

## Overview

This document aims to both introduce Zinga and underline some of the technical highlights of the product when it is used as a unique system for the protection of marine structures. Zinga has been studied at each stage of the project's life cycle and, where appropriate, compared with more conventional systems i.e. epoxy-tar above the water line and sacrificial anodes below.

## Product Introduction

Zinga is a remarkable form of zinc-based corrosion protection because it provides both active and passive protection.

Active protection, or cathodic protection, arises from the zinc (the anode) sacrificing itself in favour of the base metal (the cathode). Zinga reacts with the substrate metal to form an electrolytic bond that results in an initial potential of -1040mV between the steel and the zinc. Once the steelwork becomes wet the zinc ions go into dissolution and the current starts to flow from the zinc to the steel, depleting the zinc layer and protecting the steel beneath. In this way the protection of the metal is guaranteed, even when the zinc layer is damaged. Other well established methods of cathodic protection include hot-dip galvanising (HDG) and zinc thermal spraying, both of which exhibit a constant sacrificial rate of the zinc layer.

Within Zinga though this sacrificial rate reduces dramatically after the zinc layer has oxidised. The zinc particles within the Zinga layer are protected by the organic binder without adversely affecting the electrical conductivity. This enables Zinga to create a sufficiently negative potential to provide galvanic protection (less than -850mV) but with a lower rate of zinc loss than HDG because the binder acts as a "corrosion inhibitor" to slow the rate of zinc dissolution. The binder is the principle reason that Zinga works so much better than HDG in a marine environment with roughly 1/3 of the corrosion rate of galvanised steel under similar saline conditions.

If the Zinga layer is sufficiently damaged to expose the base metal below, the steel would form a layer of surface rust but no corrosion would take place beneath it. This is called "throw" and enables Zinga to protect bare metal up to a 5mm or so away from where the coating ends. This is the same working principle as zinc sacrificial anodes. Zinga is simply a different form of these anodes – a liquid anode or sheet anode with the protection spread across the steel surface.

Passive protection, such as paints and cladding, creates a "barrier" between the steel substrate and the elements. Once this barrier is compromised then the moisture and atmospheric salts will be able to start corroding the steel beneath the damaged area. This corrosion will then begin to creep extensively beneath the coating.

With Zinga, the organic binder and the zinc oxide layer that forms on the surface create an impervious barrier by blocking the zinc's natural porosity with oxide particles. Unlike other passive coatings, once breached the zinc oxide layer simply renews itself by re-oxidising.

## Surface Preparation

Zinga requires abrasive blast cleaning to Sa 2.5 with a blast profile of 60-80µm and the surface needs to be free from grease etc. The correct surface preparation is vital to the long service life of Zinga.

## Application

Application can be done using airless, conventional or electrostatic spray equipment – whichever the contractor prefers. Zinga can be applied in a wide range of temperatures and humidity and, unlike epoxy tars, can even be applied to mildly damp surfaces where temperatures allow. The broad range of allowable application conditions that Zinga affords means that very few days are lost in large projects due to poor weather i.e. the maintenance window is extended. This, coupled with Zinga's unlimited shelf and pot life, means a significant reduction in wasted time and materials.

Zinga dries quickly with each coat only requiring an hour or so before another coat is applied at 20°C – longer at lower temperatures. After the final coat has dried completely the Zinga can be sprayed with fresh water or left out in the rain to accelerate curing. This exposure to fresh water and air is vital to seal the zinc and should be done for at least two hours prior to exposure to a saline environment wherever possible.

By contrast an epoxy tar coating requires at least twenty-four hours between coats and anywhere between forty-eight hours and seven days to cure fully before installation.

## Installation

Zinga possesses the unique characteristic that existing coats can be directly covered with a new layer regardless of the age. The old layer will re-liquidise and fuse together to form one single homogenous Zinga layer. Hence if the coating is damaged during installation, it can be repaired easily by using a paintbrush or roller and without the need for abrasive blasting. Fresh Zinga will simply 'melt' into the adjacent zinc coating without the protection being compromised in any way.

Unlike most paints, the zinc in Zinga will not be removed by crushing or shearing forces. The coating may get gouged out by sharp edges, but the 5mm "throw" ensures that the protection continues unchanged.

## Performance

- Zinga is non-toxic and is even certified to BS6920 (2000) for use in contact with drinking water.
- Zinga is extremely flexible and adheres extremely well due to the high penetration of the zinc into the blast profile so it will not crack, peel or delaminate – even after physical damage.
- Zinga will not degrade under any form of UV.

- The Zinga layer adsorbs magnesium and other salts from sea water which passivate the zinc layer further ensuring excellent performance under immersion and in the tidal zone.
- In some marine environments barnacles do not like the taste of zinc and many other forms of marine life do not like adhering to the Zinga surface because of the low current passing between the zinc and the substrate.
- Existing marine projects have shown remarkably low rates of zinc loss in service (see references NB Killybeggs).

### **Future Maintenance**

Annual dry film thickness measurements allow for accurate zinc loss rates to be established early in the structures life. This enables precise forecasting for future maintenance requirements. Like anode blocks, Zinga will begin to lose efficiency when the coating has depleted down to a certain weight. This figure for Zinga is in the region of 35µm d.f.t. (250 g/m<sup>2</sup>), but asset owners are always advised to re-load the zinc when the layer thickness reaches 50µm. This is the lowest figure to work off when calculating maintenance schedules and is easy to monitor.

Above the waterline Zinga can be "reloaded" whenever required. A steam clean will suffice to remove surface salts and contamination. This negates the need for further abrasive blasting with obvious cost savings. As previously mentioned, fresh Zinga re-liquidises the old zinc to form a single complete layer with no compromise in future coating performance.

Below the waterline, when the Zinga reaches 50µm dft, the protection can be supplemented by the addition of sacrificial anode blocks. Zinga works extremely well in conjunction with anodes as they both protect using the same principles and can be balanced to provide a complete active system.

### **Project Insurance**

Although Zingametall (the manufacturers) have full product liability insurance, SGS Axa-Med, a division of SGS Belgium NV, can provide a full Insurance Backed Application Guarantee for a small premium. They will inspect the individual projects and, if approved, write a suitable specification and scrutinise the whole process from surface preparation onwards. The period of the guarantee is dictated by the chosen insurance underwriter and is dependent on the type of project, environment etc. They carry out annual inspections and report directly to the asset owner with recommended maintenance schedules etc. In the event of a premature failure SGS will coordinate all aspects of the investigation including:

- Evaluating extent of the damage
- Try to establish the cause of the failure
- See how the problem can be resolved in practice

The SGS service is invaluable on high value and high profile projects as all the risk is borne by them. Please see attached information for more detail.

**References**

Please find the following documents attached:

*Technical Background*

- Working Principles of Zinga (Ghent University)
- An Initial Evaluation of Zinga (BNF Fulmer - 1990)
- Atmospheric Exposure & Electrochemical Evaluation of Zinga (1992)
- 8500 Hour Salt Spray Test Results (Taiwan University – 2000)

*Testimonials*

- Killybeggs Fish Landing Pier – Ireland
- BC Ferry Ramps – Canada
- Schwenk Cement Factory – Germany

*Insurance*

- Zingametall Product Liability Insurance Policy
- Instructions on how to obtain SGS Guarantee
- Pros & Cons of SGS Guarantee
- Application form for SGS Guarantee
- Example of SGS Report (3<sup>rd</sup> Year Inspection of Killybeggs)

For further information please contact Zinga UK or visit the website  
[www.zinga-uk.com](http://www.zinga-uk.com)