structural integrity and durability, being the overriding concern. Most thin gauge galvanized corrugated iron and IBR have coatings of between Z60 and Z100 (4 – 7 micron) and between Z80 and Z150 (6 – 11 micron) respectively. If one considers the product life cycle of these thin coatings it is a classic case of penny wise, pound foolish. This problem is rife in the informal sector and amongst emerging contractors. All this is in flagrant disregard of the National Building Regulations and SANS 10400 part-L, the current edition of which specifies a minimum coating of Z275 for coastal and heavily polluted regions and Z200 for all other areas. Another unfortunate aspect is that documentation pertaining to the coating is frequently 'doctored' to meet contractual requirements. In an attempt to address this problem the National Regulator for Compulsory Specifications has agreed that the shortly to be published revision to SANS 10400 Part-L will require: *all coil used for the manufacture of metal cladding to be indelibly marked 50mm in from each edge and at not more than three metre intervals, with amongst other data the weight and type of any metallic coating and identification of any other coating applied to the coil. Furthermore products used in roof coverings shall preserve their properties, when used in accordance with the manufacturer's recommendations and with normal maintenance specified by the manufacturer, for at least fifteen years.*

Local cladding manufacturers refer to this indelible marking as branding. Branded coil has been available in the RSA for over fifteen years, mainly as an option to the more reputable cladding manufacturers. Fortunately two local and one foreign mill have adopted a policy of supplying branded product only.

### 55% aluminium-zinc

Since their introduction in the 1990's 55% aluminium-zinc coatings have steadily gained market share particularly in coastal regions. Considerable quantities have been used inland where the refined metallic finish has been employed as much for aesthetic reasons as for improved corrosion resistance. This material is not suitable for highly alkaline (e.g. over swimming pools) and animal husbandry environments nor for the storage of water. Although somewhat more expensive than a galvanized coating it is relatively simple to apply and can withstand a fair amount of mechanical abuse. Like all aluminium based products this coating is susceptible to both wet storage stain (black stain/rust) and fingerprint staining. Reputable coil producing mills apply a thin organic film to the surface which eliminates fingerprint staining and partially reduces the risk of wet storage stain. This film also assists with the even weathering of the coating. However, if aesthetics are important cladding should be rolled from a single batch of coil. Whilst the weathering (rate of corrosion) of this coating reduces with time its durability in a given environment is basically proportional to the thickness of the coating. As with galvanized coatings the current edition of SANS 10400-L specifies a minimum coating of AZ150 for coastal and heavily polluted regions and AZ100 for all other areas. Until recently this type of coating was only available with coating thicknesses ranging from AZ100 to AZ200. Regrettably unbranded imported coil with thinner coatings is now being sold into the local market. Fortunately the more reputable cladding manufacturers are supplying branded product only.

### Colour coated

In addition to their aesthetic appeal mill produced colour coated (pre-painted) material with either a galvanized or 55% aluminium-zinc coated substrate offer additional resistance against corrosion. The overall performance of these products in a given environment is dependent on the combination of paint system, the thickness of individual layers plus type and thickness of the underlying metal coating. Not all paint systems are equal. Performance of paints is directly linked to their formulation plus quantity and quality of the ingredients used. Paint systems with the same formulation composed of lesser quantity and quality of materials will not have the same durability as those made with better quality materials. Basically paint systems on cladding are composed of three layers; a chemical treatment of the surface of the metallic coating which governs the adhesion of the primer to the metallic coating (this is important at cut and sheared edges as any interfacial defects between the metal

## Aluminium roofing and cladding

Brian Dennis, Technical Consultant to the Aluminium Federation of S Africa

Aluminium industrial and commercial roofing sheet is manufactured and widely used in South Africa. Its traditional use in the more corrosive environments has been extended by its modern characteristics of re-cyclability, sustainability, re-sale value and general eco-friendliness. Its credibility as a mill-finish material is based on over forty years of local case-histories. Systems can be designed for severe atmospheric and most industrial applications, up to C5+ corrosivity rated applications (ISO 9223). This corrosion resistance is achieved by the natural oxide film which re-forms spontaneously if the film is damaged.

Several substrate alloys can be used such as 3003, 3004, 3105 and 4107, conforming to BS EN 573-3: 2009. These are general engineering alloys and in tempers selected for their structural performance, formability and optimum corrosion qualities. Mechanical properties remain high even after longer service lives so such roofing continues to be trafficable and structurally sound.

These roofing systems are increasingly used with coil-coated finishes, such as super-durable polyesters or PVDF types which can maintain appearance and film integrity for 15 to 20 years or more. There are several critical and state of the art technologies incorporated into the continuous coil manufacturing process.

Attention is necessary to fastener selection and installation systems - especially in galvanic corrosion situations. The traditional 304 or 316 stainless steel or aluminium fasteners are still technically preferred and cheap imported types best avoided."

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*The underside of a ridge cover sheet fitted in 1928 shows a residual zinc coating of 45µm.*

coating and primer will allow moisture to be drawn in by osmosis), a primer which provides corrosion protection and a top coat that in addition to providing a colour acts as a barrier to UV radiation and minor mechanical damage. The extremely high levels of UV radiation experienced in Southern Africa quickly reveal the quality of the pigments and resins used. Lesser quality materials fade, discolour or chalk prematurely. Failure of the primer manifests in the form of blisters and pockets of rust. Brands such as Chromadek, Colorbond, COLORPLUS and Color-Tech have performed well in local environments. Details of their composition and performance are well documented and freely available. All have technical departments to answer queries plus provide advice on the use of their various products. Before using cladding rolled from unknown colour coated coil it is important to establish the type and thickness of the underlying metallic coating together with details of the composition and formulation of the paint system. Tests results, preferably from SANAS accredited facilities, complying with the requirements of relevant internationally recognized standards, other than the salt spray test, will give an indication of performance in a given environment. Best of all are 'real world' tests where samples of the coatings are exposed at open test sites located in various environments. Geometry of the cladding profile can influence the performance of colour coated material. Profiles formed with sharp corners or very small radii can produce micro cracks in the paint which can be a source of cathodic delamination. Colour coated materials are also subject to wet storage damage. Paints exposed to trapped moisture for extended periods become impervious, thereby allowing moisture to penetrate to the underlying metallic coating and forming a corrosive cell.

### Metal alloys

The corrosion resistance of almost all metals is dependent upon the formation of a thin oxidized layer (patina) that forms on the surface when exposed to the atmosphere. This layer, when damaged, reforms relatively quickly on zinc and aluminium-zinc surfaces, however the process takes much longer on aluminium, stainless steel and copper alloys. Mechanical damage or exposure to concentrations of certain contaminants can destroy this layer resulting in accelerated corrosion. The oxide film on an aluminum surface becomes highly unstable in the presence of a liquid and an acidic or highly alkaline environment (pH below 4 or above 9). Fragments of carborundum from cutting discs is detrimental to stainless steels. With metal alloys it is important



*Swarf and mild steel grinding dust not removed at installation now seriously affecting roof sheeting aesthetics and ultimately corrosion resistance.*

to match the composition of the alloy to the corrosive agents in the surrounding environment.

### Environment

Whilst legislation has considerably reduced the amount of corrosive gasses released into the atmosphere there remain a number of industrial areas that are highly polluted. The concentration of informal settlements and the number of non-electrified settlements that rely on the burning of coal for heating produce atmospheres that are highly corrosive in what are generally considered rural or mildly corrosive areas. Although ISO 9223 and 9224 are useful tools in determining the corrosivity of environments they require a working knowledge of both the corrosion process and local conditions to enable one to make a reliable assessment of the corrosivity of a given environment.

We are of the opinion that a map similar to that produced by the Hot Dip Galvanizers Association Southern Africa during the 1970's will simplify the process from a macro perspective. In recent years several attempts have been made to develop a corrosion map for the RSA which would reflect the corrosivity of the environment prevailing in the various regions. Unfortunately government agencies have declined to fund such an exercise. Industry and private sources also declined to support the initiative. There have been a number of academic studies in a select number of individual regions but these can't be reliably extended to a national level.

An aspect regularly overlooked when considering the corrosivity of the environment when selecting a suitable cladding material is the impact of micro environmental conditions prevailing in the neighborhood or even from processes within the structure itself. Fallout from foundries, galvanizing, petrochemical processes, fertilizer and cement packaging, wood processing, gasses released from stored goods and numerous other industrial processes can have a detrimental effect on the coating/s. Intensive animal farming requires special attention.

### Bi-metallic corrosion

Bi-metallic (galvanic) corrosion occurs between dissimilar metals in the presence of an electrolyte such as water can accelerate the rate of corrosion of the more anodic (electrochemically active) metal which sacrifices itself to protect the more cathodic (electrochemically passive/noble) metal e.g. zinc and carbon steel. The metals do not necessarily have to be in direct contact. Runoff from a passive onto an

active metal can have the same results e.g. from a copper pipe onto a galvanized or 55% aluminium-zinc coating. The rate of corrosion is proportional to the respective areas of the anode to the cathode i.e. large anode to small cathode yields a small rate of corrosion e.g. an aluminium pop-rivet in galvanized flashings and visa-versa with small anode to large cathode. Runoff from any coating or material other than galvanized should never be discharged onto galvanized cladding nor into a galvanized gutter or downpipe. The attached tables indicate the relationship between various combinations. Runoff from inert materials onto an active metal can also accelerate the rate of corrosion e.g. colour coated or polycarbonate onto galvanized material.

**Ponding and crevice corrosion**

Ponding and crevice corrosion can also result in premature failure of a coating or metal. Ponding is where moisture accumulates for a period of time in indentations in the surface of the cladding resulting from excessive foot traffic or concentrated loads such as inadequately supported scaffolding. Concealed-fix profiles with broad pans on roofs inclined at less than 5° are particularly susceptible. This problem can be acute during winter in the summer rainfall areas where pollutants that precipitate onto a surface are mixed with dew to form a highly corrosive poultice.

Crevice corrosion occurs when stagnant water (depleted oxygen) is entrapped between two surfaces such as unsealed lap joints or ineffective sealing gaskets between the heads of fasteners or washers and the cladding. Examples are over/under tightened fasteners, fastener not perpendicular to the cladding or degraded gaskets.

**Fasteners**

It is vitally important that the durability of the coatings to fasteners and washers is at least equal to or better than that of the coating on the cladding. The same applies to the sealing gasket. In addition the gaskets should contain absolute minimum levels of conductive carbon black fillers in order to prevent the establishment of an electrochemical cell. EPDM gaskets have proved to be the best material for gaskets. EVA based gaskets are not as resilient when exposed to UV radiation. Plastic gaskets generally have a low resistance to UV radiation and the high temperatures associated with roof cladding. Plus the addition of conductive carbon black to improve UV performance promotes the establishment of an electrochemical cell. Despite much being written on the subject of the durability of the coatings applied to fasteners and washers vast quantities of inferior products are flooding the RSA market with once again price overriding structural integrity and service life. The coatings on these products generally fail within a year of being installed, leading to staining of the surface and ultimately to failure of the coating of the cladding. What most consumers fail to realize is that warranties issued by the coil manufacturers and cladding profilers are subject to the cladding being fixed with approved/recommended fasteners that comply with the requirements of SANS 1273. Carbon steel based fasteners are not suitable for the fixing of metal alloys such as aluminium, stainless steel and copper. Fasteners for cladding are divided into two categories; primary, used to attach the cladding to the supporting structure and secondary, used to attach ancillary items such as flashings as well as to seal side and end laps. The shortly to be released metal cladding standard SANS 10237 and revised SANS 10400 part-L prohibit the use of any form of rivet or nail as primary fasteners.

**ANNEX-C (informative)**  
**COMPATIBILITY OF METALS AND METAL COATINGS**  
**TABLE-C1: COMPATIBILITY OF MATERIALS IN DIRECT CONTACT**

Lower surface	Upper surface								
	Galvanized	Galv + paint	Al/Zn	Al/Zn + paint	Aluminium	Stainless steel	Copper	Lead	Unseasoned or wet timber
Galvanized	Yes	Yes	Yes	Yes	Yes	No	No	No	No
Galv + paint	Yes	Yes	Yes	Yes	Yes	No	No	No	No
Al/Zn	Yes	Yes	Yes	Yes	Yes	No	No	No	No
Al/Zn + paint	Yes	Yes	Yes	Yes	Yes	No	No	No	No
Aluminium	Yes	Yes	Yes	Yes	Yes	No	No	No	No
Stainless steel	No	No	No	No	No	Yes	No	No	No

Al/Zn=Aluminium/zinc

**TABLE-C2: ACCEPTABILITY OF DRAINAGE FROM AN UPPER TO LOWER SURFACE**

Lower surface	Upper surface										
	Galvanized	Galv + paint	Al/Zn	Al/Zn + paint	Aluminium	Stainless steel	Copper	Lead	Fibre cement & cement tiles	Slate & glazed tiles	Glass & Plastic
Galvanized	Yes	No	No	No	No	No	No	Yes	Yes	No	No
Galv + paint	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes
Al/Zn	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes
Al/Zn + paint	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes
Aluminium	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes
Stainless steel	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

### Site storage

As stated above all metal based cladding is susceptible to wet storage staining which, if left unchecked, can result in the depletion of the protective coating and corrosion of the substrate. This process can be initiated within hours of bundles of cladding being exposed to moisture from the time of being produced in the profiler's factory. What is important is that the components are stored (preferably inclined) above a dry surface, are kept constantly dry and are exposed to free flowing air. It is of paramount importance that components exposed to moisture are separated, dried and exposed to free flowing air as soon as possible. Bundles tightly wrapped with waterproof materials are particularly vulnerable as are those where the covers are draped over the packed items and then anchored to the supporting surface, they sweat when exposed to hot/cold cycles. The best way of preventing this form of corrosion is to deliver the cladding as close to the installation date as possible.

Moisture is not the only reason to protect cladding materials whilst awaiting installation. The accumulation of dust, debris and other building materials such as mortar etc. can damage the surface. In order to avoid mechanical damage cladding needs to be stored out of the way of other trades and traffic.

### Workmanship

High speed (Abrasive) discs should not be used for cutting cladding components, the high temperature generated and molten sparks of metal damages adjacent surfaces whereas the resultant burr inhibits cathodic protection of the cut edge plus is a source for unnecessary scratches of the coating/s. Preferably a slow speed toothed blade or nibbler should be used. Swarf from cutting and drilling can initiate corrosion if not removed promptly. Chafing from improperly installed safety lines repeatedly remove areas of coating thereby exposing the steel substrate.

### Following trades

The surfaces of metal cladding can be irreparably damaged by building materials stored on roofs by other trades. Copper pipes, raw timber, uncoated carbon steel and wet cement based products can swiftly initiate corrosion of the surface. It is a common practice to support air conditioning units on wooden blocks.

### Solar heaters and PV panels

Electrical conduits placed directly on the surface of the cladding are another source of accelerated corrosion. The interface between support frames for solar water heaters, which invariably have a minimal protective coating, presents a similar scenario. PV panels should never be installed on galvanized roofs. Runoff from inert surfaces accelerates corrosion of the galvanized coating.

### Maintenance

Deposits of corrosive agents from ventilators, extractors, stacks, etc. plus all forms of vegetative material need to be cleaned from cladding and gutters on a regular basis so as to ensure optimum performances from the cladding material. Areas unwashed by rain, e.g. underside of overhanging eaves, canopies, carports, etc. should be washed with clean water at not more than six monthly intervals inland or quarterly at the coast.

# Stainless steel roofing

Stainless steel roofing and cladding has been extensively used by the world's leading architects for many of their most iconic creations. However, for various reasons, the use of this prestige product in South Africa has been rare.

### What is stainless steel?

Stainless steels contain more than about 12% chromium as well as some other alloying elements. It is this chromium content that provides stainless steel with its corrosion resistance. It does this by combining with oxygen from the air to produce a chromium-rich oxide surface layer. This is known as the 'passive layer' and provides lasting protection against all types of corrosion. This passive layer is naturally self-healing when oxygen is present. Corrosion resistance is increased with higher chromium levels and, additionally, through the addition of elements such as molybdenum and nitrogen. There are many different grades of stainless steel, but a handful of them are used for most roofing and cladding purposes.

### Stainless steel – an ideal roofing material

Stainless steel is a highly versatile material, offering an attractive combination of benefits over the lifetime of a building. These include durability, safety, low maintenance, low weight, a variety of finishes, recyclability, environmental safety and life cycle cost benefits.

### Durability

Stainless steel is highly corrosion resistant, allowing its use in even the most severe atmospheric conditions. The corrosion resistance of stainless steel is in the order of 100 – 1 000 times better than conventional metal roofing materials. It has high strength and low coefficients of thermal conductivity. It will outlast virtually all other roofing materials.

### Safety

The austenitic stainless steel grades most frequently used for roofing, have a higher melting point than many other roofing metals, providing additional safety in the event of fire. They also retain a higher proportion of their strength at elevated temperatures than carbon steels and aluminium, and higher stiffness at all temperatures.

### Low maintenance

Maintenance costs continue to increase. Because of their long-term corrosion resistance and smooth surface finishes, most stainless steel roofs require very little maintenance. Painting and other protective coatings are not generally required.

### Low weight and versatility

The high mechanical properties of stainless steel allows for lower thickness than most other metallic roofing materials. This may result in a lighter, more cost-effective supporting structure.

### Finish

Stainless steel is often used for its aesthetic qualities – specifically, its bright, reflective appearance. However, a low reflective or matt



Photo: [https://en.wikipedia.org/wiki/Walt\\_Disney\\_Concert\\_Hall](https://en.wikipedia.org/wiki/Walt_Disney_Concert_Hall)



*Walt Disney Concert Hall in Los Angeles, California in the USA.*

finish is often preferred for roofing, both to reduce reflectivity and to blend in with more 'traditional' materials. Highly reflective surfaces tend to show up shape problems, so these materials are often rigidized or embossed to improve both their rigidity, shape and reflectivity. Stainless steels can also be electrochemically coloured which provides a long lasting vibrant range of colours.

When cost efficiency is paramount, the most common choice would be a 2B finish, which is smooth, flat and rather reflective. A rule of thumb is that the brighter and smoother the finish, the better the corrosion resistance and the easier the maintenance.

### Recyclability

Stainless steel is the ultimate 'green material.' It is infinitely recyclable and, globally more than 70% of all stainless steel is made from re-cycled materials. Stainless steels are inert to most atmospheric corrodants, and consequently generate no noxious heavy metal pollutants which could end up in the water systems of our cities. There are also no painting requirements, so deterioration and flaking of paint is also not a concern.

### Application

Stainless steel is suited to all roofing systems (batten rolls, standing seams, self-supporting trays, tiles, complex shapes). It allows for optimum architectural creativity and the realization of intricate designs. It combines easily with other materials such as glass, wood or concrete.

Note that stainless steel fasteners should be used on stainless steel roofs.

### Economy

Stainless steels are often considered as expensive, but this is only so on an initial cost basis. When evaluated over the expected life of a project, which could be in excess of 50 years, the stainless steel

option could be significantly cheaper. One has to take into account factors such as no re-painting, no replacement, zero effluent problems, possible reduced supporting structure costs, improved fire-safety (lower insurance costs), the residual value at the end of the project, etc.

Stainless steel roofing offers excellent quality versus price ratios in construction. Choosing stainless steel offers a long-term guarantee.

### Life cycle costing "app"

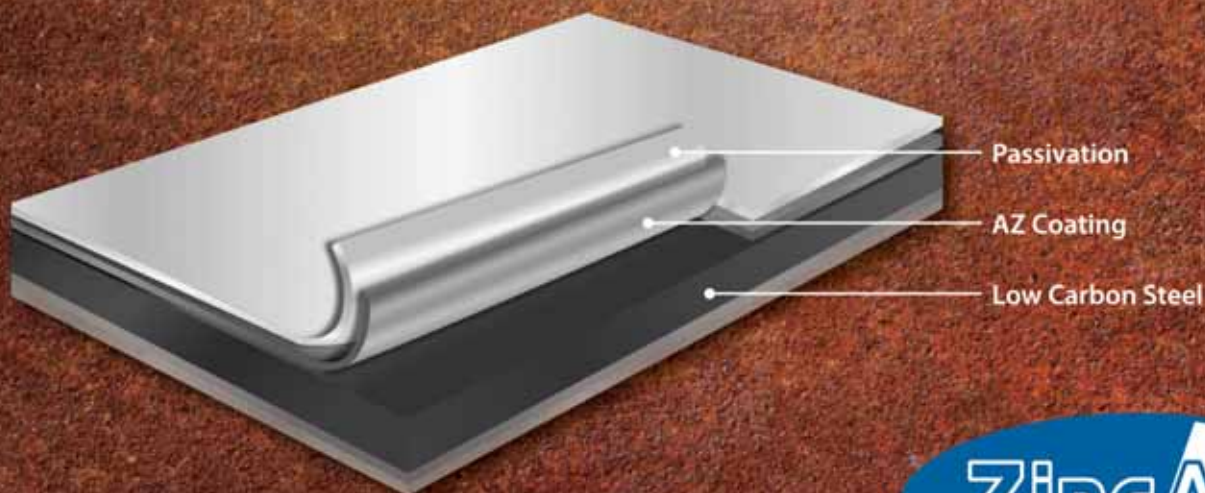
A Life Cycle Costing "App" for tablets and smart-phones is available from SASSDA to assist in determining the most cost efficient material selection for your upcoming project.

Photo: <https://de.wikipedia.org/wiki/Cancom>



*Cancom Headquarters in Germany uses coloured stainless steel cladding.*

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# Understanding the corrosion properties of aluminium-zinc coating

## History of aluminium-zinc coating (AZ coating)

In the early 1960's the research process had reached a point where a mixture of 75%Al-25%Zn was achieved and as quoted by Ange Borzillo... "I remember those first tests. We saw something that took us by surprise. After samples were dipped and pulled from the bath, they heated up and glowed red just standing in the air". Further developments lead to the addition of silicon to reduce this exothermic reaction and to the composition 55%Al-43.4%Zn-1.6%Si. It was in 1965 that the first trial run was performed at Sparrows Point.

In 2010 Safal Steel (Pty) Ltd started producing in South Africa, under licensed agreement with BIEC International Inc, the aluminium-zinc product called ZincAl and later added the pre-painted ColorPlus.

## Factors influencing the enhanced corrosion properties of aluminium-zinc coating

### a. Coating microstructure

The coating microstructure of the AZ coating consists of (refer to Figure 1):

- 80% Aluminum-rich primary and secondary dendrites
- 20% Zinc-rich interdendritic phase

The coating microstructure of the traditional galvanized coating (GI) consists of (refer to Figure 2):

- Almost pure zinc.

### b. Corrosion protection mechanism

The AZ-product follows a two stage corrosion mechanism (refer to Figure 1):

- *Sacrificial protection:* During the first year of environmental exposure the zinc corrodes to form a zinc oxide that deposits in the interdendritic regions. These oxides are often referred to as passive oxides, once they are formed the corrosion rate of the AZ product rapidly reduces to a parabolic curve.
- *Barrier protection:* The aluminum and stable oxides will supplier the barrier to corrosion.

The two stage protection follows a parabolic trend after the first year of corrosion. It is imperative to ensure the dendritic structure of the AZ-coating is maintained with the correct Dendritic Arm Spacing size (DAS).

The GI-product follows a single stage corrosion mechanism (refer to Figure 2):

- *Sacrificial protection:* The zinc is consumed forming corrosion products in a linear manner for the lifespan of the product.

The two stage protection is the reason why under most conditions the AZ coating performs better than the conventional GI coated product.

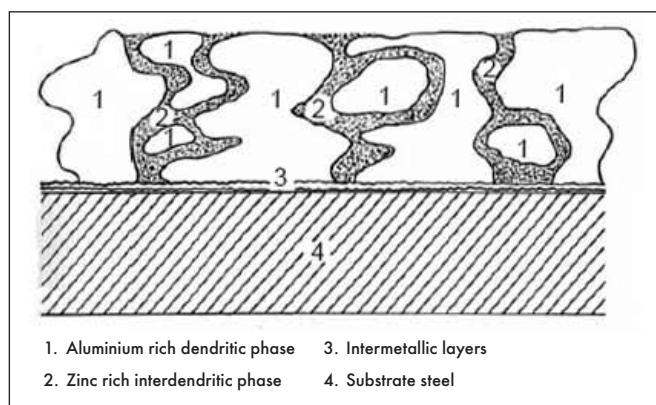


Figure 1: A schematic cross sectional view.

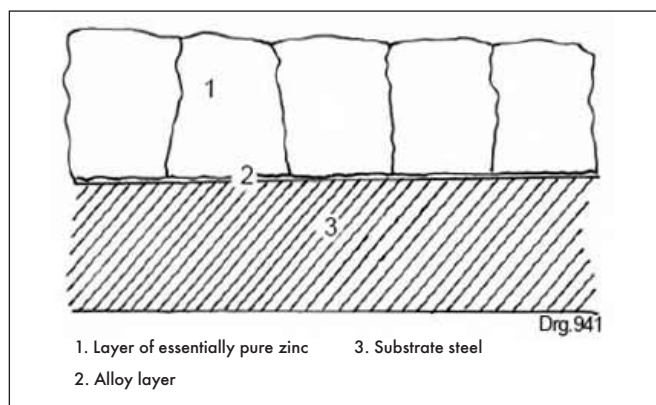


Figure 2: A schematic cross sectional view of an AZ coating of a GI coating.

Corrosion* Categories	C1	C2	C3	C4	C5	CX
Corrosivity*	Very Low	Low	Medium	High	Very High	Extreme
Outdoor*	Very low Pollution	Low Pollution SO <sub>2</sub> <5µg/m <sup>3</sup>	Medium Pollution SO <sub>2</sub> : 5µg/m <sup>3</sup> to 30µg/m <sup>3</sup> or some effect of Cl <sup>-</sup>	High Pollution SO <sub>2</sub> : 30µg/m <sup>3</sup> to 90µg/m <sup>3</sup> or substantial effect of Cl <sup>-</sup>	Very High Pollution SO <sub>2</sub> : 90µg/m <sup>3</sup> to 250µg/m <sup>3</sup> and significant effect of Cl <sup>-</sup>	Extreme Pollution SO <sub>2</sub> : > 250µg/m <sup>3</sup> Extreme industrial and coastal
AZ Coating**	100	100	150	150	200	200

\*Reference to ISO 9223 second edition 2012-02-01 : \*\*AZ-Coating type g/m<sup>2</sup> guideline, only.

Table 1: Typical atmospheric environments.

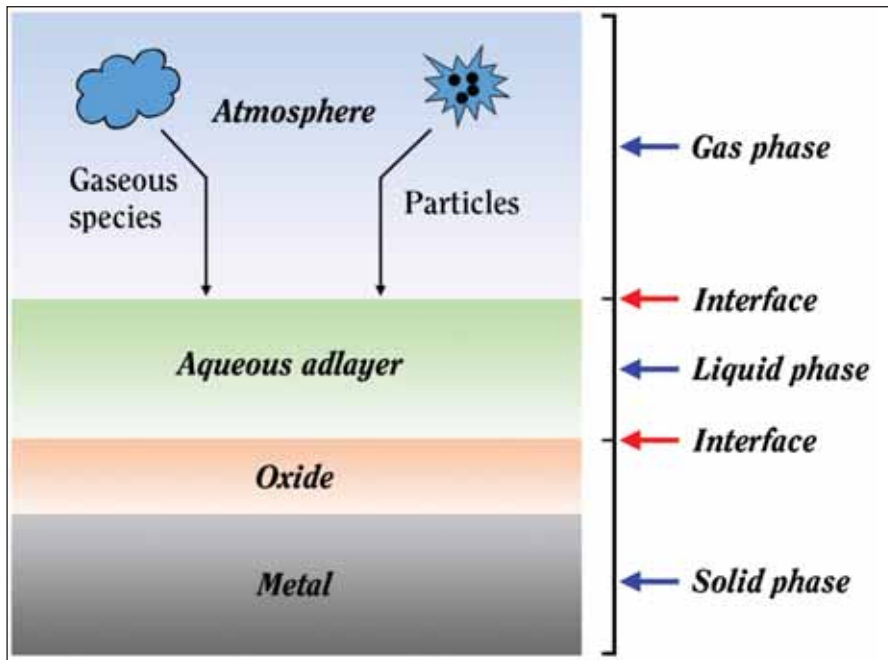


Figure 3: Environmental corrosion.

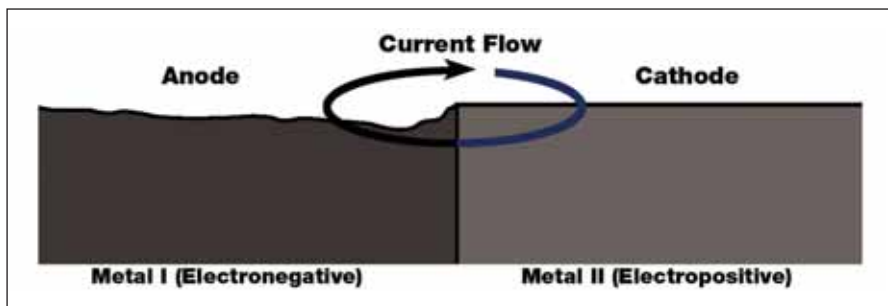


Figure 4: Bimetallic Corrosion

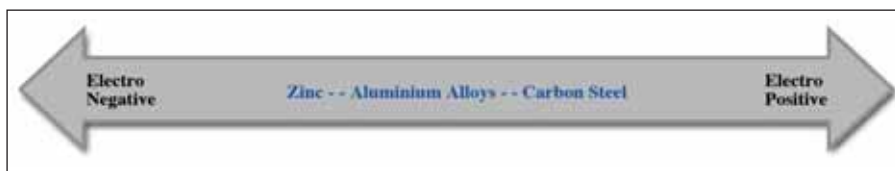


Figure 5: Abbreviated galvanic series in sea water.

**c. Atmospheric environmental conditions:**

**1.1 Atmospheric Corrosion Mechanism**

Atmospheric corrosion on AZ-coated product normally follows the process (see Figure 3):

- Moisture accumulation on the coated product.
- Gaseous species (SO<sub>2</sub>, NO<sub>2</sub>, CO<sub>2</sub>) and particles (Cl<sup>-</sup>) settles in aqueous layer.
- Byproducts of the gaseous species and particles results in the formation of corrosion oxides on the coated product and destroys the passive oxides. Latter then reforms.

**1.2 Typical atmospheric environments (see Table 1)**

The corrosion category is a guide to the environmental conditions, however to conclusively decide the AZ-coated product type to be used, a complete analysis of all conditions should be considered:

- *Outdoor conditions:* Gaseous species concentration, particle type, total particulate matter, distance from the ocean.
- *Indoor conditions:* Industrial activities.
- *Weather conditions:* Rainfall, temperature, humidity, UV factor.

**d. Bimetallic corrosion**

Bimetallic corrosion occurs when two metals, with different potentials, are in electrical contact while immersed in an electrically conducting corrosive liquid. Because the metals have different natural potentials in the liquid, a current will flow from the anode (more electronegative) metal to the cathode (more electropositive), which will increase the corrosion on the anode (see Figure 4).

Bimetallic corrosion is visible between AZ-coated products and fasteners coated with zinc (see Figure 5):

- Zinc coated fastener acts as the anode and will corrode first, while the AZ-coated product acts as the cathode.
- Once the zinc coating is removed due to the corrosion, the remaining steel fastener acts as the cathode and the AZ-coated product acts as the anode and corrosion of the AZ-coated product is increased.

The selection of the correct fastener is important to ensure the lifespan of both the roof sheeting and side cladding is ensured.

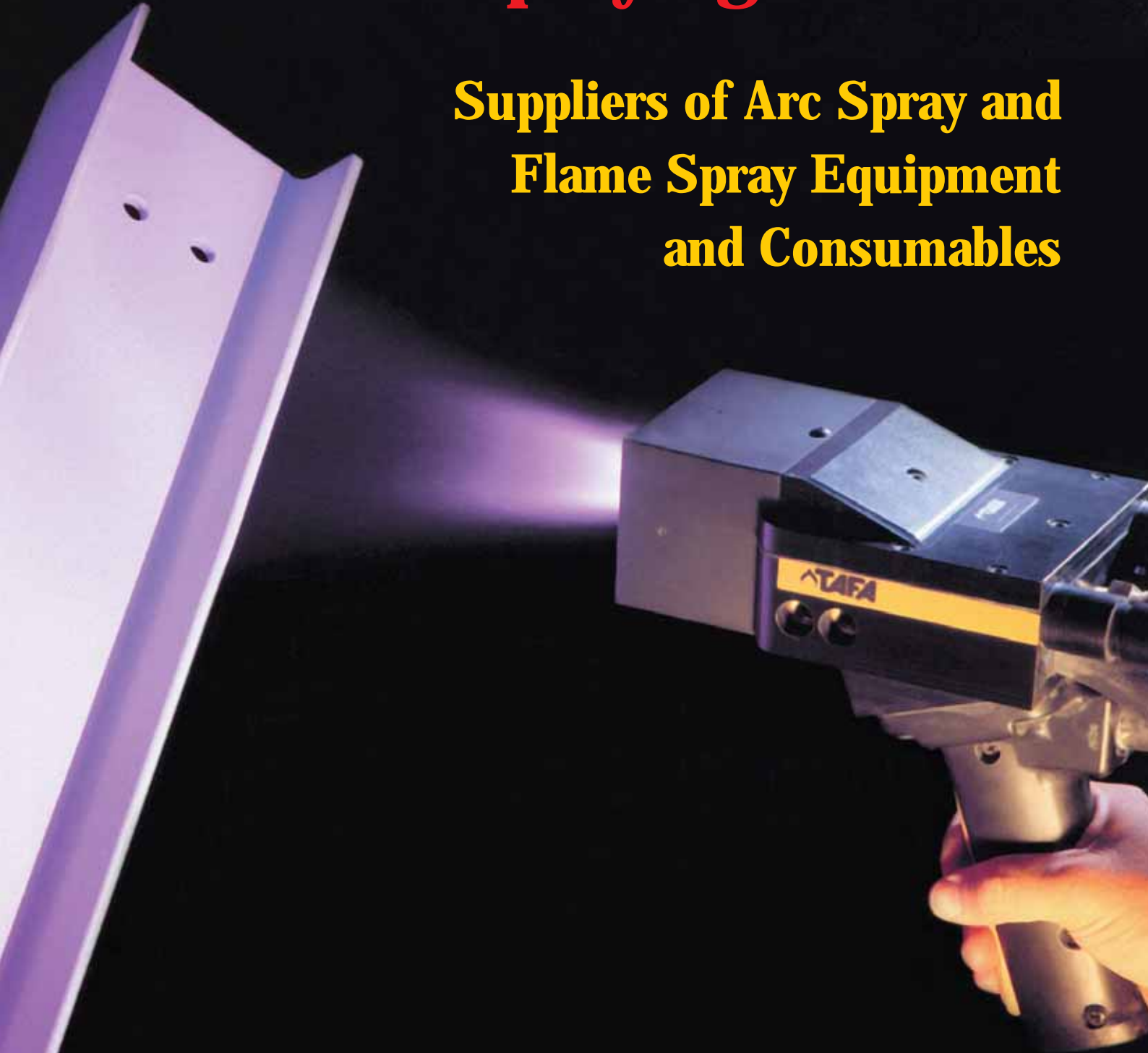
Fasteners are corrosion rated Class 1 to Class 4 based on:

- *Porosity:* Rating 6 to 8.
- *Coating type:* Electroplated Zinc, Mechanically Plated Zinc, Hot Dip Galvanised
- *Coating composition:* % Zinc and % tin with coating thickness ranging 4 to 45µm.

The AZ-coated product has shown a supremacy in the field of corrosion. Further enhancements have been made in the production of pre painted AZ-products such as Modified Polyesters, Polyurethane and Polyvinylidene Fluoride (PVDF). These products ensure enhanced corrosion protection in highly corrosive industrial and environmental conditions.

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# Subsea pipeline corrosion management

Wesley Fawaz, Executive Officer of the Australasian Corrosion Association

At offshore oil and gas fields around the world, there are thousands of kilometres of subsea pipelines connecting drilling rigs and production platforms to wellheads and onshore facilities. These represent billions of dollars of investment by companies over many years.

Owners of these high-value assets must understand the cost implications of ignoring the effects of corrosion. There are many advantages of planning for corrosion control and mitigation, two of which are that the life of an asset can be extended and maintenance time and costs reduced.

The marine environment is a harsh one and pipelines are exposed to a range of external physical, climatic and chemical effects that can cause corrosion and degradation to the outside of the pipes. Not to mention the fluids flowing through a pipeline are themselves corrosive to the inside surfaces.

Monitoring the impact of corrosion on subsea pipelines and offshore structures is a critical aspect of ensuring pipeline integrity. A key way of minimising corrosion is to employ appropriate protection technologies. Companies such as Deepwater Australasia (DWA), Carboline and Independent Maintenance Services Pty Ltd (IMS) supply products and services that meet the varied challenges of offshore and deepwater oil and gas operations around the world.

To enhance the effectiveness of the work of companies like DWA, IMS and Carboline, the Australasian Corrosion Association (ACA) works with industry and academia to research all aspects of corrosion in order to provide an extensive knowledge base that supports best practice in corrosion management, thereby ensuring all impacts of corrosion are responsibly managed, the environment is protected, public safety enhanced and economies improved.

Most of the world's shallow water oil and gas deposits have been found. As the demand for oil has increased, exploration companies have been looking at reservoirs in deeper and deeper waters. The cost of floating facilities and platforms over deep water

reservoirs is extremely high, so projects with equipment located on the sea floor are becoming common.

According to David Flanery, Business Development Manager at DWA, the method of corrosion protection selected depends on the material that is used to construct offshore infrastructure. Pipelines are often epoxy or concrete encased whereas a platform usually has large amounts of exposed steel. Subsea assets often require protective systems that include special coatings with a long-duration operational life, sacrificial cathodic protection systems, or combinations of these.

Ricky Collins, Sales Manager Australasia at Altex Coatings, a regional Carboline supplier, stated manufacturers have developed insulating products that have been designed to withstand the rigours of deepwater operations. The material used in these has been specifically engineered for use with subsea pipelines.

Surface coatings and other corrosion prevention methods are usually maintained by companies such as IMS. The scope of the work these companies carry out on offshore structures ranges from general maintenance work through surface preparation and coating to spot blasting and painting.

According to Jan Sikora, Operations Manager at IMS, all of the work his company does to keep offshore structures in optimal condition



*Clamping an anode to an underwater pipeline.*

is planned proactively by the asset owners. "Regular inspections are carried out to determine the condition of an offshore installation and then the asset owner plans the schedule and scope of works to be carried out by us," he added.

There are a variety of methods for securing a pipeline while on the sea bed. The depth of the water above the pipe determines whether it must be buried or weighted to keep it in place. In general, if the water depth is less than 50 metres, most countries require that pipelines be laid in a trench.



*Preparing the steel of an offshore structure for priming and spray coating.*

The working and operating environment for equipment and pipelines in the deep ocean are vastly different to those of coastal activities. The temperature of seawater at depths of thousands of metres drops to around 2°C. Oil from deep wells can be as hot as 176°C. As the hot oil comes up from the well it travels through the much colder pipeline and the fluid in the pipe can quickly cool down. At approximately 21°C, the water and gas mixtures in the pipe can form gas hydrates or paraffins. If the build up of paraffins is too great, it can ultimately block the pipeline. Such blockages can be extremely costly to clear and, if a pipeline ruptures, can cause catastrophic damage to equipment and the environment.

Subsea Flow Assurance is a term used in the offshore oil and gas industry to describe processes that ensure subsea pipelines and equipment maintain oil flow. It is therefore essential that appropriate insulating materials are applied to infrastructure in order to maintain or at least slow down the heat loss from the fluids being transported. Manufacturers of surface coatings have worked to develop suitable materials to

handle the extreme conditions of deep water activities.

“An offshore production field is a very complex system,” Flanery said. “Ideally, all the different components and their separate corrosion protection needs should be carefully planned at the design stage.” For example, oil and gas flows from the reservoir, through the subsea tree and, typically, to a manifold or pipeline end termination (PLET) via a jumper pipe. Fluids pass along the pipelines to a production platform for processing before being sent to a tanker or onshore facility for further processing. (A jumper is a short flexible or rigid length of pipe that is used to connect a flowline to other components.)

There can at times be a design gap between the corrosion protection systems of two adjacent assets, such as a flowline and a manifold. This can occur because each specialist company manufactures its specific component and different contractors lay them on the sea bed. The corrosion protection system for each asset is sometimes not communicated between

companies and often the operator may not take holistic oversight of the field. “You cannot just look at a pipeline in isolation,” Flanery said. “It is always part of a much larger system.”

Typical offshore pipelines are composed of 12 metre lengths of pipe welded end-to-end on a pipe lay vessel. Each joint is covered with a factory applied anti-corrosion coating, except for approximately 60 centimetres at each end. These areas are left bare to prevent the heat from welding operations from damaging the coating. Once the girth weld is completed between the two joints, an uncoated area of approximately 1.2 metres remains. Most pipelines are designed to use a field applied joint coating, typically in the form of a heat shrinkable sleeve.

Cathodic protection (CP) is a technique used to control the corrosion of a metal surface by making it the cathode of an electrochemical cell. A simple method of protection connects the metal to be protected to a more easily corroded “sacrificial metal” to act as the anode. The sacrificial metal then corrodes instead of the protected metal.

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The most common CP system for pipelines uses bracelet anodes that are clamped onto the pipeline approximately every 10 joints, or 120 metres. The anode is bonded to the pipeline via small wires, or bonding straps, fastened to studs welded directly to the pipeline.

Regular inspections are a requirement of any company operating an offshore field and they must be able to certify that there is no danger of a pipeline rupturing. For compliance, usually the entire length of the pipeline needs to be surveyed every five years.

One method of monitoring a pipeline's CP system is called Electrode Field Gradient (EFG) measurement where a Remotely Operated Vehicle (ROV) or diver swims along the entire length of a pipeline to record the field gradient of the pipeline's CP system. Field gradient can be used as an indication of cathodic protection activity. The field gradient strength is a function of the distance between the reference electrode array and the pipeline. However, all pipeline surveys must include periodic "stabs" along its length to recalibrate the EFG readings.

"While towed or autonomous underwater vehicles can be used, you cannot really tell how good a pipeline is without contacting it," Flanery added.

One of the latest methods for surveying pipelines is to install CP test stations at a regular, calculated interval, similar to those for onshore buried pipelines. This enables a more rapid and accurate pipeline survey using minimal survey equipment aboard a survey vessel. An ROV or diver is required to make contact readings at these test stations using a special probe. This method allows the survey vessel to plan stops along the pipeline corridor and drop a diver or ROV into the

water only at those locations. The diver or ROV 'stabs' the test station and this is correlated with the readings from an EFG probe to determine the integrity of the CP system at that point. Next, a nearby anode can be located and stabbed. During both contact measurements the voltage gradient is recorded.

From these readings, the survey crew can use onboard pipeline CP attenuation modelling to determine the next appropriate survey site and report on what actions may need to be taken immediately or planned to maintain optimal operations.

DWA has a range of corrosion control and monitoring equipment that can be quickly deployed to site and easily added to a pipeline to enhance the effectiveness of the monitoring program.

Several deepwater pipeline coatings are premium-grade, tough, resilient glass syntactic polyurethane elastomers that provide the required thermal insulation properties and are 100 per cent solids 'cast in place' material. "The term '100 per cent Solids' implies a coating in solid form, but this is misleading," said Altex Coatings' Collins. "The term actually means that the coating contains no solvents or VOCs." Zero Volatile Organic Component (VOC) coatings pose no fire hazard and only low health risk while the coating is being applied. They are also very environment friendly as hazardous organic solvent vapour is not generated and released into the air.)

"Syntactic foams" contain the right combination of resins, pigments and glass-spheres to provides the necessary properties to handle the environment and application parameters. Standard lightweight insulation is not suitable for the deepwater environment.



*Technician abseiling down the support structure of an offshore rig.*

They cannot endure long term water exposure and low temperature, More importantly due, under the extreme pressures (3000-6000 psi) at these water depths, most insulation materials will simply collapse and not survive the 25-year life expectancy of the equipment.

Collins added "A product like Carboline's Carbotherm® 735 will handle all these conditions and yet is flexible enough to tolerate movement, bending and vibration during shipment, installation and operation."

Working on the structural cross members of an offshore platform requires a unique combination of skills, but also additional safety precautions. IMS staff need to be good corrosion prevention technicians as well as proficient abseilers.

"Both of the skills are very important in our job and we emphasise that safety is observed in all aspects of our work," Sikora said. "When we find the right person with the appropriate corrosion qualifications, we train them in rope access. To ensure the safety of our workers is not compromised, we also hire experienced Level 3 abseilers and then train them in corrosion prevention techniques."

Comprehensive planning is the priority when dealing with the constraints and challenges of offshore corrosion control. "Once we get to an offshore site, if we forget something it is hard to arrange delivery of more materials or tools," Sikora added. "You can't just jump in your van and drive to the local hardware store."

The weather and access can also impact on work at an offshore site. There is often limited space for the workers and all their equipment

### Wesley Fawaz, Executive Officer of the Australasian Corrosion Association



Wesley Fawaz is the Executive Officer of the Australasian Corrosion Association. He is responsible for the implementation of the strategic direction and management of daily operations of the organisation. Wes holds a Bachelor of Business majoring in management, marketing and HR.

An Association Management Professional, Wes provides support and advice to the ACA Board, fostering strong links between the Association, its members and industry to ensure that they continue to minimise the impact of corrosion in the wider community.



on an offshore platform and sometimes the workers must travel on and off the platform every day, which restricts the actual working hours available.

Fortunately, the latest polyurea and polyurethane coatings and primers have been developed to have rapid cure times so that structures can be covered quickly.

“With an effective protection system and regular maintenance, an offshore field should have an operational life of up to 40 years,” Flanery added.

The ACA is a not-for-profit, industry association, established in 1955 to service the needs of Australian and New Zealand companies, organisations and individuals involved in the fight against corrosion. The vision of the organisation is to reduce the impact of corrosion.

**About the Australasian Corrosion Association**

The Australasian Corrosion Association Incorporated (ACA) is a not-for-profit,



*Technician and support ship with an offshore structure.*

industry association, established in 1955 to service the needs of Australian and New Zealand companies, organisations and individuals involved in the fight against corrosion. The vision of the ACA is to reduce the impact of corrosion.

For further information, please visit the web site: <http://www.corrosion.com.au>

**Media enquiries**

Relate Technical Communications Pty Ltd  
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# From the KETTLE

Because corrosion control of steel by hot dip galvanizing plays such an extremely important role for specifiers and end-users in their specification choice, it was proposed that we highlight and demystify a number of surface conditions over a series of editions that bear very little influence of the coatings durability seen both during the initial inspection and also after years of being exposed to a particular environment. See surface condition F3 and F5.

LEGEND		
#1	As the life of a zinc coating is proportional to its thickness, a thicker coating will proportionally outlast a thinner one, however, a thicker coating can be more prone to mechanical damage, when handled inappropriately.	
#2	All passivation products including sodium di-chromate will be excluded by the galvanizer when he has received written instructions that the hot dip galvanized steel is to be painted.	
#3	While double dipping is occasionally seen to be necessary due to a limited bath size, the galvanizer must inform the customer that this practice can increase the propensity for distortion, before he commences with the work.	
#4	While the galvanizer can lower the zinc temperature and shorten the immersion time to limit coating pickup, however, due to increased costs to himself, he is not obliged to do this and if necessary will recover the cost from the purchaser. Insufficient vent, fill and drain holes will lengthen immersion times.	
Hdg	Hot dip galvanizing A Accept R Reject N Negotiate C Clean REP Repair SS Significant surface.	
F3	Coating thickness 183µm.	Coating thickness 219µm.
<p><b>DESCRIPTION:</b> Thick hot dip galvanized coating as a result of steel reactivity.</p> <p><b>CAUSE:</b> Reactive steels, primarily from high levels of Phosphorous and inappropriate silicon content can cause very thick coatings. Such coatings will provide extended durability but tend to be brittle, particularly at edges and hence subject to mechanical damage during handling. The coating may take on a dull, mottled or circular patterned effect over parts or extending over the entire component.</p> <p><b>EFFECT / REMEDY:</b> Appropriate steel specifications related to Silicon and Phosphorous and in combination with shorter immersion times and lower zinc temperatures (including correctly sized and appropriately positioned vent/fill/drainage holes) can reduce coating thickness #4. “The life of a zinc coating is proportional to its thickness, so the thicker the coating, the longer the life”.</p> <p><b>ACCEPTABLE TO SANS 121:</b> A</p> <p><b>ACCEPTABLE FOR DUPLEX AND ARCHITECTURAL FINISH:</b> A</p> <p>The correct steel specification, quality of design and fabrication is required to achieve “Architectural Quality” hot dip galvanizing #4.</p>		
	Coating thickness 349µm.	As can be seen below, coating thickness to silicon-killed steel frequently generously exceeds the minimum local and mean coating thickness required by SANS121. Coating thickness 242µm.
		
	Coating thickness 290µm.	Coating thickness 281µm.
		
F5	Coating thickness non-reactive – 89µm.	Coating thickness reactive – 327µm.
<p><b>DESCRIPTION:</b> Reactive (“silicon-killed”) and non-reactive (“aluminium-killed”) steels, welded together.</p> <p><b>CAUSE:</b> The difference in coating thickness, is brought about by a combination of a reactive (R) (sometimes thicker gauge) silicon-killed steel, and/or high phosphorous resulting in a thicker coating, while a less reactive (LR) (sometimes</p>		

<p><b>F5 continued</b></p> <p>thinner gauge) aluminium-killed steel, will result in a thinner coating.</p> <p>Should the galvanizer be required to increase the coating thickness on the LR steel, the resultant coating thickness on the (R) steel will be excessively thick resulting in a brittle coating that could be subject to mechanical damage.</p> <p><b>EFFECT / REMEDY:</b> SANS121:2011 (ISO1461:2009) Standard, paragraph 6.5 states, "Where articles including a number of different thicknesses of steel, each thickness range shall be regarded as a separate article and the relevant values in Table 3 and 4, as appropriate, shall apply.</p> <p>Whenever possible select steel with similar chemical composition (Si and P) for fabricating a component. If need be, accept a concession request by the galvanizer / inspector, when a thinner coating is possibly below specification.</p> <p><b>ACCEPTABLE TO SANS 121:</b> A/N – Advise customer and agree on a suitable course of action.</p> <p><b>ACCEPTABLE FOR DUPLEX AND ARCHITECTURAL FINISH:</b> Depending on customers use.</p> <p>See also the Association's Architectural Check List #4.</p>	<p>Coating thickness non-reactive – 119µm.</p> 	<p>Coating thickness reactive – 337µm.</p> 
	<p>Coating thickness reactive – 420µm.</p> 	<p>Coating thickness non-reactive – 187µm.</p> 



## AfriCORR Congress

AfriCORR16 – the African Corrosion Congress, is scheduled for 25 - 29 July 2016 at the Midrand Conference Centre in Midrand, South Africa. With 6 internationally renowned Plenary Speakers already confirmed and many papers already received, this is set to be the “Corrosion Congress of the Year”!

### AfriCORR16 Exhibition

The Exhibition will form an integral part of the activities. The exhibition provides an excellent opportunity for organisations to come face to face with delegates, providing a market place to increase your organisation's visibility and to showcase and demonstrate your products and services. The exhibition will be held in the same hall as the Congress, thereby ensuring maximum exposure and interaction with a captive audience.

Further information is available on our website  
[www.africorr.org.za](http://www.africorr.org.za)



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## Manager's Message

Dear Readers

2016 has passed its half way mark and The Corrosion Institute of Southern Africa still has a very full agenda for the remaining few months.

The year thus far has not been without its challenges but I am excited to say that the remainder of 2016 is looking very promising indeed.

We have exhibited at a number of Expos over the past few months and are always excited to meet new people within our industry.

Training has been challenging and we have not seen the numbers we would like to see, however it seems to be improving slowly and with a number of courses scheduled for the rest of the year we are optimistic that we will see numbers steadily improve. On a positive note, we have ventured out a bit and hosted the first of hopefully many more courses in Ghana.

We held our Annual Fishing Day at the beginning of July and saw a much bigger turn out than in previous

years. I would like to offer my sincerest thanks to our numerous sponsors for contributing to making the day so successful.

AfriCORR is just around the corner and promises to be exceptional, with international speakers booked and various workshops on offer, AfriCORR, provides a welcome arena for interested parties to share, discuss and learn from one another.

Our monthly technical evenings are always interesting and give you the opportunity to meet with others in our industry, please visit our website to view the dates in the various regions. Should you wish to present at one of these evenings, please contact the CORr for more information and available dates.

Enjoy this edition and once again I would like to invite our readers to let us know what they would like to see in future editions.

Regards

*Lynette Van Zyl, Manager – CorriSA*



## Comment – Chairman of the Western Cape

I wish to thank the local committee for making the success of the Western Cape a reality, including compiling a full schedule of technical presentations and site visits going forward. We welcome John Houston who has been co-opted on to the committee.

We encourage both members and others to attend the monthly meetings for constructive input and knowledge transfer.

A recent decision to invite the chairpersons of both KZN and Western Cape to the National Council meetings will have positive long-term motivational effects on the individual members of the

respective regions as well as the overall success of the Corrosion Institute.

Africor is around the corner and we look forward to seeing familiar faces at this is our bi-yearly showpiece. An important opportunity to gain knowledge, show-case developments in the industry and network with key players.

I again congratulate Terry on an extremely professional, very informative and well-put together publication. The bar remains at an extremely high level.

Yours in Corrosion

*Graham Duk, Chairman – CorriSA Western Cape*



## Comment – Chairman of KwaZulu Natal

The KZN region has gotten off to an extremely slow start to 2016. A new committee was elected by the council to try to revive the region and increase the attendance at the technical evenings. This has been a slow process and is an ongoing effort.

The following dates can be diarized for the upcoming months:

- **26th July 2016:** Development of Soluble Salt Contamination Measurement. Presented by Craig Woolhouse from Elcometer, UK

- **19th August 2016:** Annual Corrosion Institute Golf Day

The KZN region had the pleasure of hosting a CIP Level 1 course from 20 to 25 June at Westville Country Club. Bruce Trembling and Mark Terblanche, the NACE instructors, had the honour of seeing out the "old" and bringing in the "new" NACE CIP format. The Log-Book and written theory exam of this 6-day program has been replaced with a computer based training (CBT) theory exam.

*Ryan van Wyk, Chairman – CorriSA KwaZulu Natal*

## Fishing Day

On the 2nd July 2016 CorrISA hosted its annual fishing day and once again our diehard fisherman showed us that winter simply isn't a deterrent. The competition was fierce and Keegan Howarth walked away with the prize for the biggest fish. With our youngest fisherman of the day 2½ year old Torrin Hinrichsen catching a fish of 190g.

The youngsters who participated in the crabbing competition were far more competitive than our fisherman and refused to give up

and although the crabs were scarcer this year, some managed to catch a few with 4 competitors bagging 6 crabs each.

This year the sponsors were phenomenal and The Corrosion Institute would like to offer its sincerest thanks to each and every one for helping us make the day such a success.

Thank you to all who braved the cold we look forward to seeing you all again next year.



## Cape Town AGM and future activities

### Annual General Meeting

In August we will be holding our AGM and we will have the honour of having the President of the Corrosion Institute SA, Ed Livesey visiting us. I know that many of you have questions for Ed and he has requested that to be in a position to answer the questions as comprehensively as possible if he receives them in advance so that he can address them at the time.

Please correspond with any of the committee or if necessary the editor of CE, with your question / questions or any other matters that you want discussed.

Part of the AGM will be devoted to the selection of our new committee to take us through from August 2016 to end August 2017. This is important, as these individuals work behind the scenes to keep our CorriSA WC Region on track.

We currently have 9 members on the committee, and we have been well served by the incumbents so we do not anticipate any major changes in the structure of our regional management body. However, if any member feels that they have a contribution to make, and would like to be of service to our region as a committee member, please

let us know ahead of the meeting and we'll make the necessary arrangements.

### Kelvin Grove Expo

On Thursday 20 October we will be holding our first Western Cape Expo will take the form of companies showing what they have to offer at various stands. The details have yet to be decided but if this is something of interest and you would like to take a stand or have any queries then please contact:

*Simon Norton on the following email address: chemdetect@iafrica.com*

### Annual Gala Dinner

The Annual Gala Dinner will be taking place at Kelvin Grove on Friday 18 November

For those who were not at the very successful Annual Gala dinner last year here are a few snaps:

<https://goo.gl/photos/RAZUMVYvP43Nuob87>

Please contact Tammy if you are interested in:

- attending
- taking a table or
- sponsoring the event

*Enquiries and RSVP: Tammy@blastrite.com*

### Yearly Plan

Here is the plan for the rest of the year. Please keep these dates open, thanks.

#### July

#### *Development of Soluble Salt Contamination Measurement*

Craig Woolhouse from Elcometer UK

**Kelvin Grove: Monday 25 July**

#### August

#### *Movie Night*

AGM to coincide with this

**Kelvin Grove: Thursday 18 August**

#### September

#### *Graeme Stead from Speccoats and Past President of OCCA*

Topic to be advised

**Kelvin Grove: Thursday 15 September**

#### October

#### *Expo at Kelvin*

Further details to follow

**Kelvin Grove: Thursday 20 October**

#### November

#### *Annual Gala Dinner*

Kelvin Grove : Friday 18 November

For more information on the Corrosion Institute of South Africa please visit:

<http://www.corrosioninstitute.org.za/>

### CAPE TOWN COMMITTEE: 2015/2016



*From left to right: Back: Flippie van Dyk, Leonie du Rand, Graham Duk, Pieter van Riet, Terry Smith, Indrin Naidoo and Simon Norton. Front: Tammy Barendilla*



## Ghana Report – 2016

One of the flagship courses of the Corrosion Institute of Southern Africa was presented for the first time in Ghana, Accra, from 8 – 14 May 2016, on behalf of a Ghanaian government grant presented to FDS Engineering. This presented a novel change in education at the Corrosion Institute by taking the course to the student and not the student to the course.

The flagship course offered is the 5 day in depth Corrosion Engineering course which at the end is examined with a three hour exam. Two lecturers, Louis Pretorius and Armin Schwab undertook the adventure into Africa to deliver the course to a class of 15 students.

On arrival in Ghana, the course organisers reviewed the course material before the course started on Sunday and decided that three quarters of the class undertook would not have the ability to pass the more complicated chapters, i.e. Chapter 1 – Understanding Corrosion, Chapter 5 – Material Selection and Design and Chapter 8 – Cathodic Protection. The lecturers discovered that a large portion of the students were in fact blasters and spray painters.

Five students did the full course, all 8 chapters and the balance of the students did 5 of the 8 chapters. The lecturers then spent additional time on more practical aspects of training that was more suitable for blasters and sprayers. It was noted that the general education level of the Ghanaian's was reasonably high and even though they were English second language, they showed enormous commitment often working 12 hours a day and one evening until midnight.

The quiz relating to the day's training was given to them early the following day. The students asked many pertinent questions the following morning



and during a short review of the previous day's work. This indicated that they were spending time and effort studying in the evening and reading the "Golden" book.

On the lighter side, the Ghanaians showed their true colours and personality with big smiles and colourful spicy food that had the lecturers speechless yet smiling at their hospitality.

Day four of the course presented the lecturers with surprise guest being the Ghanaian Government Inspector, who sneaked in on the course during the morning session and later in the afternoon spent time with the lecturers and students getting a hands-on feel of the course and standard hereof.

This was indeed a surprise to the lecturers as this was unbeknown to them, but a clear sign of the government's commitment to uplifting and training the Ghanaians and footprint into the next suite of upcoming courses.



### NACE O-CAT (Offshore Corrosion Assessment Training)



The Offshore Corrosion Assessment Training course is a five-day intensive program addressing the element of in-service inspection and maintenance planning for fixed offshore structures. The course also addresses the Minerals Management Services (MMS) A-B-C facility evaluation grading system requirements for Level 1 inspection reporting. A written and practical exam is given at the end of the course.

#### Who should attend?

The course will be valuable to anyone involved in the corrosion control facet of integrity management of fixed offshore structures. The curriculum will benefit personnel with management and planning responsibilities to the field inspectors conducting in-service inspections of the facility. The program would also be practical for offshore platform operations personnel to better understand corrosion prevention systems utilized for offshore structures and their successful implementation..

#### Recommended entry requirements

- English Literacy
- Matric or higher qualification
- Minimum of 3 months experience in the evaluation of corrosion or coatings breakdown on marine vessels.

#### Supplied

- Course manual and OCAT Offshore platform photo assessment guide
- Lunch, light snacks and refreshments

#### Duration

- 5 day course (Mon-Fri)

**Date :** 26<sup>th</sup> – 30<sup>th</sup> September 2016

**Venue:** Belmont Square Conference Centre, Cape Town

For More information contact:

**LINDA HINRICHSEN**  
COURSE ADMINISTRATOR

Tel: +27 010 224 0761  
Cell (071) 388 3179  
Office (086) 126 7772 (CORRSA)  
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email: [courses@corrisa.org.za](mailto:courses@corrisa.org.za)



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# An Introduction to the Elcometer 130 SSP (Soluble Salt Profiler)

Author: John Fletcher, DipIM, CSci, FICorr, Technical Support Manager

Contamination of blast cleaned steel surfaces prior to application of protective coatings leads to premature coating failure resulting from corrosion caused by the soluble salts left on the surface after the cleaning processes. It has become common practice to include a salt contamination test prior to the application of the first coat to ensure that the required cleanliness has been achieved.

Soluble salt measurements in general require two processes, the first is to extract a test solution with the salts from the surface, and the second is to analyse the solution to determine the concentration of the salt on the surface.

In the case of the saturated filter paper extraction method, specially cleaned filter papers are wetted with a controlled volume of pure water and the paper is then placed on the surface to extract the soluble salts. The paper is left on the surface for 2 minutes and then it is removed from the surface and placed on the electrode of the conductivity meter. The meter then tests the conductivity for this known area of the filter paper and the known volume of test solution. The result is displayed by the gauge as a value in  $\mu\text{g}/\text{cm}^2$ .

In line with several modern electronic coating inspection gauges, the latest design of

conductivity meter makes use of microprocessor electronics to enable operational features to be added to make the measurement of surface salt concentration and the management of the resulting data quicker and easier. The gauge case is hand-held and fully portable for field use and is designed to be dust and water resistant to IP64 equivalence.

The NACE equivalency test described in SP0508, Methods of Validating Equivalence to ISO 8502-9 on Measurement of the Levels of Soluble Salts, has shown that salt crystals do not form evenly on a steel surface. The efficiency of the extraction method and the relevance of the test result are therefore dependent on both the area of extraction and the differential in concentration of salt between adjacent areas.

A new sensor design for the Elcometer 130 SSP conductivity meter has been developed that has a matrix of individual contact spots rather than the usual concentric rings. By taking the conductivity measurements between the spots using a raster scan of the sensor, it is possible to plot the relative conductivity across the filter paper.

Using the matrix array it is possible to measure the conductivity of selected areas

of the filter paper and even produce 2-D and 3-D conductivity maps of the area of the filter paper. Four Bresle Patches can comfortably fit in to the area covered by the filter paper.

Working with the University of Manchester in the UK, an automated, repeatable and reproducible doping method was developed to apply known salt concentrations over large blasted steel panels. The variation in readings between the Elcometer 130 SSP method and the Bresle Test method are significantly within the background contamination level of the Bresle Patches.

The Elcometer 130 soluble salt profiler provides fast and accurate measurement of the level and density of soluble salts – over 4 times faster than other Bresle equivalent methods.



## TECHNICAL EVENT: Tour of Jotun, Cape Town



Members waiting, receiving instructions from Jotun staff and reading the latest copy of Corrosion Exclusively.

## NUI /CorrISA Bursary

A much needed gap has been filled by the generous donation by National Urethane Industries to establish a bursary for academic studies related to corrosion at South African tertiary education institutions and the Corrosion Institute. The new bursary has been named "The NUI/CorrISA bursary".

Earlier in May this year National Urethane Industries approached the Corrosion Institute of Southern Africa to discuss the setting up of the bursary that is specially targeting young people that were either engaged in or where aiming to commence studies in corrosion related courses and that wanted to make a career in the corrosion or related industry in South African. To kick start the initiative NUI has provided R500 000 to the NUI/CorrISA bursary fund. During June twenty suitable students were identified and each was awarded an amount of R25 000 to be used for

tuition fees and paid into their university accounts. The current bursars are performing studies in Metallurgy and in Chemical Engineering and Science and included both undergraduate and post graduate studies.

Currently at university level very limited focus is given to the study of corrosion, and in many cases in industry corrosion is subsequently viewed as a fait-accompli that one just had to live with and about which very little can be done apart from selecting more resistant materials or the application of an isolating coating. These two aspects are of course suitable and important in many cases however there are many other options that are often not even considered due to lack of expertise in the broader corrosion sciences and engineering in South Africa. As currently no dedicated corrosion specific focused degree qualification exists at any South

African university, National Urethane Industries decided to set up the bursary to sponsor corrosion related studies so that a wider more innovative approach to dealing with corrosion problems could be encouraged. In line with this approach the current basket of studies that the new NUI/CorrISA bursary targets include qualifications in Metallurgical, Chemical, Environmental, Microbiological, Materials, Electrical sciences and engineering.

The selection committee is comprised of a balanced team with representation from NUI, CorrISA and Academia making up the team. Eligibility requirements are that the students must be South African citizens, engaged in corrosion related studies at a South African educational institution and must be (or become) an active member of CorrISO (the Student Organization branch of CorrISA). The reasoning behind active CorrISO involvement is to maintain momentum in the drive to counter the devastating effects of corrosion by providing a forum for these bursars to engage with each other and with the more experienced specialists in South African industry. Preference is given to financially needy applicants and to those engaged in projects that are adjudicated by the selection committee to be particularly innovative and beneficial towards dealing with corrosion.

NUI CEO Mr. Donovan Slade, indicated that the bursary is to become an initiative that will be regularly supported by NUI for years to come and that he hoped to see the value increased and it expanded next year to also include SAQA registered courses being presented at the Corrosion institute of Southern Africa. Furthermore he challenged other companies to follow suite and especially support CorrISA courses through the pending SAQA approval of these courses. NUI and its management is applauded with making such an important contribution towards corrosion education in South Africa.

*For next year interested parties for studies in corrosion can send their details and the details of the intended 2017 course they want to study, the education institution name, complete with their latest academic record and/or their resume/CV to the bursary committee at either [gregc@uj.ac.za](mailto:gregc@uj.ac.za) or [manager@corrisa.org.za](mailto:manager@corrisa.org.za) before 25th November 2016.*

## Corrosion Awareness Day

The Annual Corrosion Awareness day was held at the CORē on the 22nd of April. This year the Corrosion Institute aim was to introduce corrosion and its impact to our young minds. We invited University and school students who participated in a show and tell demonstration on corrosion. In addition to this we had numerous members exhibit and all of our visitors were treated to interesting talks on the various technologies in our industry. The day was enjoyed by all who attended.

The feedback received was extremely positive and know that going forward the Corrosion Awareness day will grow in leaps and bounds.



**TECHNICAL EVENT: Gauteng**



*Corrosion Institute members attending a number of technical evenings at the Corë in Midrand.*

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**NACE CIP TRAINING COURSES: Johannesburg**



*Delegates at various NACE and other interesting Corrosion Control Courses held at the Corē in Midrand.*

# The RUST Spot...



## in conversation with Graham Stead

### My background and how you came to be involved in the Corrosion Institute

I joined the Corrosion Institute shortly after I arrived in Johannesburg in 1977.

Going back to the beginning, my first contact with the paint industry was when I worked for British Industrial Plastics making resins. I had a permanent holiday job with them for the duration of my university career. With this background, I joined Elvolac Paints in Pinetown

after my military training, in 1965. There I spent 10 years involved in the manufacture and marketing of industrial paints and adhesives. I then took up job as technical manager of Crown Paints in Cape Town. This was my first brush with anti-corrosive coatings. Crown Paints manufactured 'Copon' and this brought me into contact with the "Corrosion Community" in Cape Town. After a year in the Cape I took a position as Technical Manager of Crown Paints, Johannesburg. Some of the first people I met were Michael Brett and Walter Barnett. My first memory of the Corrosion Institute was Prof Robinson's lecture theatre 333 at Wits.

I met all sorts of interesting characters. Tom Edwards (Dulux), Barry Claxton (Denso), young

Dr Colin Alvey who had just joined MAB&P, John Hay (Cortex). The projector was operated by two of Prof Robbie's Metallurgy students Steve Lennon & Chris Gross (they were paid in beer!). Neil Webb had also joined MAB&P as had Michael's brother Charles. Brian Statham was at Eskom Research in Rosherville.

### What was the state of the industry then and what role did you play within the institute?

Plascon bought out the Reed-Decor Group and I soon found myself promoted to head up the Technical Service Department at Plascon Head Office. This was an ideal position from which to participate and promote the Corrosion Institute. 1978 was an amazing time in South Africa's



## NACE CP INTERFERENCE



### Description

The Cathodic Protection Interference focuses on AC and DC interference.

#### Who should attend?

Students who have extensive CP field experience, a strong background in mathematics, and a strong technical background in Cathodic protection.

#### Prerequisites

CP 3 – Cathodic Protection Technologist certification recommended.

- Minimum of 3 years CP work experience

#### Cost

- Please see the registration form

#### Supplied

- Course manual
- Lunch, light snacks and refreshments

**Date :** 15<sup>th</sup> – 20<sup>th</sup> August 2016

**Venue:** The CORē, 38 Allan Road, Glen Austin, Midrand

For More information contact:

**LINDA HINRICHSEN**  
COURSE ADMINISTRATOR

Tel: +27 010 224 0761  
Cell (071) 388 3179  
Office (086) 126 7772 (CORRSA)  
Fax: (086) 726 0318  
email: [courses@corrisa.org.za](mailto:courses@corrisa.org.za)



history of infrastructure development. Such a vast amount of building and construction over a relatively short time had never before occurred and will never be seen again. There were 'six pack' power stations being built in Mpumalanga and Gauteng and a pumped storage scheme (Drakensberg Power Station), with dams & canals in the Tugela catchment area being developed. Our first nuclear power station – Koeberg was underway; and then there was Sasol 2 followed by Sasol 3 and the construction of a new town – Secunda. These were massive projects by African standards the construction of which lasted well into the mid 1980s. On the mining front there were new deep shafts in the Western Transvaal and Gold and Uranium plants popping up all over. And six giant crude oil containment tanks were built in Saldanah Bay.

**What successes did you enjoy during your time with the Institute and what role do you play now?**

I was a council member of the Corrosion Institute at this time and actively participated in the education activities offered at the time. Lecture Theatre 333 at Wits was a great venue but was now not suitable for the expanded membership, so a base was established at Science Park on the Wits Eastern Campus where it resided until the move to Midrand several years ago. We all participated in the development of the Corrosion Course and the compilation of the 'Corrosion Book'. We ran bi-annual Corrosion Schools, which

were hugely popular. Bob Andrew, who was the Chief Corrosion Officer for the JCI Group at the time, came up with some innovative schools for educating Engineers on the subject of designing corrosion protection for plants built in corrosive conditions. The papers presented in these schools were published and are still invaluable sources of reference. At this time we also participated in the development of SAQCC courses for Corrosion and Galvanizing Inspectors – pre-cursors for the NACE Courses.

At Council level we initiated 'The Pipeline Interest Group', which grew into a very active body that met regularly and organized its own symposia. This was followed some time later by the formation the 'The Coatings Interest Group', which was also successful in getting specialist subjects of common interest spotlighted.

Unfortunately, due to internal politics at the time both interest groups were sadly disbanded, in spite of their value added potential to CorriSA.

**Talk about your years with the Institute and what changes you've seen over that time?**

I have been a Fellow of the Institute for nearly 30 years (Membership No. 282 February 1987). During this time I presented several papers, mostly on the subject of pipe protection. I received a Silver Medal Best Paper award for my work on the Beira Oil Terminal in 1995.

The big change in the Institute happened after the successful and profitable International Corrosion Conference held in Cape Town and the subsequent decision by the then presiding Council to go with the NACE courses. I was sad to hear this. During my time on the Council we had considered this and rejected it.

The Corrosion Institute has since become a profitable business and has been able to buy its own premises and employ full-time staff. It certainly still performs a critical function in South African Industry but I really feel that some of the essence or the spirit of past members has been lost.

My role in the Institute these days is limited to attending occasional meetings and participating in social events such as the fishing day, which I thoroughly enjoy, and the annual prize-giving dinner.

However I am not resting on my laurels! I am still working (in a retired fashion) as Technical Director of our paint company Specialized

Coating Systems (Pty) Ltd (Speccoats). I am Hon. Education Secretary of OCCA Northern Section and last year organized a successful Mini-symposium on 'The role of organic linings protecting steel drinking water pipes' which is a corrosion related subject. We also arrange joint OCCA/CorriSA meetings at Midrand. I help with the arrangements with SAPMA/OCCA for the 'Coatings for Africa Exhibition & Conference', which is starting to enjoy huge success. I also help with tutoring for the SAPITI courses – teaching 'Basic Science' to beginner learners.

**If you could go back, what things would you do differently?**

I believe that life is like a journey down a river and it takes you on a path full of surprises. I regret nothing really. I sometimes wish that I had stayed in consulting for longer but it was a lonely life and one needs strong partners to back you up! I have been fortunate to have been involved in some really exciting projects through the years and, to a lesser extent, they are still happening. When I left university I knew very little about industry and how everything in life inter-meshes. On coming to the Highveld I have been fascinated by the Mining Industry. In my youth I used to sit on hills outside Klerksdorp during my early army training days and wonder what all those lights were about! Now I have some knowledge of what happens underground and above. As a paint chemist I have had a very interesting and unexpected career!career!

**What advice do you have for the industry going forward?**

We have to encourage clever people to take blue collar jobs. I am appalled by the lack of expertise in our industry. I understand that previously disadvantaged people in the new South Africa want to get to the top and earn good salaries quickly but this is not helping the situation at the coal faces. I have learnt slowly through many years and I have had the privilege of having excellent mentors and good advice on the way up. I have also made many mistakes along the way but these also teach one. I cannot accept that people can graduate from university and be given responsibilities that they are in no position to handle just because of the ethnicity and connections! I see crumbling infrastructure all around me. In the past there were people who used to care about, for example, how our rolling stock looked and the railway network that mobilized our economy. We have to re-institute these values.

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