HOT DIP GALVANIZING TODAY

2006 Volume 3 Issue 3

HOT DIP GALVANIZERS ASSOCIATION Southern Africa

28

Featuring:

The 2006 Eskom Hot Dip Galvanizing Awards – winners and entries

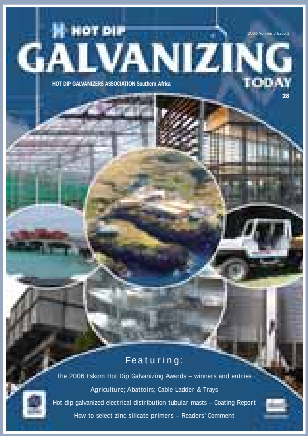
Agriculture; Abattoirs; Cable Ladder & Trays

Hot dip galvanized electrical distribution tubular masts – Coating Report

How to select zinc silicate primers – Readers' Comment

ZINC

steel
SOUTHERN AFRICAN INSTITUTE OF STEEL CONSTRUCTION



The Association is a technical information centre established for the benefit of specifiers, consultants, end users and its members

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HOT DIP
GALVANIZING TODAY

Official journal of the Hot Dip Galvanizers Association Southern Africa • 2006 Volume 3 Issue 3

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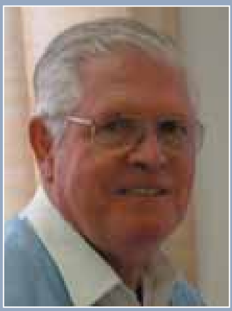
ISSN 1023/781X

Front Cover: *A kaleidoscope of photographs including some awards entries and two of the features*

Hot Dip Galvanizing – Adding value to Steel

Executive Director's Comment



It has been said that the older one becomes the quicker the years seem to pass. This cliché certainly appears to hold true when one considers the speed at which this year has progressed.

The LME zinc price has come off its high of marginally under $4 000 per ton. It is now moving in a range of $2 900 to $3 100 per ton. However this reduction in the US $ price is being offset by the weakening of the Rand.

The subject of the international zinc price was highlighted at Intergalva 2006, held in Naples Italy, during the second week of June. The more detailed report on Intergalva 2006 is featured elsewhere in this issue. What is clear is that hot dip galvanizers, worldwide, are very concerned and are watching the price of zinc on a daily basis.

This issue will feature our annual hot dip galvanizing awards. Comments from the judges were that the entries were of a higher standard than in the past, but unfortunately two of the categories had only one entry each, with no entries being received under Exports.

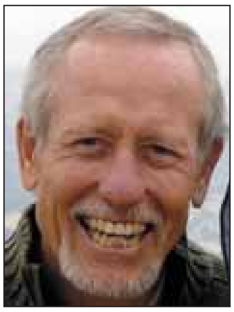
The annual awards are an opportunity for clients, consulting engineers, project managers and Association members to showcase their projects and to illustrate how hot dip galvanizing can be and is used, as a superior corrosion control system. It is also an opportunity to show how Duplex coatings are used to combat very severe corrosive conditions as well as to improve aesthetic and architectural appearances. Our annual awards are not designed as an inter-galvanizing competition, but rather to highlight the professional and technical application of the process to combat corrosion, and to protect and provide extended service life of steel structures.

The staff at the Association are available to assist with preparation and writing up awards entries during the course of the year. In this way we will increase participation from a broader interest perspective and at the same time use the event to promote the application of hot dip galvanizing and duplex coatings as a cost effective system for corrosion control.

Finally, the good news for the industry is that demand for hot dip galvanizing is on the increase, this being in spite of the higher zinc price. The process remains competitive with other corrosion control systems, so when one considers the corrosion protection of steel, consider hot dip galvanizing to protect your steel assets.

Bob Wilmot

Note from the Editor



In spite of the relatively daunting cost of zinc and the recent Rand weakening against the US Dollar having a major effect on the cost of hot dip galvanizing, our industry is currently quite busy with a number of fairly big projects coming to fruition. A number of galvanizers, particularly in Gauteng are working multiple shifts to try and offset the demand placed on them. Despite this, we believe there is still excess capacity amongst the galvanizers.

The galvanizing industry is ideally a service industry and for this reason should be able to accommodate most reasonable requests, provided the customer has taken a few things into consideration, prior to placing his order.

These are, choice of available bath size to suit component size; expertise of the galvanizer when difficult components are to be coated; location of the galvanizer; appropriate materials handling equipment; not necessarily placing the order on the lowest quoted price and good communication and forward planning from the outset by both parties and continuing throughout the project.

However, we are sure that in recent times, there are those who have experienced a service fall off in terms of turn about time or coating quality from their respective galvanizer, and although this should be discussed with the galvanizer, one is always welcome to discuss these and other issues with the Association.

We kick off in the magazine with the annual Eskom Hot Dip Galvanizing Awards event, by featuring the overall winner, the category winners and all the exciting entries.

Eskom provides us with a short article of why they have been involved in sponsoring the event since its inception.

The features for this issue include Agriculture, Abattoirs and Cable ladders and Trays, with the latter including a coating report of what is required in terms of hot dip galvanizing by the electrical/mechanical support fraternity.

As case histories, we revisit Fairacres Dairy Farm and Karan Beef – Balfour to see how the hot dip galvanized coating is performing after 10 and 7 years respectively.

Duplex Coatings addresses "How Economics Drive Change in Managing Maintenance Costs" and we include a paper on "How to select Zinc Silicate Primers", sent in by a reader in answer to Gerald Haynes' article on why zinc rich primers do not work effectively in the provision of long term cathodic protection – the debate rages on!

The "Coating Report" addresses coating issues with regards to a number of hot dip galvanized Eskom tubular electrical distribution masts in Tsakane.

Our personality profile is Derek van Heerden an architect who is passionate about South Africa and through his lecturing at the University of KZN loves being in touch with the talented youth of the day.

Our guest writer discusses "Like light, people and companies can be different things at the same time", whereas Miss Conception addresses "Will buried hot dip galvanized components contaminate the soil?"

In Walter's Corner, Walter discusses "How does hot dip galvanizing perform in immersed conditions?"

Should a reader wish to express an opinion or provide us with an article, kindly contact me – enjoy the magazine.

Terry Smith

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2006 Eskom Hot Dip Galvanizing Awards

Overall Winner

South African Weather Base – Marion Island

Description

The use of 3CR12 and hot dip galvanizing for the South African Weather Base

Location

Marion Island – South Indian Ocean

Tonnes of steel

Approximately 500 tonnes

Project partners

Client:
Department of Environmental Affairs & Tourism

Designer / Structural engineer:
Endecon (Centurion) Structural Engineers. (Also the Engineer and Principal Agent)

Architect:
IXIXI

Contractor:
National Department of Public Works

Civil engineer:
Infraburo

Electrical engineer:
Karabo Engineering

Mechanical engineer:
Risimati

Quantity surveyor:
Narker & Associates

Fabricator:
Petrel Engineering and Union Steel

Grating manufacturer:
Andrew Mentis (Pty) Ltd

Hot dip galvanizer:
Cape Galvanising & ConGalv

Project inception date

April 2005

Project value:

R200 million

Information

- Marion Island is a volcanic island teaming with wild life and is home to many sea-birds, penguins and seals. Most of the island is covered with soft, spongy moss vegetation, called mire, which together with the high rainfall create swampy conditions.
- Annexed by South Africa in 1947, Marion Island became best known for forecasting the weather to ships in sub-Antarctic and South Africa. Since then it has grown

An aerial view of the weather base during construction.

from a meteorological station to include research programmes in the fields of oceanography, biology and geology.

- Managed, funded and administered by SA Dept of Environmental Affairs & Tourism, Marion Island was proclaimed a special nature reserve in 1995.
- The project involved the design, off-site fabrication of steel and equipment, the logistics of loading and sea transportation of the entire base facilities; offloading and construction of the base buildings on a remote island where the weather conditions control progress and completion of construction.
- The corrosive conditions encountered at this remote location can be classified as a C4 or a C5 environment in terms of ISO 9223. Zinc corrosion rates for this environmental classification are estimated in the range of 2 to 4 micron (µm) per year. Considering the actual site conditions the expected corrosion rate of zinc would be approximately 3µm per year.
- As a result of the remote site location and non-availability of construction materials and equipment, the designer decided on the use of pre-fabricated 3CR12 and hot dip galvanized steel for the weather base. The site location also required attention to corrosion protection requirements for which hot dip galvanizing offered the ideal solution.
- The use of hot dip galvanized steel will provide an estimated service life in excess of 30 years, with alternative corrosion control coatings not being able to match the performance.
- An interesting aside: The SAS Aughulus (while on her way to Marion Island) received a call to intercept a trawler that had been illegally fishing for Patagonia toothfish. After several weeks the trawler was intercepted and handed over to Australian pursuers. The galvanized steel was subjected to an extra three weeks of severe mechanical handling!

The logistics for the project were extremely complex – here the packaged hot dip galvanized components are being loaded onto the SAS Aughulus.

Various views showing the hot dip galvanized steel used in construction of the base.

Judges' comments

Marion Island was highly regarded and it was recommended that the overall award be given to this entry. The application was extremely novel under very difficult circumstances and it is believed that this entry is very appropriate for the overall award because of its novelty, interest in the island and is an excellent example of how hot dip galvanized steel can be used in difficult conditions.

Duplex Coatings Category Winner

Eden Island – a bridge in the Seychelles

Description

Fabricated steel bridge, hot dip galvanized and painted in South Africa for erection in the Seychelles.

Location

Seychelles

Project partners

Client:
Eden Island Development Co. (Pty) Ltd

Designer:
LC Consulting (Cape) (Pty) Ltd

Fabricator:
Mazor Steel

Main contractor:
Vijay Construction

Piling contractor:
Franki Africa

Hot dip galvanizer:
Cape Galvanising (Pty) Ltd

Paint applicator:
Cape Galvanising (Pty) Ltd

Project inception date

March 2006

Information

- The project involved bridging one small island to the mainland forming part of the Seychelles group of islands situated off the East coast of Africa.
- The corrosive conditions encountered at the site location are best described as "exterior industrial with high humidity and/or salinity coastal".
- As a result of the site location and availability of construction materials, it was decided to use pre-fabricated steel (off site in South Africa).
- The site location also resulted in the need for specific design requirements to meet the corrosion environmental conditions.
- The use of a duplex coating system is estimated to provide a service life in excess of 35 years. The duplex system also allows for repainting maintenance of the top coat before attack of the hot dip galvanized layers takes place.
- This project has shown how steel can be used in remote locations.
- The primary benefit and feature of this project is the cost effectiveness given the site location and availability of local materials and equipment.

Judges' comments

The panel recommends that the award in this category be given to the Eden Island entry. Although a sole entry, the application is a good example of the benefits of duplex coatings.

Eskom in partnership with hot dip galvanized steel products spells growth

Hot dip galvanized transmission structures have stood the test of time. In sponsoring the annual Hot Dip Galvanizing Awards event Eskom acknowledges the successful role that this industry plays in the Power Supply Industry. The Galvanizing Industry is not just seen as a consumer of electricity but as a supplier of high quality products that Eskom is dependent upon.

The infrastructures used to build these lines have been tested to withstand weather conditions that are unique to this country. High lightning prone regions have specially designed lines to withstand the impact of direct lightning strikes. Notwithstanding the technical expectations of these high voltage towers, the approval by the Environmentalists was also sought where sensitive fauna and flora was being threatened. In order to have the minimum impact on our beautiful country-side, tower structures are aesthetically designed to comply with all parties.

Eskom is committed to the NER's Demand-side-management programme that encourages electricity consumers to either shift electrical load or adopt more energy efficient processes. The Galvanizing Industry plays a vital role in support of this programme and can make a large contribution to its success.

There is power in partnerships...

Mining and Industrial Category Winner

Bidfreight Port Operations Warehouse

Description

A new warehouse at Maydon Wharf, Durban to store bulk paper rolls.

Location

Maydon Wharf, Durban

Tonnes of steel

467 tonnes

Project partners

Developer / Owner:
Bidvest / Bidfreight Port Operations

Architect:
Anthony Jarvis

Project manager:
SKH Professional Engineers

Contractor:
Vital Steel Projects

Hot dip galvanizer:
Phoenix Galvanizing

Project completion date

February 2006

Project value

R28 million

Information

- Bidfreight Port Operations is a port storage and logistics company who provides world-class facilities for the handling of various products.
- Bidfreight, which is the largest private sector tenant at the Durban port, announced an investment of R100 million on upgrading their port side facilities in Durban following a deal with the National Port Authority that secured its leases for up to 20 years.
- Part of the investment was the construction of a new warehouse, which would essentially store bulk paper in rolls. Whilst the brief was for a warehouse for storage of paper, it was to be flexible in order to accommodate a variety of other products that may be handled in the future.
- The biggest challenge the architects faced was the difficult shape of the land, with a monopitch roof being preferred to avoid any internal box gutters and to allow for extension in the future.
- The design of the roof structures developed from the need to avoid any internal gutters and to have column free space. A simple girder truss, without complex bracing, was considered to be too flexible over these spans, and thus the design of a double truss or box truss was developed.
- The "box section" was rationalised as the design progressed, taking into account fabrication, transport to site, erection on site and in particular, hot dip galvanizing of large assembled sections of the trusses.
- The architects were aware of the limitations of hot dip galvanizing large pre-assembled sections and had to fine-tune dimensions and design of the trusses to fit the local galvanizing baths.
- Logistically the contract presented many challenges. The size of the "box sections" was so large that only 2 units could be transported on a single truck and trailer. The size had to be modified in order to ensure that it could be transported by road on a truck and trailer as opposed to a low bed. All of the box trusses had to be double-dipped due to the size.
- The roof truss "box sections" were jigged one at a time. All these sections were galvanized as double dips, taking 4 hours each to go through the entire hot dip galvanizing process. Once the sections had been galvanized, the boxes were quality checked and transported immediately to site.
- From the inception of the project, hot dip galvanizing was the planned method of corrosion control due to the fact that the site was located 200 - 300m from the Durban Bay.
- The design of this project proved to be exceptionally innovative and it is believed that the building is unique. This project is high profile and has formed part of a substantial capital investment in the Durban port.

Judges' comments

The panel recommends that the award be given to the Bidfreight entry.

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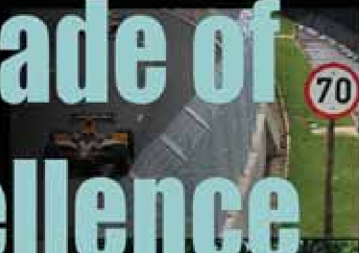

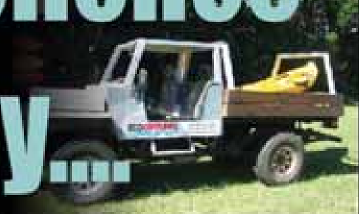

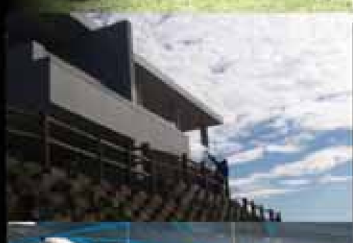

Line 1:
14 m long x 1.4 m wide x 2.4 m deep
Line 2:
7 m long x 1.2 m wide x 3 m deep
Line 3:
Centrifuge

HOT DIP GALVANIZERS ASSOCIATION SOUTHERN AFRICA

ISO 9001 SABS

OHSAS 18001 SABS ISO 14001

SABS

Vintage Category Winner

Braithwaite type pressed steel water tank

Description

Hot dip galvanized pressed steel water tank, estimated age of 70 years.

Location

Constitution Hill, Johannesburg

Project partners

Developer / Owner:
Johannesburg Development Agency / Blue IQ (in respect of the Constitution Hill Development)

Heritage Architect for the site:
Herbert Prins

Hot dip galvanizer:
Unknown

Information:

- The concept of liquid storage in tanks constructed by means of a series of modular steel panels bolted together on site was originally developed and patented in 1901 by "Braithwaite" in the UK.
- It is estimated that the hot dip galvanized "Braithwaite" tank has been standing for about 70 years and the coating is still in a serviceable shape.
- In order to establish when it was installed, the history of the fort was discussed with Herbert Prins, a Heritage Architect. The Johannesburg Fort was built in 1892, with the rampart built in 1896. It would seem that there is a strong possibility that the water tanks were ordered from the UK to accommodate water for the entire gaol, including the awaiting trial prisoner block. This suggests that the tanks may have been in existence since about 1930.

- The structure has been preserved as part of the site's heritage policy.
- There are future plans to re-instate it operationally, as part of the site's future grey water reticulation plan.

Judges' comments

The adjudication panel recommends that the award for this category be given to the Braithwaite Tank entry, although no other entries were received. The panel further recommends that the citation for the award focuses on the concept of the tank and the proven durability rather than on the applicants alone. This type of tank has had a long proven record of success all over the world and the various features of the tank, e.g. ease of construction and erection and the possibility to erect the tank in rural areas should be 'celebrated' by the award. The use of hot dip galvanized steel has undoubtedly enhanced the durability.

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- Sectional steel water tanks are easy and quick to install.
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- Minimal site preparation for circular bolted tanks.

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- Hot water; effluent; fuels; corrosive liquids.

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Innovation / Research and Development Category Winner

Eco tourism leisure vehicle

Description

A leisure vehicle which was refurbished and hot dip galvanized.

Location

Glenmore, Kwazulu Natal

Project Partners

Developer / Owner:
Glenmore Eco Venture cc

Designer / Contractor:
The Works

Hot dip galvanizer:
Phoenix Galvanizing (Pty) Ltd

Information

- Ecoventures is an adventure tour operation firm in Glenmore, Natal South Coast. The Eco Tourism Leisure Vehicle was born when the vehicle the company used to transport kayaks to the beach corroded after only four years of service.
- The partners consulted with Terrence Hill of The Works and considered replacing the vehicle with a fibreglass one due to the extreme corrosive conditions faced.
- This idea was discarded (due to the terrain) in favour of a mild steel structure. The Leisure Vehicle was originally planned as a box-frame steel cart, but the team decided to recycle the existing vehicle and incorporate a mild steel plate structure cab in place of the badly corroded cab.
- Terrence Hill consulted with the hot dip galvanizer throughout the process, confirming bath capacity, adequate drainage, bracing of steel plates within the structure to minimise distortion etc. It was essential that the cab be manufactured and galvanized as one complete unit.
- The client was advised to have the vehicle sandblasted prior to hot dip galvanizing in order to increase the zinc pick-up during immersion.
- This project was not earmarked for hot dip galvanizing, but as all available options were looked into and the environment taken into account, the logical choice was hot dip galvanizing. Not only would hot dip galvanizing render a uniform coating but it would offer the ideal solution to the highly corrosive environment the vehicle faces.
- Extensive use of recycling was made (chassis, body and engine), making it extremely cost effective. The leisure vehicle will remain useful to the company for an estimated 10 years.

Judges' comments

The panel recommends that the award be given to the Eco Venture Vehicle for its novelty, technical challenges and possible future opportunities for protecting vehicles for corrosive conditions.

Architectural Category Winner

Mitchell's Plain Public Transport Interchange – North Terminal

Description

The use of hot dip galvanized steel in an exposed way for bus and taxi facilities, office accommodation and trading facilities at the Mitchell's Plain Public Transport Interchange.

Location

Mitchell's Plain CBD, Cape Town

Type of steel:

Structural Steel

Project partners

Developer / Owner:
City of Cape Town

Architects:
Holm Jordaan Architects & Urban Designers in association with ACG Architects & Development Planners

Project manager:
Kayad Consulting Engineers

Structural engineers:
P.D. Naidoo & Associates

Main contractor:
Quickcon

Hot dip galvanizer:
Cape Galvanising (Pty) Ltd

Steelwork contractor:
Scott Steel Projects (Pty) Ltd

Project inception date

May 2004

Project Value

R35 million

Information

- The Mitchell's Plain Public Transport Interchange is the second largest transport interchange in the City of Cape Town in terms of commuter numbers.
- Until recently there were no taxi facilities in the Mitchell's Plain CBD. The City of Cape Town identified this project as a Presidential Project, funded jointly by the City of Cape Town, Western Cape Province and the National Government.
- The aim of the project was to provide a safe and seamless interchange between the various modes of transport, and to address pedestrian comfort and convenience. Part of the project also caters for the informal traders who have over time set up their trading stalls in the CBD, by providing them with a dedicated market area.
- The bus terminus is 100m long and 60m wide with 3 bus lanes under cover. The taxi terminal is 90m long and 40m wide. There are 4 double storey buildings, accommodating offices, boardrooms public toilets, trading and related facilities.
- The nature of the design required the use of steel to cover wide spans of covered roof area for the bus and taxi terminals.
- Early on in the design process it was decided to opt for hot dip galvanizing for corrosion protection. Later it became an aesthetic finish.
- Due to the fact that the project is located approximately 3km from the coast, with strong south-easterly winds bringing on salt-laden sea air, there was concern that hot dip galvanizing alone would not provide sufficient protection against corrosion. With the help of the Hot Dip Galvanizers Association, tests were carried out on existing galvanized items that were at the site for more than 20 years, in order to determine the effectiveness of the hot dip galvanized coating. The results indicated that there was still substantial coating thickness remaining.
- Due to the maintenance of paint, it was decided that only hot dip galvanizing would be used. The colour concept of the entire project was adapted to fit in with the grey colour of the galvanized finish. The use of hot dip galvanized steel in an exposed way, not only in the taxi and bus terminals, but also in the office buildings, provides an excellent showcase.

Judges' comments

The panel highly recommends that the award for this category be given to the Mitchells Plain Transport Interchange. The panel was highly impressed with this entry and it scored exceptionally well in all the adjudication criteria.

Black Mountain

Mining & Industrial Category

Description

The site establishment, installation of infrastructure, shaft sinking and equipping of two shafts for Black Mountain.

Location

Aggeneys, Northern Cape

Tonnes of steel

2 360 tonnes

Project partners

Developer / Owner:
Anglo Base Metals

Project manager:
Anglo Base Metals – Black Mountain – Charles Howard

Hot dip galvanizer:
Barloworld Galvanizers

Project inception date

May 2000

Project value

R940 000.00 million

Riversmead Poultry Farm

Mining & Industrial Category

Description

The hot dip galvanizing of various structures at a poultry farm in Port Shepstone.

Location

Port Shepstone

Project partners

Developer / Owner:
Riversmead Poultry Farm

Project manager:
Span Africa Steel Structures (Pty) Ltd

Hot dip galvanizer:
Phoenix Galvanizing (Pty) Ltd

SEE ARTICLE IN AGRICULTURE FEATURE

Leeuwpan Colliery – Phase 2 — Mining & Industrial Category

Description

Hot dip galvanizing of washing plant and loading facilities

Location

Delmas

Project partners

Developer / Owner:
Kumba Projects

Contractor:
DRA

Hot dip galvanizer:
Barloworld Galvanizers

Project inception date

June 2005

Project value

Contract value:
R91 million

Hot dip galvanizing value:
R1.2 million

"S"-Beam Belt Take Up System — Mining & Industrial Category

Description

Hot dip galvanized "S"-Beam type belt take up system used in the mining industry.

Although the old type of loop take up system was efficient it had its limitations as far as proper corrosion control and coating maintenance was concerned. The settlement of product fines as well as limited access for coating maintenance caused a serious corrosion problem.

The new design incorporated the "S"-Beam type belt take up system, otherwise known as a loop take up system, was designed and supplied by Nepean SA, supported by the Australian parent company and hot dip galvanized locally.

Project partners

Developer / Owner:
Nepean South Africa

Hot dip galvanizer:
Barloworld Galvanizers

Project inception date

July 2005

Four One Two Musgrave Road

Architectual Category

Description

A multimillion Rand residential development situated on Musgrave Road, Berea, Durban.

Location

Berea, Durban

Tonnes of steel

12 tonnes

Project partners

Developer / Owner:
Golden Pond Trading 143 (Pty) Ltd

Architect:
Rodger & Associates

Project manager:
Domain Properties

Main contractor:
Nik Steel

Hot dip galvanizer:
Phoenix Galvanizing (Pty) Ltd

Project value

R43 320.00

Environmental Affairs Head Office – Sun Security Screens

Architectural Category

Description

Hot dip galvanized sun / security screens at the Environmental Affairs Head Office in Polokwane.

Location

Polokwane

Project partners

Developer / Owner:
Limpopo Public Works & Environmental Affairs

Architect:
Office Twentyfourseven (o24-7)

Specifier:
Office Twentyfourseven

Project manager:
Limpopo Public Works

Main contractor:
Kgabo Developers

Engineer:
Munyai Malaka & SNA

Hot dip galvanizer:
Galvadip (Pty) Ltd

Project inception date

June 2005

Project value

R228 000

St. Andrews School for Girls – Synthetic Turf Sports Field Lighting

Architectural Category

Description

Hot dip galvanized lighting masts and ancillary steel works, including fencing. The masts are of the external access type with ZOI Glideloc safety ladders

Location

St. Andrews, Bedfordview

Tonnes of steel

4 tonnes

Project partners

Civil Engineers & QS:
RFJ & Associates

Lighting design:
Beka (Pty) Ltd – Mr. Peter Davies

Lighting contractor:
Versalec Lighting (Pty) Ltd.

Mast sub-contractor:
ZOI Projects cc

Hot dip galvanizer:
Supergalv

Project value

R550 000

Standard Bank Parkade

Architectural Category

Description

The hot dip galvanizing of the support steelwork for the steel clad roof and vehicle barricades, balustrading and all façade work for the Standard Bank Parkade.

Location

Simmonds Street, Johannesburg

Project partners

Developer / Owner:
Standard Bank of South Africa Limited

Architect:
TC Design

Specifier:
Pure Consulting (Pty) Ltd

Project manager:
Standard Bank: Property Finance & Advisory Services

Main contractor:
Concor Building & Trencon Construction JV

Sub-contractor:
Spiral Engineering

Hot dip galvanizer:
Armco Galvanizers

Vaalbank Pedestrian Bridge

Architectural Category

Description

Hot dip galvanized Steel Pedestrian Bridge

Location

The Vaal River, Kwazulu Natal

Project partners

Developer / Owner:
KZN Department of Transport

Architect / Bridge design / Project management:
Emzansi Consulting Engineers Coastal cc

Specifier:
Emzansi Consulting Engineers Coastal cc

Civil contractor:
Northern Natal Civils cc & Somashe Enterprises JV

Steel contractor:
Newfen Engineering

Hot dip galvanizer:
Phoenix Galvanizing (Pty) Ltd

Project inception date

March 2005

A1 Grand Prix

Innovation / Research & Development Category

Description

Hot dip galvanized debris fencing and impact barriers for the A1 Grand Prix held in Durban.

Location

Durban, Kwazulu Natal

Project partners

Developers / Owners:
A1 Holdings, A1 Team SA, eThekwini Municipality and Kwazulu Natal Government

Specifier / Project manager:
D3 Motorsport Development

Main Contractor Impact Barriers:
Cobro Concrete

Main contractor debris fencing panels:
R&N Engineering

Hot dip galvanizers:
Phoenix Galvanizing (Pty) Ltd and Voigt Willecke Galvanizers

Project value

Debris fencing: R8 million
Impact barriers: R10 million

Cousins Steel International Office Accommodation

Architectural Category

Description

The use of hot dip galvanizing for corrosion protection and aesthetics for the offices of Cousins Steel International

Location

Morningside, Durban

Project partners

Developer / Owner:
Cousins Steel International (Pty) Ltd

Hot dip galvanizer:
Voigt & Willecke (Pty) Ltd

Project inception date

August 2004

Project value

R600 000

Report on Intergalva 2006

The 21st International Galvanizing Conference and Exhibition, Intergalva 2006, was held from 11 to 16 June in Naples Italy. The conference programme commenced with registration on Sunday afternoon 11 June. Monday 12 June was the start of three days of formal technical papers being presented to an audience of more than 450 delegates from all over the world.

The conference programme included the following general subject headings:

- World View of the hot dip galvanizing industry, with the current high price of zinc being of special interest, as well as developments in China.
- Metallurgy of Galvanizing, including papers on various additives to molten zinc bath to combat the effects of silicon and phosphorous in reactive steels.
- Steel and Zinc Working Together, covering subjects relating to liquid metal embrittlement (LME) and hydrogen embrittlement relating to hot dip galvanizing.
- Developments in Galvanizing Plant Design, including a paper on kettle wall measurement under full operational conditions.
- Zinc, Galvanizing and the Environment, featured as a high priority and is seen as becoming increasingly important with the enforced compliance of environmental standards.
- Galvanizing Protects Steel, covering hot dip galvanized reinforcement in concrete structures, performance of resilient railway track fasteners, lead free galvanized tubing and continuous wire and sheet galvanizing.
- Surface Treatment and Process Bath Controls, which was directed at the hot dip galvanizers in terms of benchmarking performances, pickling bath management and the options for galvanizing in future markets.

Numerous international contacts were re-established together with a number of very valuable new ones. Three papers from South Africa were presented, these being:

Barloworld Galvanizers on the subject of their 4m deep zinc kettle, and two from the Association, one on hot dip galvanized reinforcement in concrete structures, and the second on the subject hot dip galvanized, high tensile spring steel, resilient rail fasteners (Pandrol).

Full details of the conference programme together with copies of all the technical papers, presented at Intergalva 2006, as well as all previous conference publications, are available in the Association's library and can be duplicated should members require more detailed information on the subjects presented.

Thursday 15 June was spent visiting three galvanizing plants in the area south of Rome. The three plant visits were very educational and highlights the fact that environmental controls receive a high priority. The Italian plants are generally well designed, robust and include well thought out handling equipment associated with large lay down areas for incoming and outgoing material.

A power point presentation, using photographs taken during the course of these three visits, has been compiled and copies can be reproduced should Association members have a specific interest.

During the course of Intergalva 2006, the Association was represented and participated in two additional meetings. On the Sunday evening the International Zinc Association (IZA) held a co-ordinating and updated information meeting of country Associations. The objective of this meeting was designed to highlight the needs of the hot dip galvanizing Associations around the globe to explore ways in which the IZA could provide assistance and support.

Monday late afternoon we attended the "Meeting of Countries" held by the Asian Pacific General Galvanizers Association (APGGA), to which we were formally welcomed as a member. We plan to participate, via the electronic media, in certain APGGA working groups on subjects covering the following:

- Technical (including standards).
- Funding and Marketing (including case studies & website).
- Training & Training Material – such training to cover operators, inspectors (both internal and external) and training of members' sales personnel.
- Environmental issues including Occupational Health and Safety and Chromate replacement.

We plan to publish progress reports on these working groups, as we believe that they are beneficial to our members as well as the broader industry within our region.

The 22nd International Galvanizing Conference and Exhibition, Intergalva 2009, will be held in Spain during 2009, under the chairmanship of the Asociación Técnica Española de Galvanización.

Bob Wilmot

Hot dip galvanizing of centre pivots

Hot dip galvanizing has been the preferred method of protection against corrosion on centre pivots for many years, probably since the early 1970's. Centre pivot irrigation was introduced to the world in the 1950's and today there are many thousands of centre pivots irrigating hundreds of thousands of hectares all over the world.

However, the basic form of corrosion protection by hot dip galvanizing has not changed much, if at all, in the last 30 odd years. What has changed though, and quite drastically in the recent past, is the quality of the irrigation water.

In South Africa, we have seen a marked deterioration of irrigation water in areas such as the Loskop Dam irrigation scheme near Grobersdal and Marble Hall, the Crocodile and Komati river systems in the Mpumalanga Lowveld from Kaapmuiden to Komatipoort.

"In the good old days" hot dip galvanized centre pivots would build up a deposit layer of lime on the machine structure that acted as an additional protection to the galvanized layer. Many of these pivots are older than 20 years and still rust-free. They could possibly last another 20 years!

Recently, this additional protective layer is absent or minimal, and we are finding that the pivots are rusting on the inside of the pipe in about 8 to 10 years or even sooner in some parts of South Africa. Often, this is only discovered when the structure collapses because corrosion has reduced the pipe wall thickness on the inside to less than half the original wall, and the structure becomes too weak to support itself.

Unfortunately, the corrosion is mostly on the inside of the pipe and therefore impossible to see from a visual inspection of the outside of the structure, which gives the farmer a false sense of security. The issue is further compounded by farmers accusing manufacturers of "thinner" or "weaker" galvanizing, especially farmers who have old pivots that have a lime protective layer as well as newer pivots that are more prone to rusting because there is no additional protective layer.

The question now is : What about the future? Will the quality of our irrigation water improve in the future, and if not, will pivot manufacturers be compelled to find alternatives to galvanized pivot structures?

Editorial comment

As the article states, a hard type of water will allow a build up of scale on the inside of the pipe providing additional protection, whereas a soft water will not. The corrosive effect of soft water is compounded by the addition of fertilizers to the water and also the lack of bleeding off of the water within the centre pivot pipe when the irrigation cycle is finished. See also Walter's Corner.

A centre pivot system in use.

The Association wishes to thank Valley Irrigation for this article.

Riversmead Poultry Farm

Riversmead Poultry Farm based inland from Port Shepstone, has been in the Apostolides family since 1944. For the last 25 years, the farm has specialised in Broilers. Broilers are young chickens specially bred for fast growth and slaughtered when they weigh about four pounds, usually between seven and nine weeks of age. The farm currently supplies chicken to a number of large butcheries, retail outlets and restaurants in Durban and Pietermaritzburg.

The farm has a number of structures on the farm housing chicken. Originally chicken houses were built out of timber, but have changed to steel over the years due to bio-security reasons. Initially the farm only made use of hot dip galvanized lip channels for the roof of the structure and painted the remainder of the structure.

In 2005 the owner requested Phoenix Galvanizing, along with HDGASA to conduct an investigation on the farm, on buildings that he felt "weren't coping well". What ensued was a thorough inquiry into various structures on the farm, some dating back 15 years. Although it was apparent judging by the age of some the buildings, that Phoenix Galvanizing was not responsible for the original hot dip galvanizing (the company celebrates it's 10th year of existence this year); the company took the decision to assist, in their ongoing commitment to creating awareness of the hot dip galvanizing coating. A comprehensive study was undertaken by Phoenix Galvanizing along with Span Africa Steel Structures (the construction company responsible for the structures) and HDGASA.

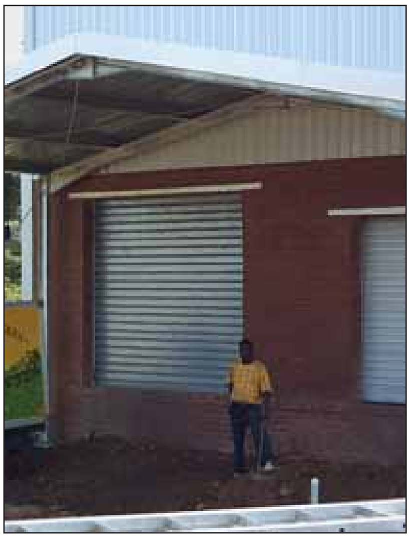
A coating inspection inside a chicken house.

Hot dip galvanized structure for the new feeding mill.

Port Shepstone is regarded as a highly corrosive area given the close proximity to the ocean. Chicken houses are scattered across the farm, some as close as 4km from the ocean. The South Coast is also notorious for the wind and an almost constant South Easter does not help the cause.

Another factor that had to be taken into account was the chickens. (The droppings alone are highly acidic.) Upon investigation it was revealed that the chickens had a life cycle of approximately six-seven weeks before they ended up as "Sunday lunch". The chicken houses accommodate the birds on beds of wood shavings. A feeding track is suspended from the hot dip galvanized lip channels that support the roof. Every six weeks the chicken houses are hosed down from top to bottom with a harsh acidic chemical, used to disinfect the entire structure in readiness for the next batch of broilers.

There were a few areas of concern from a hot dip galvanizing point of view. What seemed to be happening in the maintenance of the buildings was that the wood shavings on the floor circulated during the washing down and settled into the "lips" of the lip channels, forming a corrosion cell.



The abboitoir loading bay at Riversmead Poultry Farm.

Inside the chicken house showing the wood shavings and feeding units, notice the hot dip galvanized water supply piping.

A combination of the acidic washdown chemical, wood chips and fairly humid environment has resulted in a poultice on the inside of the lip channel, resulting in accerated corrosion.

Furthermore, the feeding track was fastened to the galvanized lip channels with electro-plated “electrogalvanized” fasteners. With time these fasteners lost their thin zinc coating and started to discolour the hot dip galvanized lipped channel. When one sees discolouration on the hot dip galvanizing one is often inclined to think the coating is failing, when clearly this is not always the case. Zinc by its nature has sacrificial protection properties and will sacrifice itself in order to protect uncoated mild steel.

Coating thickness readings of up to 154 microns were measured on some structures that were 15 years old. Structural steel buildings on the site ranged in age from 1 to 15 years. The hot dip galvanized coating was performing well considering the harsh conditions.

Phoenix Galvanizing had made their intentions to involve HDGASA clear from the beginning of the enquiry. This step was highly appreciated by both the owner and the construction company. Following the site visit, by all parties including HDGASA, data and visuals were used to compile a report, which was forwarded to both the clients.

A decision was taken that all future steel buildings on the farm will be hot dip galvanized. All lip channels used for maintenance and repairs to older buildings are ordered pre-drilled and then hot dip galvanized, ensuring adequate corrosion protection.

Fairacres Dairy Farm

It was time to revisit the Karg family farm in Rosetta, Kwazulu Natal, to find out how the hot dip galvanized coating on the structures of this modern dairy farm were standing up to the corrosive elements of both weather and farming with animals. Unfortunately for the writer, the visit had to be done via telephone and not in person, but owner Brandon Karg was happy to talk to me despite the interruption to his busy routine.

Some six years ago when *Hot Dip Galvanizing Today* first spoke to the Karg's, they had just installed a new 'free stall barn', which was a concept that had originated from overseas and which assists in the monitoring, control and production of milk from the dairy herd. The steel-framed building is 160m long by 40m wide.

The cows move freely around inside the barn whilst not being milked, eating specially mixed food rations. They then move from the barn to the dairy in groups, remaining on concrete to eliminate bringing mud into the milking shed. Each cow is fitted with a transponder around the foot, which monitors and records how far the cow walks each day, and health conditions such as whether the cow is in heat, or if she suffering from mastitis.

Once inside the milking shed, the cow steps onto a slowly rotating platform where a milking machine is attached to her udders. The cow remains stationery, chewing on her ration of pellets until the milking process is complete and the platform has rotated 360°. She then steps back off the platform and exits the shed. The cows are milked three times a day and in between these sessions they go out to graze in the paddocks. The Karg's farm with a herd of 800 dairy cows.

The milking shed was built some 10 years ago, and all the support steel structures as well as all fasteners and feed troughs in both that and the 'free

Another load of milk leaving for the market.


Hot dip galvanized tube cattle dividing rails in the feeding sheds.

Coating thickness on the tube cattle dividing rails after 6 years of exposure.

Hot dip galvanized coating thickness on the structural steel in the feeding shed.

Hot dip galvanized cattle seperation barrier.

Hot dip galvanized tube making up the treatments/artificial insemination stall.

Coating thickness on the tube for the treatments/ artificial insemination stall after 6 years of exposure.

Base of cattle seperation barrier post, showing the build up of cattle dung etc.

Hot dip galvanized purlin in the bulk tank room.

Coating thickness on the purlin in the bulk tank room.

Cattle dung removed from the base of the cattle seperation barrier post and coating thickness measured.

stall barn' were hot dip galvanized. Although the atmospheric conditions are not particularly damaging, the presence of the cows in both buildings, emitting carbon dioxide and gallons of urine every day, is very corrosive. Despite these conditions, says Brandon Karg, the steel structures continue to show no signs of corrosion and require little or no maintenance. Looking at the performance of the hot dip galvanizing *(see photos)*, it is expected that a service life of in excess of a further 30 years will be achieved.

In contrast, in other parts of the farm where hot dip galvanizing was not applied, these steel structures are showing signs of heavy corrosion. Maintenance is high and some of the items such as gates have had to be replaced. Hot dip galvanizing as a means of corrosion protection definitely proves its worth on this prime dairy farm.

2006 FEATURES

NOVEMBER/DECEMBER

- **Mining:**
  - Gold mining
  - Coal mining
  - Platinum mining
  - Diamond mining
  - Overland conveyors
- **Bolts and Nuts**

OBITUARY

We express our sincere condolences to Frank Goodwin and his family on the death of their daughter.

Frank has been active with the International Lead Zinc Research Organization for many years during which he has become a good friend of our Association, as well as a valuable source for the latest technical information relating to zinc and its numerous uses.

Butterworth Metal Industries Transkei (Pty) Ltd

Butterworth Metal Industries Transkei (Pty) Ltd was registered and began operations in 1974, in the small Eastern Cape town of Butterworth. Originally established as a sister factory of Border Tin & Steel (Pty) Ltd, which was established in 1908! They are now part of the CL Group, which is the holding company of several businesses.

This ensures that the company is well established locally and is well on the way to becoming one of the largest hot dip galvanized and tinned metal goods manufacturers in the southern hemisphere. Products include items such as tinned billy cans, hot dip galvanized metal buckets, watering cans, baths, refuse bins, rainwater tanks and other hot dip galvanized and tinned aligned goods.

BMI are a medium-sized concern and contribute to the struggling economy of the region. Many locals are dependant on their existence and the company provides employment to about one hundred people living in a radius of approximately 160km.

BMI has been an active member of the Proudly South African concept since the inception of the campaign and has recently become a member of the Hot Dip Galvanizers Association of Southern Africa.

Through these organisations, constant training, and the commitment of their dedicated staff, the company intends being a major player in the industry for many years to come!

Some of the staff at BMI.

Hot dip galvanized watering can and bucket water feature.

Playing in a hot dip galvanized metal bath.

Personality Profile

Derek van Heerden

Derek van Heerden is a born and bred "Kwazulu Natalian". After completing his schooling in Newcastle, Derek enrolled at the then University of Natal for a degree in Architecture. Part of his studies was completed at the University of Cape Town. His formal training was followed by a period of extensive travel in the Middle East, in an attempt to "get away from everything to do with architecture". Fortunately the inherent yearning to create and design triumphed over a nomadic lifestyle and Derek returned to the province of his birth and took up a part-time teaching position at UKZN from 1985-1995. In 1995 he became a full –time lecturer, a position that he still holds presently and is passionate about;"I love being in touch with the youth of today. I love being surrounded by their positive attitude & optimism. It excites me to see the raw talent and sheer brilliance of the kids that we are sending out there and into the future of this country." He further explains: "if I didn't build, I would have nothing to teach about and vice versa."

A sabbatical in 1999 to Australia and New Zealand exposed Derek to the work of Glen Murcutt, Gabriel Poole, Lindsay Clair & John Mainwaring, the pioneers and masters in the field of Regional Design. The Aboriginal proverb: "Touch the earth lightly" encapsulates the philosophy whereby sustainably designed buildings aim to lessen their impact on the environment through energy and resource efficiency. This influence from 'Down Under' continues to be a great source of inspiration to Derek and is evident in all the projects that he engages in.

The award winning firm East Coast Architects of which Derek is a member, along with Steve Kinslar & Dave Barrow was established in 1998. New

kid on the block Suhayl Ballim joined the dynamic trio in 2002. The firm has been responsible for several award winning projects such as the Africa Centre for Health and Population Studies in Somkhele in Northern Kwazulu Natal. In 2003 it was honoured by the KwaZulu-Natal Institute of Architects as one of the best three new buildings in the Province and went on to win a national award of excellence conferred by the South African Institute of Architects as one of the best buildings in the country. In 2004 the project also scooped a prestigious Sustainable Built Environment Award. The building has also been featured in the 2005 edition **"The Phaidon Atlas of Contemporary World Architecture"**.

The firm was also responsible for Intuthuko Junction in Cato Manor and the extensions to the Nelson R Mandela Medical School.

Derek explains the firms successful design philosophy as threefold: The firm is Regionalist and design critically appropriate buildings to celebrate the East Coast – buildings that make a climatic and environmental statement. They enjoy passive design & try to develop buildings that function naturally, without artificial lighting and ventilation. Most importantly their projects are heavily community based. They engage the services of local tradesmen and as far as possible utilize materials which are locally sourced.

The firm is currently developing the Seven Fountains Primary School at Shayamoya, Kokstad for the very high profile Oprah's Angel Network. This project is a good example of community involvement and bottom-up facilities provision. The company is also developing the new Head Quarters of the Wentworth Aids Action Group. The Centre will also house the humanitarian organization Keep A Child Alive of which American R&B singer, Alicia Keys is an ambassador.

Steel features prominently in most of their designs. Derek concedes that he likes honesty in the materials that he utilizes. "Steel must look like steel – in that way I am a kind of Brutalist." It is for this reason that hot dip galvanizing features boldly in many of the projects the firm develops. The long term benefits are also legion and a critical factor in buildings that "sustain themselves".

Derek is passionate about South Africa and about developing a true contemporary South African Architecture. "I love being in South Africa and believe we should build buildings that make us enjoy being in this country. Embracing other styles of architecture enforces a statement of wanting to be somewhere else."

Derek is father to three boys ranging in age from 17-22 and husband to Sharon. Van Heerden hobbies include traveling, reading, "obsessive compulsive home-improvement that have been ongoing for the last 20 years", gardening and spending time in the great South African Outdoors.

Karan Beef – a world class enterprise

Since *Hot Dip Galvanizing Today* last reviewed the world-class operation of Karan Beef, the giant feed-lot and beef processing enterprise in Balfour at the beginning of 2000, the operation has continued to grow with a corresponding expansion to their infrastructure taking place.

The farm in Heidelberg now carries 110 000 head of cattle on its feedlots and is processing 16 000 head a day through its neighbouring abattoir in Balfour. From the moment the young calves are selected and purchased from supplying breeders, and arrive at the feedlots, Karan Beef controls the entire supply chain up to the marketing and distribution of packaged beef products or of 'swinging carcasses' for butchers, via its own facility at City Deep.

Alterations and coating repairs must be kept to a minimum particularly in this type of application. Here the coating repair material that was used has failed and must be redone with a more suitable material.

Karan Beef is a major exporter of its beef products to overseas markets and is therefore subject to the HACCP Quality Control System, the benchmark used by the world governing body to determine food hygiene standards. The abattoir, which was designed by the world renowned Texan, Professor Temple Grandin, who was a guest speaker at last year's international Compassion in World Farming Conference held in London, makes use of the latest technology and animal handling techniques to ensure the animals experience as little stress as possible before slaughter. Stress adversely affects the meat quality, as well as being ethically undesirable.

The hot dip galvanized structural steel, floor gratings and carcass conveyor support systems, including all fasteners in the various plants have stood up well to the corrosive conditions they have been subjected to since the Association last visited Karan Beef. These include among other things the use of aggressive chemicals during CIP (cleaning in place).

The latest expansions at Karan Beef include five new cold rooms, a new dispatching area, three extra offal freezers and an upgraded by-product plant. Based on international recommended standards, as well as the company's requirements of minimal maintenance, all the support steelwork of these expansions, (with the exception of the latter), including the roof structures, will be hot dip galvanized.

Coating thickness on this structural steel is still far in excess of the minimum required by the specification (70µm), in spite of its exposure to this atmosphere for more than 6 years and continual wash down of the structure with the cleaning chemical.

The hot dip galvanized coating on the 2mm thick edge plate of this walk way has been reduced by about 10µm over the 6 years of exposure (about 1.5µm per year). This is in spite of the aggressive wash down method that is used to produce clean surfaces, required by authorities.

From an environmental perspective, Karan Beef is most definitely at the forefront. The creation of a large wetland on the farm not only acts as a natural bio-filtration system, purifying accidental run-off from the feedlot before its return to the Suikerbosrand River system, but attracts one of the largest selections of waterfowl found anywhere in Southern Africa. Karan Beef has been awarded an ISO 14001 rating in recognition of its adherence to air pollution control and environmental stewardship.

Karan Beef can rightfully claim to be the largest, fully integrated beef production organisation in Africa, using state-of-the art technology to enhance the quality of its operation and the humane and sensitive handling of its animals and environment.

OBITUARY

WILLEM KRUGER

It is with regret that we announce the sudden death of Willem Kruger, a friend and colleague of many years standing.

In his younger years Willem was introduced to Hot Dip Galvanizing at Stewarts and Lloyds (now Tosa Pipe Systems) where at one stage he was in charge of production in the Hot Dip Galvanizing division.

Willem became well known for the development of the recycling process whereby spent hydrochloric acid used for stripping zinc off steel was no longer dumped but rather recycled to produce zinc chloride, one of the two main ingredients which make up the flux solution, an essential requirement in the galvanizing process. Under the company name Alfa Chemicals, Willem also developed other chemicals for which there is a demand for the agricultural sector.

We express our sympathy towards his family at this time of sorrow. His friendly and charming personality will be missed by us all.

Hot dip galvanized cable ladders – quality surveillance report

Introduction

Unlike organic paint systems, a hot dip galvanized coating is produced by a metallurgical reaction between iron and molten zinc. A series of hard abrasion resistant iron/zinc alloys are formed and these are overcoated with relatively pure zinc as the product is withdrawn from the galvanizing bath. The various layers all play a significant role in the provision of corrosion protection. For the coating to form, the steel surface is required to be totally free from all contaminants such as mill scale, rust, grease and oil.

As the name implies, the hot dip galvanizing process entails dipping of the articles into a series of pre-treatment chemicals prior to immersion in the molten zinc. The advantage of this method is that all product surfaces are wetted uniformly, including areas, which would be inaccessible for cleaning and coating by other methods.

After pre-cleaning and further drying, the products are dipped into the molten zinc which is heated to a temperature of about 450ºC. The steel is immersed at a fairly rapid speed and once the coating has formed, withdrawal is at a slow speed to ensure uniform drainage and a relatively smooth finish.

Specification

The local specification for general hot dip galvanizing is SANS 121 (ISO 1461) and the applicable coating thickness for varying steel thickness is according to table 1 and 2.

Hot dip galvanizing provides two forms of corrosion protection:

Barrier protection

The durability of a hot dip galvanized coating in a given environment is largely determined by its thickness. Protection is provided primarily by means of a barrier whereby the coating prevents both oxygen and moisture from reaching the steel substrate. The coating is therefore predictable in nature, once the coating loss per year is established (see Corrosion Categories and Rate of Coating Loss – ISO 9223, table 3), life of the hot dip galvanized coating can be determined fairly accurately.

Sacrificial protection

The surrounding zinc also provides effective sacrificial or cathodic protection, where steel surfaces are exposed, as a result of localised coating damage while corrosion creep under the coating cannot occur.

Zinc is a reactive metal, thus a freshly galvanized zinc surface is attacked by oxygen and carbon-dioxide present in the atmosphere. This results in the formation of a stable protective surface film of zinc carbonates, which retards corrosion of the underlying zinc. It is for this reason that the coatings initial metallic lustre is replaced by a matt light grey appearance *(see photo X)*.

TABLE 1. MINIMUM COATING THICKNESS ON ARTICLES THAT ARE NOT CENTRIFUGED – SANS 121 (ISO 1461)

Profiles	Local coating thickness min. µm	Mean coating thickness, min. µm
Steel ≥ 6mm	70	85
Steel ≥ 3mm to < 6mm	55	70
Steel ≥ 1.5mm to < 3mm	45	55
Steel < 1.5mm	35	45

TABLE 2. MINIMUM COATING THICKNESS ON ARTICLES THAT ARE CENTRIFUGED TO SANS 121 (ISO 1461)

Diameter of the article	Local coating thickness min, µm	Mean coating thickness min, µm
≥ 20mm diameter	45	55
≥ 6mm to < 20mm diameter	35	45
< 6mm diameter	20	25

Table 1 and 2. (SANS 121).

South African Bureau of Standards – Mark Scheme and Certification

Most galvanizers in South Africa are Mark Scheme holders and are therefore empowered to issue a certificate of conformance in terms of SANS 121 (ISO 1461). The issuing of this certificate of conformance implies that the articles that have been hot dip galvanized, in conformance with the specification.

Coating inspection

When inspecting a hot dip galvanized coating, it must always be borne in mind that the primary purpose of hot dip galvanizing is to protect steel from corrosion.

The service life of a hot dip galvanized coating is directly related to its coating thickness, thus this is the single most important inspection check to determine the quality of a hot dip galvanized coating.

The next most important check is the coatings continuity, which depending on the fabrication standard, may or may not be continuous. Weld slag or weld porosity can interfere with the formation of the coating, leading to bare spots.

The general or batch hot dip galvanizing process conforms to SANS 121 (ISO 1461) and this specification requires that the hot dip galvanized surface be:

- Relatively smooth
- Continuous
- Free from gross imperfections
- Free from sharp points (that can cause injury) and
- Free from uncoated areas.

'Roughness' and 'smoothness' are relative terms where the end use of the product must be the determining factor in setting tolerances. Mechanically wiped surfaces, such as continuously hot dip galvanized sheeting or automatic tube hot dip galvanizing are not to be used as the criteria for assessing batch hot dip galvanizing products.

Significant surfaces:

In addition, SANS 121 allows the specifier to select if necessary, significant surface/s other than matting surfaces. This can be defined as, 'A surface, which impacts on the performance of that article.'
In order to ensure that a significant surface is provided, the purchaser must provide the galvanizer with a sketch indicating these surfaces or negotiate the surface finish with the galvanizer, whereby suitable samples are hot dip galvanized and after acceptance by the customer, are kept,

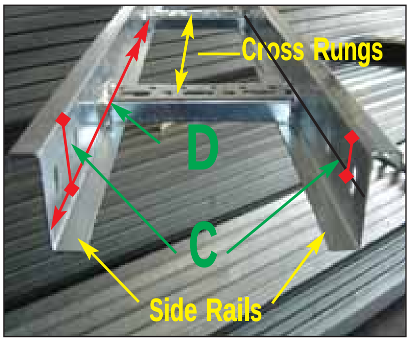


Photo 1. Significant surface, where cables come into contact with the cable ladder surface.
C = Height of side rail above cross rung x D – full length of cable ladder.

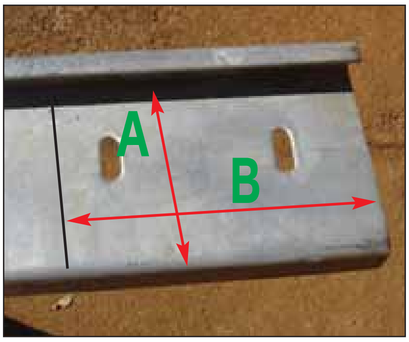
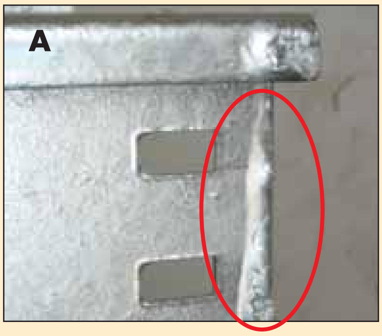
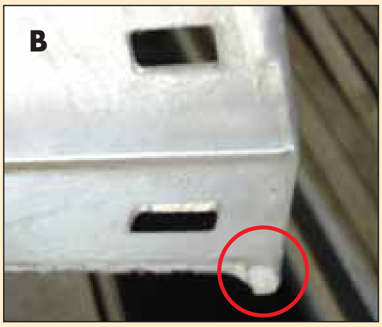
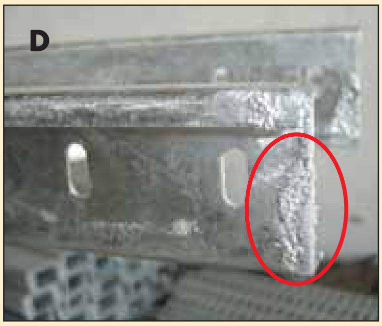
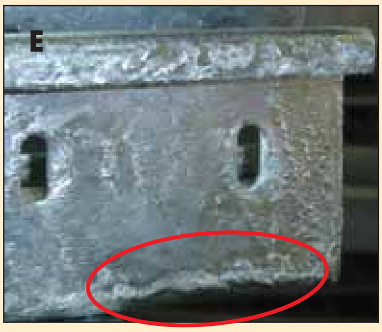


Photo 2. Mating surface on the outer face of the cable ladder at splices, both sides and both ends of cable ladder (4x)
A = Width of splice B = Length of splice / 2









Cable ladders in photos A to E (above) are unacceptable **(U)** and must be cleaned by the galvanizer of the lumpiness caused by excessive zinc. See cleaning method.

Photo F (above) shows some feathering of zinc layer at holes equal to or smaller than 8mm in diameter. Molten zinc has a high surface tension and will not easily drain from holes less than 8mm in diameter – acceptable **(A)**.

Photo G indicates a run of zinc possibly when the cable ladder was removed from the bath of molten zinc at a unusually flat exit angle. See normal coating thickness (H) and coating thickness at run (J) above. The zinc run does not interfere with either the mating surface or the identified significant surface, the cable ladder for this reason is acceptable **(A)**.

one each, by both parties to ensure future acceptance or rejection.

In terms of cable ladders the significant surface can be defined as any area on which cables come into contact *(see photo 1)* and mating surfaces, with the splice areas *(see photo 2)*.

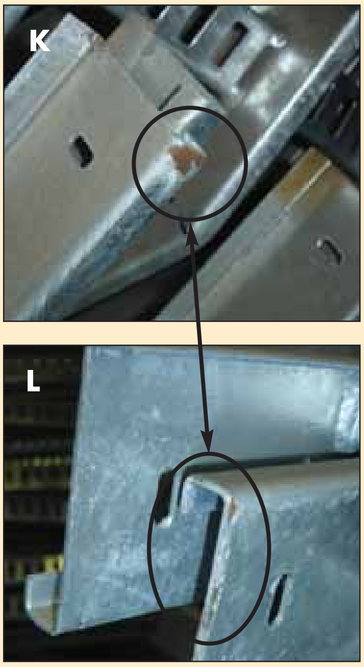
Surface conditions:

The surface conditions shown in photos A to J are either acceptable **(A)** or unacceptable **(U)** or negotiable **(N)** with the customer, in terms of SANS 121.

Overcleaning after hot dip galvanizing:

As explained in the introduction, hot dip galvanizing entails the dipping of suitably cleaned steel into molten zinc at about 450°C, the principle of good galvanizing is fast immersion and slow withdrawal.

The articles are to be removed from the bath of molten zinc at a crawl speed ideally about 1.0m per minute, the angle of withdrawal is also important in that it be as steep as possible, ideally inclined at 45° to the surface of the floor *(see figure 1)*.



Mechanical cleaning of lumps and runs can result in uncoated areas, which are unacceptable **(U)** and must be repaired. **See #**. See also photos K and L above.

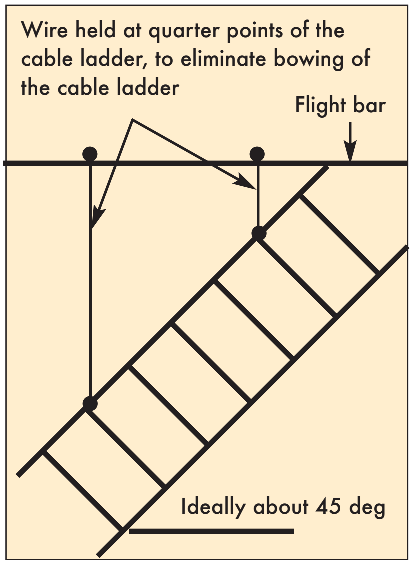


Figure 1.

The angle of the cable ladder relative to the flight bar will depend on the depth of the available zinc bath but the maximum possible angle should be achieved to increase the quality of the coating and to ensure that the zinc run off is at the ends of the side rails.

Droplets or spikes at the inside edge of the cable ladder side rail. In terms of SANS 121 (ISO 1461) these are totally unacceptable **(U)**.

The hot dip galvanized coating at the top ends of the cable ladder will be smooth and acceptable. Molten zinc will run off the lower ends without the need to bang the cable ladders together, only the last remaining zinc run at the cable ladder end must be removed by the action of the skimmer at the bath, with the aid of a paddle. Should a solidified droplet of zinc form at the cable ladder end, it should be removed by the aid of a flame, energised by LP gas and oxygen. Care should be taken that only the zinc droplet is melted, resulting in a relatively smooth appearance. Excessive exposure to a flame will discolour the coating and although the coating will not be impaired, this may be unacceptable for aesthetic reasons. See also *photo M* of typical jigging, left.

Spikes and droplets:

Although the spikes and droplets indicated in *photo N* are not on matting or significant surfaces, they are required by the specification to be removed, by the galvanizer, prior to delivery.

Mechanical damage:

Articles to be hot dip galvanized are entrusted to the galvanizer for coating, and while every precaution

Unacceptable mechanical damage.

can be taken, mechanical damage at the galvanizer's plant can occur. However, the galvanizer is responsible for mechanical damage of articles during galvanizing.

Other surface conditions:

Although in the following instances the components are not cable ladders, the surface condition discussed, remains similar.

Appearance of sodium di-chromate:
A small amount (less than 0.3%) of sodium di-chromate is generally added to the quench water for passivation. This will generally ward off the formation of wet storage stain. Occasionally, when topping up with this chemical, more is added, resulting in a dark yellow to brown colour on the hot dip galvanized surface. The darker colour will provide enhanced initial corrosion protection. Acceptable **(A)** *(photo O)*.

Bare spots:
Although excluded from SANS 121 (ISO 1461), bare spots of about $5mm^2$ in size (2.2 x 2.2mm), due to small-localised flaws, which maybe process or non-process related, are adequately protected by the sacrificial properties of zinc and will have very little influence on the service life of the coating. Where necessary such spots may be repaired. Gross uncoated areas are cause for rejection. **(A), (U), (N)** *(photo P)*.

Ash deposits:
Ash deposits are grey non-metallic deposits consisting of zinc oxide that may be deposited on the hot dip galvanized surface when the component is removed from the zinc bath. The coating is normally intact under the ash deposit and should be cleaned by the galvanizer. Acceptable **(A), (N)** *(photo Q)*.

Dross inclusions:
Dross pimples result from agitation of the dross layer at the bottom of the bath or from dragging the components through the dross layer. Furthermore, minute iron / zinc dross crystals can become suspended in the molten zinc and result in dross inclusions because of too little lead in the zinc bath.

Dross pimples appear as small hard lumps on an otherwise normal hot dip galvanized surface.

The galvanizer should avoid disturbing the dross layer by controlling the immersion depth and ensure that the molten zinc has a sufficient supply of lead (The lead carrying capacity of molten zinc at 450°C is about 1.3%). Acceptable **(A)**, except when excessive and present at mating or significant surfaces, then it is unacceptable **(U)** *(photo R)*.

Touch marks:
Components entering the zinc bath should not be in tight contact with each other. Jigging wire should also be loosely attached to eliminate wire marks.

In order to minimise coating repair, the galvanizer should make use of a flame when removing tightly bound jigging wire from the component/ coating after hot dip galvanizing. Acceptable / Negotiable **(A), (N)** *(photo S)*.

Ungalvanized areas in the vicinity of the welds:
Localised ungalvanized areas near a weld can be caused by weld slag

Appearance of sodium di-chromate.

Dross inclusions.

Excessive bare spots.

Touch marks.

Weld spatter.

Ash deposits on mating surfaces.

Ungalvanized areas in the vicinity of welds.

Wet storage stain or white rust.

Photo X shows the matt grey appearance of a zinc carbonate film, which naturally forms when the original metallic lustre of a hot dip galvanized coating comes into contact with a normal atmosphere of moisture and carbon dioxide. It is this stable surface film that provides the corrosion protection that hot dip galvanizing is known for.

deposit, weld porosity or weld undercut. Oxide deposits and weld residues are resistant to normal pickling acids and must be removed by the fabricator, prior to pickling and hot dip galvanizing *(photo T)*.

Weld spatter:
Weld spatter is oxidised, weld material, that is fused or not onto the surrounding material during welding. Loosely adherent weld spatter should be removed prior to hot dip galvanizing. Although not acceptable in terms of the specification, the presence of tightly adhering weld spatter will not affect the corrosion resistant properties of the coating. Acceptable / Negotiable **(A), (N)** *(photo U)*.

Wet storage stain or white rust:
Wet storage stain or white rust is a white voluminous deposit that is occasionally found on a freshly hot dip galvanized surfaces, in close contact in the presence of moisture. The condition ceases when the cause is eliminated. If the coating thickness at the affected area is equal to or greater than the minimum required by the specification, it is not a cause for rejection, other than for aesthetic reasons.

The latter is subject to discussion with the end user. Customer is to exercise caution during transport and storage. Acceptable / Negotiable **(A), (N)** *(photo V)*.

Coating repair

In terms of SANS 121 a galvanizer may repair a coating by either zinc metal spraying or a zinc rich epoxy or paint. The latter method must conform to certain requirements in the specification.

The total uncoated areas for renovation by the galvanizer shall not exceed 0.5% of the total area of the component. No individual repair area shall exceed 10cm^2 (10 x 100mm). See coating repair procedure attached.

Coating repairs at site should also be kept to the minimum applicable to the galvanizer. In addition, when cable ladders are extensively altered due to the conditions at site, it is recom-mended that the special part be made from carbon steel and then hot dip galvanized and installed, if possible.

Shape and corrosion protection of the fasteners

In order to ensure that the head of the fastener does not interfere with cable pulling, it is recommended that a flat head fastener be used at all splice plates *(see photo W)*. Also, to ensure similar corrosion protection, all fasteners should if possible be centrifuge hot dip galvanized to SANS 121.

Terry Smith

Selection of cable support systems which satisfy both design requirements and optimum life cycle cost

At Strutfast (Pty) Ltd we have divided our cable management market into two specific sectors, namely, Commercial and Industrial.

Commercial and industrial sectors

The Commercial market is defined as the market wherein regular support of cable carrying products are generally available from building structures such as walls, floor slabs, roof structures or closely spaced structural steel members. Typical examples of this sector are low, medium and high rise office buildings, hotels, factories etc.

The Industrial market is defined as the one in which regular supports of cable carrying products are generally not available and where additional structural supports are required for fixing of our cable carrying products. Typical examples of this sector are mining, petro-chemical, and numerous other structural or heavy industrial type installations. As one can envisage from the above, the technical requirements for the cable support system in the Commercial sector are generally less demanding / stringent than for the cable support system in the Industrial sector.

Cable ladder versus cable tray

The two distinctly different product types used for carrying cables are defined as '*Cable Ladders*' and '*Cable Trays*'.

The Cable Ladder is made up of two side rails (or stringers) and cross rungs fixed at regular intervals at right angles between the side rails, whereas the Cable Tray is a flat shallow product, resembling a tea tray.

Although both cable trays are hot dip galvanized the tray on the left has been manufactured from continuously hot dip galvanized sheeting, coating class Z275 (coating thickness 16.9µm) and the tray on the right hot dip galvanized to SANS 121 (coating thickness 91µm).

Unfortunately specifiers and contractors alike make use of a third term, namely '*Rack*'. This term should be avoided, as it does not define the product type to be used.

The correct selection of a '*ladder*' or '*tray*' is determined by considering the specific characteristics of the cables being carried. Whereas instrumentation cables generally require the continuous support afforded by a cable tray, the more inflexible, rigid, but heavier electrical cables require support at intervals as afforded by the structurally stronger cross rungs of the cable ladder. In Commercial use the installation of both cable ladders and trays are easily accomplished by way of an overhead support system, either in the ceiling void fixed to the concrete slab or to structural steel members. The cable ladders or trays are then mounted in the horizontal plane supported at 1.5 to 2m centres. As the structural strength of cross rungs of cable ladders are far superior to the flat sheet or wire of the cable tray, cable ladders are able to carry heavy cable loads across a wider width than the cable tray in the horizontal mounting position. It is for this reason that cable ladders are manufactured to widths of 1 000mm or more and cable trays are restricted to a maximum width of 600mm.This rather obvious structural reality is often ignored by electrical specifiers, who regularly insist on cable trays of 1 200mm wide.

Metal framing

An assortment of bracketry, F1000 strut profiles and spring nuts known collectively as '*Metal Framing*' affords the electrical installer of cable support systems, the ability to easily and quickly install a cable support system capable of carrying the cable design loading specified for a project.

Design and specification of a cable support system

The specification of cable support systems generally falls under the jurisdiction of the electrical or instrumentation engineer, due to the fact that he controls the cabling. As a well designed cable support system requires expertise in structural and corrosion engineering, it is necessary for the specialist supplier of cable support systems to offer technical support in these areas to ensure that their products are correctly specified for each particular application.

Suppliers of cable support systems offer the market a wide range of products with varying cable carrying capabilities, manufactured in many materials and finishes (e.g. graded stainless steels, 3CR12, aluminium, fibre reinforced plastic, hot dip galvanized mild steel, duplex coated hot dip galvanized mild steel and industrial paint systems on mild steel), to cater for every type of corrosive environment imaginable.

We believe that, as there are *'horses for courses'*, similarly this range of products enables the designer to select the best option that will satisfy a specific set of structural and environmental design requirements for the life of the plant.

Structural design considerations for a cable support system

Reputable suppliers of cable support systems should be able to predict the load carrying capability/performance of each of their products at different support spans in order to recommend the most suitable product for a particular use. In order to do this, all cable carrying products should be designed and categorised in accordance with local and international standards.

The real challenge in the design of a cable support system lies in the industrial market, where cables often have to span long distances without intermediate supports. The design also depends on the preference of the electrical engineer to support the cables by laying them on a horizontal cable ladder/tray (bed), or tie them to an edge mounted cable ladder/tray (wall).

Because South African engineers generally prefer the latter method of supporting cables, a cable ladder was locally developed some eighteen years ago, which is structurally superior when carrying design cable loads over long spans when mounted on its edge. This product has all but replaced the use of angle and flat bar cable ladders in mining and heavy industrial applications. The outstanding features of this product are full welding at the junction of each cross rung with the side rail and extended bottom flange, thus creating a rigid fixed joint. In addition, the end of each cross rung is cut back at an angle in order to allow a generous opening for zinc flow during hot dip galvanizing.

In other parts of the world, engineers favour laying their cables on a cable ladder or tray, which is mounted in the

The cable tray on the right (hot dip galvanized to SANS 121) will out last the tray on the left (continuously hot dip galvanized material) by upwards of 4 times!

horizontal plane. When mounted in this position over long spans, the cable ladder or tray requires a deeper side rail profile in order to satisfy the design load requirements. The fact that very few locally marketed cable ladders or trays have side rails or turn ups greater than 76mm seems to prove my belief that South African specifiers support cables in the edge mounting position in industrial application.

Contact with overseas engineers/ specifiers who require horizontal mounted cable support systems in long spanning applications, will certainly influence the availability of suitable new products in order to satisfy this demand.

Corrosion protection system

When selecting the most suitable products for a cable support system, it is essential to select the correct material and/or coating system, which is capable of lasting for the life of the building or plant in which it is to operate.

Should the cable support system fail prematurely, the exorbitant costs of shutting down the plant to install a new support system far exceeds the additional cost of choosing the correct corrosion protection system rather than the wrong one.

We focus hereafter on corrosion protection systems involving hot dip galvanizing.

Hot dip galvanized coating

The coating of choice for ninety per cent of our stock of cable support system product is hot dip galvanized to ISO 1461 in the case of our mild steel manufactured items and continuously hot dip galvanized sheeting's Z275 for some of our commercial cable trays and wiring ducting where no welding is required during fabrication. Even considering the massive increases in the cost of zinc in recent times, I cannot envisage a more ideal coating for our products than hot dip galvanizing to an agreed standard of quality required by the electrical specifier.

Any hot dip galvanizer wishing to coat cable support products has to realise that his coating is part and parcel of the product. This, of necessity, means that surface roughness and spiking on the cable bearing surfaces and at splice mating surfaces are unacceptable, whether otherwise acceptable to SABS and ISO 1461, or not. It has been my experience that whereas some plants are unsuited to galvanize our products, others are unwilling to go the extra mile, regardless of price. To those galvanizers who are willing to work together with manufacturers and suppliers like ourselves in order to produce a quality product, which meets all of the design requirements of our industry, your positive attitude will serve to retain hot dip galvanizing as the preferred coating of cable support systems into the future.

Duplex coating system (hot dip galvanizing plus powder coating)

Where cable support systems are installed for maintenance free extended life span the above duplex coating system has proved to be highly effective.

For a number of decades, till the end of the 1980's, ninety five per cent of all steel cable management products were either hot dip galvanized (cable ladders, cable trays and metal framing systems) or powder coated (power skirting, some ladders, trays and metal framing for aesthetic purposes). It is thus understandable why the industry developed its interest in duplex systems almost exclusively on the use of hot dip galvanizing and powder coating.

In early use, the final powder coating was applied to the hot dip galvanized coating, only after application of a strontium chromate primer. As the strontium chromate coating was proving extremely costly, attempts were made to eliminate the primer by mechanical and/or chemical transformation of the hot dip galvanized substrate. Resulting from these efforts a number of powder coaters today are able to achieve the necessary adhesion between the hot dip galvanized substrate and the powder without the strontium chromate wet spray.

Resulting from a number of duplex failures, notably at Zimbali (continuously galvanized wire coated with epoxy powder) and on the West Coast of Namibia (hot dip galvanized

Edgemounted cable ladder.

commercial grade mild steel and polyester powder), sound reasoning would suggest exercising extreme caution in offering duplex coating systems for severe corrosive environments, unless fully supported by the powder (or paint) manufacturer concerned as well as the specifier. It is encouraging to notice that at least one powder manufacturer has entered the precarious area of specifying a duplex solution with hot dip galvanizing for severe corrosive environments.

It is my view that duplex coating systems of hot dip galvanizing and powder/paint will only come into their own when both the specifier and the manufacturers of paint and powder systems take full responsibility for their products for all corrosive environments, as well as the correct application thereof through the appointment of approved applicators, particularly where coating on hot dip galvanized steel is concerned. Rather than to continue marketing the obvious merits of duplex coating, I would much rather see the HDGASA embarking on a joint venture with a number of recognised industrial paint manufacturers and powder manufacturers to test duplex coatings in severe corrosive environments where failures are known to have taken place.

This will give those of us who believe that hot dip galvanizing is a wonderful corrosion protection system for steel, another product that we can market with total confidence.

The Association would like to thank Pieter Uys of Strutfast, an affiliate member, for this article.

How economics drive change in managing maintenance costs

Extracted from SSPC 01-13 – Technical Presentations
James A. Ellor, P.E., Vice President
Corrpro Companies, 1235 Jefferson Davis Highway, Suite 500, Arlington, VA22202

Abstract: *Maintenance painting costs can be controlled by proper attention to the true cost drivers.*

In these discussions, there are often two focuses: (1) the immediate costs of the work and (2) the life-cycle cost of maintaining an acceptable coating. And while much is made of life-cycle cost, reality suggests that the ultimate focus remains on immediate cost.

From an owner's perspective, cost control is attempted through (a) development of appropriate specifications, (b) implementation of advanced technology, (c) quality assurance and job management, and (d) encouraging competition.

Recognition of overall cost

When attempting to control the overall cost of maintenance painting, it becomes necessary to define the cost boundaries within which one is working. Often to the paint specifier, this is limited to the cost of an immediate job or facility. But often painting costs can have a significant impact on other operations and facilities. In some cases, these ancillary costs, such as lost production or equipment downtime, can be more substantial than the cost of the painting exercise. Thus we need to define the boundaries of the cost analysis.

At the very least the cost analysis should view maintenance painting on a facility or platform-wide basis, i.e., within the marine industry, we paint parts of the structure on a periodic basis to ensure the integrity of the entire structure. Cost analysis should view the life-cycle costs of painting the entire structure, not just selected compartments or parts.

Prioritised Painting Programmes

A primary step in developing a prioritised painting programme is to break down the various elements that comprise your overall facility or structure(s). These should be broken into logical painting groups, i.e. elements or subcomponents that lend themselves to common painting schemes or common painting time frames.

The painting specification will be mostly influenced by the intended service environment for the coating, any constraining factors for application of new coatings (such as environmental limitations), and the intended service life for the coating. The cost of painting will be immediately affected by common parameters such as surface area, surface complexity, current coating condition, structure access, and containment requirements. The life remaining in the existing coating system is also key. Remaining life can be defined by cosmetic or structural deterioration concerns. But some sort of assessment of this parameter is required.

A properly developed plan can drastically reduce long-term costs.

Based on our experience, there are commonly four primary problems in this effort that need to be overcome. These are (1) the inability of an owner to agree on an acceptable deterioration condition, (2) a lack of understanding of the practical significance of substrate corrosion on structural integrity, (3) the lack of good data on predicting the ongoing rate of coating deterioration, and (4) the divergence of funds from a pre-planned and thought out programme.

Project cost control

Provided with an understanding of the overall painting needs within a facility or structure, an owner may develop individual projects to meet the program objectives. Let us examine how the owner's focus can affect these parameters.

Appropriate specifications

Specifications are an attempt by an owner to stipulate the processes by which the painting of a structure is to be accomplished.

It is within an engineer's nature to be conservative in the development of a coating design. In our highly technical forums of today, much of the focus is on preservation in highly corrosive and demanding service. These are the areas with the most challenge. They are also the areas where coating testing can be performed in a meaningful timeframe, as failure is easier to observe.

Improved technology

Improved technology is often viewed as the panacea for coating problems. And there has been substantial improvement in technology over the past 20 years in terms of both process tools and coating materials. But this long-term trend notwithstanding, it is not clear that an owner will recognise short term benefits from improved technology. However over the longer term, the cumulative effect of new technology will provide the returns discussed above, just not on the project starting tomorrow.

As opposed to new technology, one of the most under-considered methods of reducing the cost of painting for a project is the owner granting the contractor more flexibility in terms of work hours and access to the job site.

Given the inherent start/stop costs of each day's work, longer work days and better access while on the job site can allow the contractor to optimise his crew scheduling. This can drive the most substantial savings as it directly reduces a cost the contractor must bear on an immediate project. Limiting work hours can have the opposite effect.

Quality assurance and job management

Quality assurance is necessary, especially in the most critical and corrosive environments. The biggest concern for quality assurance in process is having trained quality assurance representatives on both the owner's and contractor's side and the development of uniform guidelines between the two representatives before the project unfolds. There is also the problem of a difference in interpretation of similar specifications between different owner representatives in different locations or projects. This can cause a substantial difference in the amount of work required in the different projects. There needs to be a forum established at the beginning of the project to rapidly adjudicate any such differences between the owner's representative and the contractor.

Competition

Control of pricing requires competition. Owners should be a bit more diligent in reviewing not only bid prices, but the track record of the contractor in delivering for the original bid price. A long history of exceeding bid prices is a potential sign for trouble on your project.

We recently observed a job bid where the winning price for the contract was basically the cost of the coating materials. And while the contractor may recognise some discounts for the material over his competition, it is not likely that the owner is going to receive a quality job at the indicated price.

Conclusions

For an owner to manage maintenance-painting costs, the owner should consider the total cost of ownership and maintenance. Based on this database, the owner can prioritise the painting processes.

Provided with a programme, the owner can rely on appropriate specifications, best technology, quality assurance, and competition to control costs.

Editorial Comment

This paper has been included in the duplex section primarily to highlight the important parameters of maintenance painting on either uncoated carbon steel or hot dip galvanized coating surfaces. Of course, in the event that hot dip galvanizing has been specified and used, unless the environment is extremely aggressive, painting over hot dip galvanizing will not necessarily be required for more than 50 years in most environments.

The Association would like to acknowledge the advertisers and thank them for their support


How to select zinc silicate primers

As Published in the Protective Coatings Europe Journal by Mike Mitchell & Mark Summers

International Protective Coatings Akzo Nobel www.international-pc.com

In previous issues of Hot Dip Galvanizing Today, No's 25 and 26, we have had conflicting views of the effectiveness/ineffectiveness of an Inorganic Zinc Rich paint particularly for its Cathodic Protection properties, in this issue we publish a paper on the subject emailed to us by Rob Watson of International Paint – Durban, in response to our readers comment in magazine No 26. The paper unfortunately had to be shortened slightly, due to its size, however, we believe all the important points have been included. The paper discusses further controversial issues with respect to the product's Cathodic Protective properties. We leave it to the reader to make up his mind, once you have read the facts.

There is often uncertainty and confusion amongst users of zinc silicate primers regarding parameters such as volume solids and spreading rates, which cause few difficulties with conventional paints. The following note is intended to clarify these issues and to give some simple guidelines in selection of zinc silicates.

It is accepted that this could be argued to be an oversimplified view, but it is believed that this is worthwhile in the quest for clarity. Formulation can allow products to fall outside the parameters discussed but, in this instance, benefits should be demonstrable by performance testing.

Zinc silicates are amongst the most widely used primers in the Protective Coatings Industry, and it is necessary to ask, "why use zinc silicate primers?"

The answer is because of corrosion resistance:

- Damage resistance on handling.
- Underfilm corrosion creep on damage.
- General anti-corrosive performance.

For zinc silicates the anti-corrosive and mechanical properties are highly dependent upon the level of zinc dust present. Twenty-five years ago it was not unusual to use zinc silicates containing 90% or more zinc dust in the dry film, with the only other components being the ethyl silicate and anti -sag agents. Cost pressures and practicality has driven this down to around 86% zinc dust, with other components often being reinforcing extender pigments present to give improved film properties (i.e. reduce mudcracking in thick areas). These levels give zinc -zinc steel contact and thus potentially allow cathodic protection to take place.

Figure 2 shows the corrosion potential against time for an 85% zinc dust silicate. Until around 80 days cathodic protection of the steel substrate is definitely occurring, and subsequently up to 140 days partial cathodic protection and partial

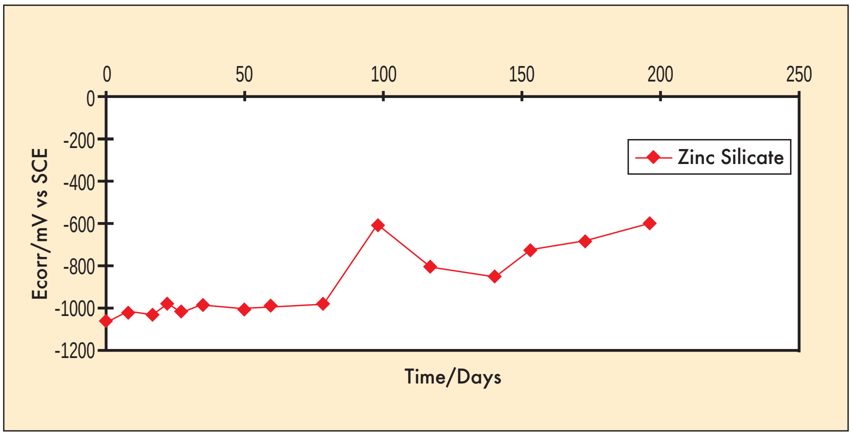
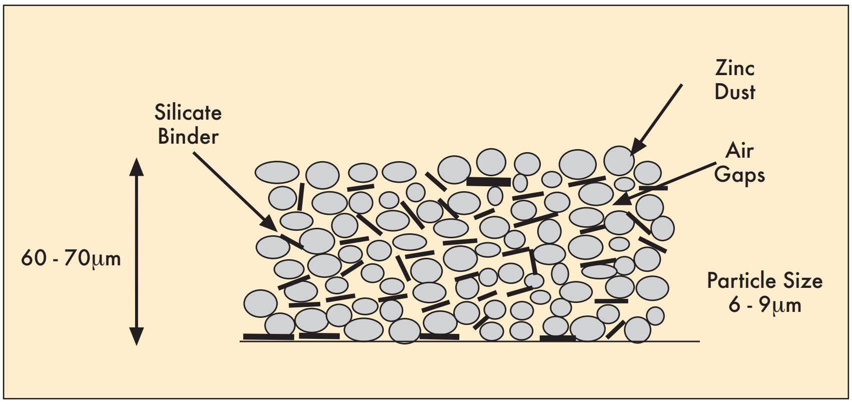
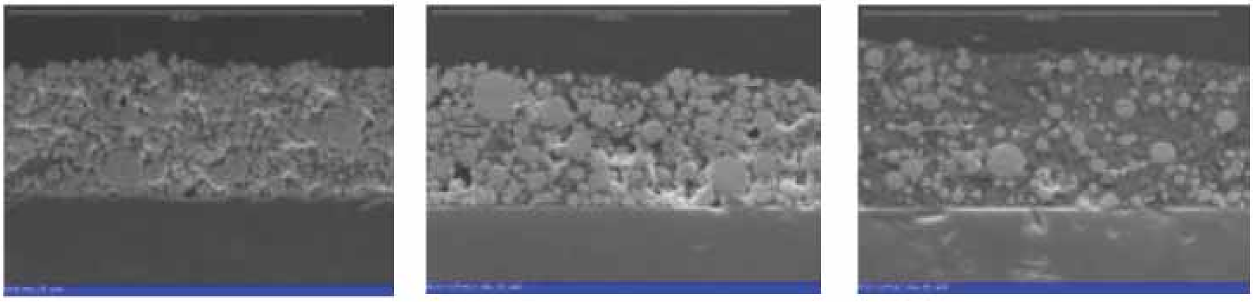


Figure 2 – Corrosion potential vs time for zinc rich silicate (85% zinc dust).



Idealised coating showing zinc dust, joined by silicate with many air gaps.



85% Zinc Dust	85% Zinc Dust (Alternative Sample)	60% Zinc Dust

SEM of cross sections.

barrier effect. After this, protection is primarily by barrier effect.

Most long term current track record is based on zincs with around 85% zinc dust (higher than in most standards such as SSPC 20 or ISO 12944), in most instances the zinc being topcoated.

How to select zinc silicate primers

There are also many instances of exceptional performance of high zinc containing zinc silicates being used as single coat systems, generally in more arid environments such as desert regions, but also on bridges and other infrastructures. Often water based alkali silicates are used as binders in this instance but all of the comments in this note apply equally to these as to the more common organic ethyl silicate (tetra ethyl ortho silicate) based materials.

It is necessary to consider the composition and the typical film of a zinc silicate to fully understand what is being purchased.

Zinc silicates are unusual coatings and, along with some flat wall and masonry paints, are one of the few coatings which are designed so that all of the solid pigment particles are not coated with polymer and all of the gaps between particles are not filled with polymer, i.e. they are designed to be porous films.

From the Zinc Silicate pigment content figures (PVC 78,5 & PVC 77,4 not published), which are considerably over a simplistic cubic close packing scenario for the zinc particles of between 62 and 66%, that a very considerable portion of the film is void, i.e. the film is porous (this is not a problem as with weathering it fills with salts and becomes a barrier but it does cause the well known 'pinholing' problem seen with topcoats applied over fresh zinc silicate). The fact that there is not sufficient polymer to fully wet and coat the pigment (zinc) particles present ensures electrical contact and Cathodic protection.

Theoretical calculations

If a purely theoretical calculation is undertaken for a zinc silicate, assuming resin, zinc and extender all film form to give a totally void free coherent film, then typically volume solids figures of around 35-45% are achieved for commercial zinc silicates. This type of figure if clearly not representative of the wet to dry film thickness ratio obtained in practice, nor of the spreading rates normally achieved.

The difference between the practical figures and "calculated" figures is a feature which causes many problems in the assessments of the commercial value of various zinc silicates and can lead to poor system performance and poor value for users.

Volume Solids Determinations

The industry norm for volume solids quotations (necessary both to determine spreading rate and in practice to give a method of accurate commercial assessment between various suppliers' coatings) is to use methods of accurately determining the wet to dry film thickness ratio of the coating.

The actual methods normally used are those described in ISO 3233 or ASTM D2697 (generally modified to allow for ambient curing). One key aspect of both of these methods is accurate determination of film thickness by measuring the volume of the dry film, utilising Archimedes' principle and weighing in air and water. This works well for all normal organic coatings, which are formulated, with the aim of achieving void free films, and values obtained correlate well with practice. However, with zinc silicates using water, volume solids figures reflect the theoretical volume solids calculated, not that which is observed in practice.

This is due to water penetrating into the pores and voids of the coating and the volume measurement, thus not reflecting the actual position of the surface.

Therefore, to use this type of method, an alternative approach is needed, e.g. NACE Item No. 54165, which is a modification of ASTM D2697. In this instance, the water is replaced by mercury, which has a surface tension such that it does not penetrate the voids in the silicate film and in order to sink in the mercury application must be

Product	Quoted Volume Solids (%)	Spread Rate for 75µm DFT (m^2/l)	Wt of Zinc Dust in Film (% Total)	S.G.	Packing Weights (Pack/Zinc)	VOC (g/l)	Wt of Zinc per m^2 (g)	Pack Size
A	(61)	8.2	86	(3.17)	49kg/33.2kg	0	(268)	4 gal kit
B	(61)	8.2	>85	(2.64)	51kg/33.2kg	479	(215)	5 gal kit
C	(75)	10.0	84	(3.38)	47kg/33.2kg	288	(243)	3.6 gal kit
D	(75)	10.0	85	(3.28)	47kg/33.2kg	389	(237)	3.7 gal kit
E	(75)	10.0	75	(2.60)	46.7kg/33.2kg	384	(189)	4.65 gal kit
F	64	8.5	(85)	2.65	Wt Mix	515	(211)	
G	62	8.2	(76)	2.4	Wt Mix	515	(171)	
H	70	9.3	(78)		Vol Mix	N/A	(157)	
I	60	8.0			Vol Mix	N/A	(217)	
J	66	8.8		2.46	Wt Mix	521	(183)	
K	62	8.2		2.38	Wt Mix	510	(190)	
L	79	10.5		3.36	Wt Mix	293	(249)	
M	58	7.7		2.13	18kg	558		8L Mix Unit
N	65	8.7		2.13	18kg	558		8L Mix Unit
O	62	7.9	85	2.51		462	220	
P	76	9.7	83	3.22		312	248	
Q	68	8.7	90	2.95		0	251	
R	63	8.4	85	2.50	11.7kg/25.8kg	480	(203)	14L Units
S	60	8.0	80	2.02		540	(145)	
T	62	8.2	80	2.4	13.5kg/24.8kg	458	(185)	15L Units
U	55	7.35	60	1.95		519	(119)	
V	65	8.5	79	(2.28)		474	(168)	
W	65	8.7	76	2.3	Vol Mix	525	(155)	
X	58	7.7	(85)	2.62	Vol Mix	470	(266)	
(...) – Indicates calculated from data given		0 – VOC corresponds to water based alkali silicates						

Table 3: Summary of extracted data sheet information on zinc silicates

to tungsten, which is of sufficiently high S.G. not to float.

Alternative methods have been described, for example in OCCA Monograph No. 4, which utilise a Profilometer to determine thickness.

Both of these methods give sensible values for volume solids, which relate well to practice.

It may be questioned as to the real relevance of this volume solids determination. Basically, it gives a measure of how much zinc the purchaser is obtaining on each square metre of surface, which is presumably why they are buying a relatively expensive primer in the first place – i.e. in the belief that the presence of the correct level of zinc is the key to obtaining long term corrosion protection.

It is interesting to note that a minority of companies actually give this weight of zinc per unit area as part of their standard data sheet information, and if this was given as a standard it would take much confusion out of the comparison of these coatings.

These results are shown in *table 3*.

The following parameters are set for the various types of zinc ethyl silicate:-

(1) 85% Zinc Dust Products
    >60% volume solids
    >2.4 S.G.
    >200 g/m^2 zinc

(2) High Solids
    >75% volume solids
    >3.2 S.G.
    >250 g/m^2 zinc

(3) Reduced Zinc
    >60% volume solids
    2.2 S.G.
    >160 g/m^2 zinc

Perfectly good products can be formulated below these suggested parameters which will give excellent performance, but the lower level of zinc per m^2 should be reflected in the product selling price.

Walter Gordon Stewart Barnett

When I reflect on the years that I have known Walter "Galvanizing Stalwart" Barnett, my thoughts return to the days of Rietfontein General Galvanizers (RGG).

In 1969, I joined Armco (Pty) Ltd as a young works engineer and as such I was directed to examine the feasibility of constructing an in-house hot dip galvanizing plant to provide corrosion protection for the fabricated steel products produced at the company's Isando plant.

As Armco was a wholly owned American company, we were required to produce and submit detailed financial justifications and business plans for capital expenditure projects. Over the next 12 years I produced six fully detailed business plans for an in-house galvanizing plant. Each time my project was submitted to the USA head office, RGG re-negotiated prices and my "pet project" was put on hold.

In 1980, RGG's holding company, Sturrock and Robson Holdings acquired a majority shareholding in Armco (Pty) Ltd and I thought that was the end of my galvanizing project. Then to my surprise, RGG was closed in 1986 and the day following the announcement, Walter arrived in my office and announced that it was time that we built the Armco hot dip galvanizing plant.

Without doubt, it was through my professional relationship and contact with Walter that my interest in corrosion science developed and more specifically that of hot dip galvanizing. When one encounters some unusual or out of the ordinary problem relating to the corrosion of steel or the application of hot dip galvanizing, Walter will relate some past experience of "when I was a galvanizer" we had the same problem and we fixed it by….

Walter has often been referred to as Mr. Galvanizer in southern Africa. He has presented numerous papers on the subject of corrosion control, including applications of hot dip galvanizing and Duplex coatings and has received both silver and gold medals from the Corrosion Institute of Southern Africa. His contributions to the galvanizing industry has not been restricted to the Southern African region, evidenced by the 2002 "EGGA PIN" presented by the European General Galvanizers Association in recognition of his contribution to the industry. He is the first person outside of Europe to be recognised in this way.

It is well known that Walter is a dedicated advocate of corrosion control by the application of hot dip galvanizing and Duplex coatings, but he has another great interest, that of the weather patterns and rainfall statistics of southern Africa. He is passionate about forecasting weather conditions and has recorded and maintained rainfall statistics for Esssexwold over the past 35 years.

Walter's contribution to the industry has and continues to be of significant value. His vision, some 41 years ago, when he was instrumental in the establishment of the Association has produced many valuable achievements. It is comforting to know that we have him as our consultant on issues of corrosion in general, and hot dip galvanizing in particular. We salute Walter and thank him for his contributions.

Bob Wilmot

Hot dip galvanized electrical distribution tubular masts – Tsakane

The Hot Dip Galvanizers Association was asked to comment on the hot dip galvanized coating used to protect a number of Eskom electrical distribution tubular masts delivered to Tsakane, near Dunnottar.

Due to the initial inappropriate site stacking by the transporter *(see photo 1)* at the occasion of the first coating inspection, a second and final coating inspection was deemed to be necessary. The three coating reports although done over a period of just over a month have for convenience, been combined into one report.

I report as follows:

Unless specifically requested for other reasons, hot dip galvanizing is normally specified primarily for corrosion protection. For this reason, the two most important inspection criteria of hot dip galvanizing are coating thickness and coating continuity.

Coating Thickness

A number of coating thickness readings were taken on the tubular masts. Coating thickness readings on one excessively repaired mast *(see photos 6, 7 and 8)* with steel wall thickness greater than 6mm thick, ranged from 97 to 149 with a mean of 109µm.

Coating thickness readings in this instance conform to the requirements of SANS 121 (ISO 1461). This specification requires that for steel thickness equal to and greater than 6mm the mean coating thickness shall be at least 85µm.

Other masts, which were pointed out may have come from Eskom stock, these had a mean coating thickness in excess of 220µm, with a maximum of 357µm on the mast wall steel and 528µm on the base plate steel *(see photos 2 & 4)*.

Photo 1. The stacking of the masts on site. The absence of timber dunnage required to prevent inappropriate component contact, when offloading and stacking, has lead to unnecessary coating damage.

Photo 2. Coating thickness reading on the surrounding coating (357µm) adjacent to mechanical damage.

Photo 3. Coating thickness reading measuring the residual iron/zinc alloy layer (57µm) at a mechanically damaged area.

Photo 4. Coating thickness reading (528µm) on the base plate steel adjacent to mechanical damage.

Photo 5. Coating thickness reading measuring the residual iron/zinc alloy layer (8µm) at the mechanically damaged area on the base plate.

The steel used for some of these masts is extremely reactive to molten zinc and hence the coating is ordinately thick, making it quite brittle to rough handling. Most mast manufacturers however, are now making use of appropriate steel for the manufacture of their masts.

As life of a zinc coating, is more or less proportional to its thickness in a given environment, the thicker coating will provide a substantially longer life than a thinner coating.

However, although the specification does not limit the coating thickness, excessively thick coatings can be brittle and more susceptible to mechanical damage, particularly if incorrectly handled, transported and stacked on site *(see photos 16, 17, 18 & 19)*.

– Coating repair has been carried out using zinc metal spraying, which is in accordance with the specification requirements. The specification requires that all bare spots be repaired and in accordance with the repair procedure, coating

Photos 6, 7 and 8 (left to right). Taken of one particular mast where it is felt that excessive coating repairs have been undertaken.

Photos 9, 10 and 11 (left to right). Mechanically damaged coatings due to inappropriate transportation, handling and stacking.

repairs must overlap the damaged area by at least 25mm beyond the damage. When using zinc metal spraying for repairing the coating, the fan area often exceeds this requirement, providing the impression that an excessive amount of repair has been undertaken. The specification limits coating repair to about 0.5% of the surface area, which in this instance may be acceptable in terms of the specification.

Coating Continuity

Except for a number of mechanically damaged areas as a result of inappropriate handling and transportation *(see photos 9, 10 & 11)*, the coating is relatively continuous and acceptable in terms of the specification. At the damaged areas, the residual coating thickness measured between 8 to 57µm *(see photos 3 & 5)*. Residual iron/zinc alloy coatings such as these are to be expected when certain silicon-killed steels are hot dip galvanized. A certain quantity of silicon is necessary to deoxidise the molten steel at the steel manufacturing stage to prevent laminations and slivers in the steel and certain quantities of silicon can lead to a heavier than usual coating thickness.

Even though the hot dip galvanized coating is reasonably abrasion resistant, a thick coating may be more susceptible to mechanical damage. When mechanical damage of the coating takes place, normally the first two outer layers of pure zinc and the outer iron/zinc alloy layer is damaged, leaving a coating of between 25 to 40µm of Fe/Zn alloy. As the iron/zinc alloy layers contain between 6 to 28% iron, a discolouration at the surface can often be detected, providing the impression that no coating exists, when clearly there is a coating.

In terms of the specification requirements, all damaged areas should be repaired. Although coating repair of small damaged areas is unnecessary (<5mm^2) in terms of the sacrificial protection mechanism provided by the surrounding zinc coating, not repairing areas greater than this will make the surrounding coating work hard to protect the uncoated area and in this instance, coating repairs are recommended. Several coating repairs by zinc metal spraying by the galvanizer to the required coating thickness, have taken place *(see photos 12 & 13)*.

Conclusion and recommendation **(Report No. 1)**

Due to inappropriate stacking at site all masts were not accessible for close coating inspection. It is recommended that the tubular masts be uplifted and transported to their various locations and then further inspected for damage.

Should the damaged areas fall within that allowable by the specification (less than 10cm^2 and in total less than 0.5% of surface area), and is acceptable to the client, appropriate coating repair must be carried out.

All damaged areas should be repaired in compliance with the specification. In terms of the specification, coating repairs by the galvanizer are allowable up to 0.5% of the total surface area and judging by the over sprayed area on one particular mast, where zinc metal spraying has been used, it would appear that coating repair may be in compliance with SANS 121. This should be discussed with the client for acceptance.


Photos 12 (left) and 13 (right). Abrading of the hot dip galvanized surface prior to zinc metal spraying is of major importance to ensure adhesion of the zinc metal sprayed coating. Furthermore, it is important that excess zinc metal spraying, that adheres to non-prepared surfaces be removed by stainless steel wire brushes, prior to delivery by the galvanizer.


Photos 14 (left) and 15 (right) – scuff marks on the sides of some of the masts.

Mast number	Reactive / Normal	Mean	Max	Min	No of readings
No 1	Normal	121	234	95	21
No 2	Reactive (1)	251	301	225	22
	Normal	123	130	90	22
	Reactive (2)	322	341	304	19
No 3	Reactive	282	318	231	19
	Normal	122	149	98	21

Table 4.




Photos 16, 17 18 and 19 (clockwise from top left) show how inappropriate stacking on site, particularly when weld on gusset plates and sharp corners clash, can cause coating damage.

There were some scuffmarks on the sides of some of the masts *(see photos 14 & 15)*. These appear to have resulted following dragging off of the components from the truck. Although unsightly, the marks will not interfere with the protective properties of the coating. If aesthetically unacceptable, these marks may be removed by vigorous action of scotch brite pads and an industrial scouring powder, followed up with running rinse water.

It has been brought to our attention that the mast manufacturer has issued a "Transporters Document", wherein the requirements of transport dunnage, offloading and stacking procedures are specified. Clearly the transporter has not conformed to these requirements.

A *second coating report* was written after the masts were reasonably distributed *(see photos 20 & 21)*, **which could have been done in the first place as there is an abundance of open land.**

Coating Thickness (µm)

Coating thickness readings on several of the masts were taken. Two of the masts were manufactured from two different steels (1 and 2) *(see table 4 and also photos 22, 23 & 24)*.

Excessively thick coatings, which are prone to mechanical damage, can be eliminated to a large degree, by making use of the appropriate steel.

Coating Continuity

Exposing the masts for proper access, revealed many mechanically damaged areas *(see photos 25 - 32)* as a result of inappropriate handling, transportation and initial site stacking. The coating is otherwise relatively continuous and acceptable in terms of the specification.
In terms of the specification requirements, all damaged areas should be repaired.

Photos 20 (left) and 21 (right) show revised stacking of the masts on site. Due to the abundance of lay down areas, this was seen to be more acceptable, however, coating damage had already occurred from previous offloading and incorrect stacking.

Conclusion and recommendation (Report No. 2)

Conclusion

The hot dip galvanized coating on the masts has been excessively damaged by inappropriate and reckless handling during loading, unloading, transportation and stacking *(see photos 25 - 32)*.

The masts may be repaired by appropriate materials, providing the damaged areas fall within that allowable by the specification (less than $10cm^2$ and in total less than 0.5% of surface area). In our opinion the areas that require repair fall within these requirements, but as all surfaces could not be assessed and in terms of the specification are

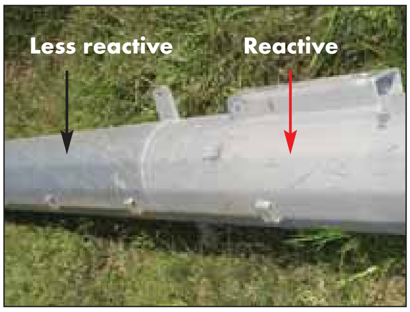
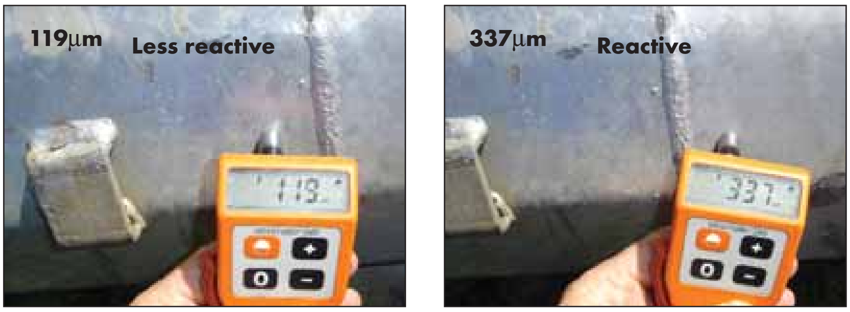


Photo 22 shows the reactive steel on the right of the mast, with the less reactive steel on the left.



Photos 23 (left) and 24 (right) indicate the difference in coating thickness readings for both the less reactive and more reactive steels, respectively.

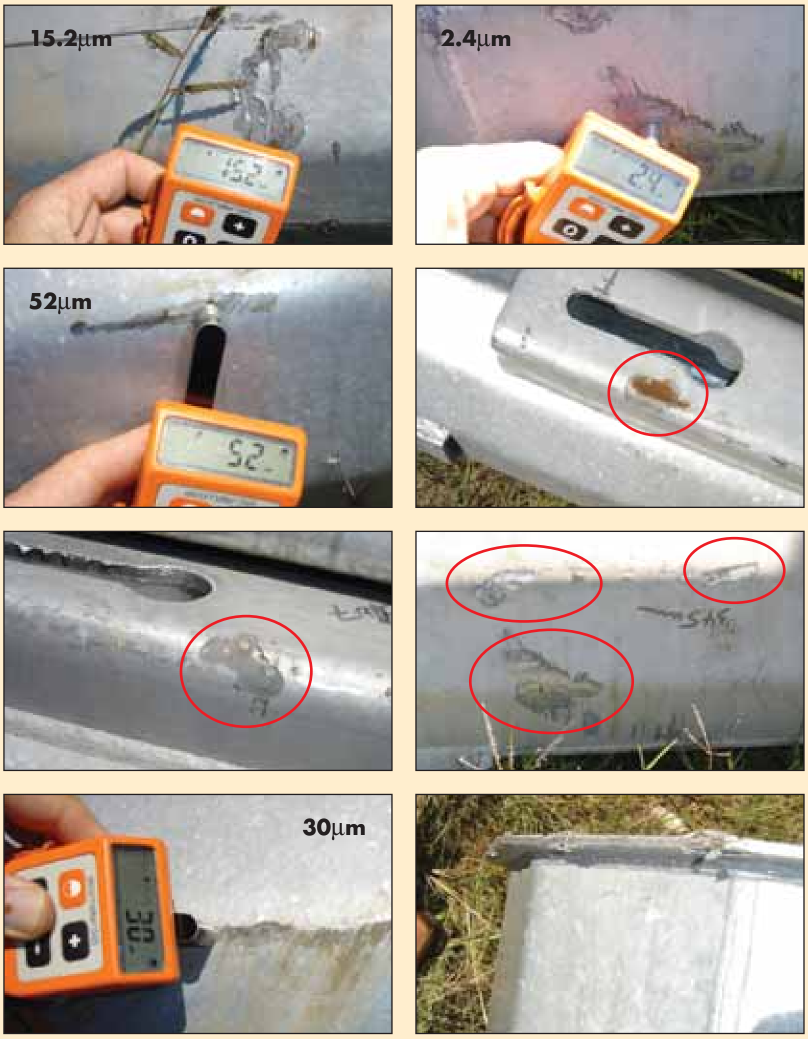
subject to interpretation perhaps these should be discussed with the client for acceptance.

Unfortunately, the negative effect this has on the client – Eskom, both for the mast manufacturer and the galvanizer, is immeasurable and in our opinion should not be taken lightly.

In order to prevent vastly different hot dip galvanized coating thicknesses on the same mast, appropriate steel should be purchased and used in the fabrication. This will prevent excessively thick coatings when immersion in the molten zinc cannot easily be reduced, due to the size of the mast.

It is further recommended that suitable lifting lugs be attached to the masts in appropriate positions, for use by all parties.

In spite of the mechanical damage that has occurred, which seems excessive, coating damage would have been far greater if the masts had been only painted.



The above photos 25 - 32 (clockwise from top left) indicate the extent of mechanical damage (where some residual iron/ zinc alloy layers remain intact) to the coating and in some instances non-damage at scuffmarks.

The coating at some of the scuffmarks *(photos 33 & 34)* was not necessarily damaged sufficiently to warrant repair.

Following the distribution of the masts on site and recommended coating repairs, a *third and final coating report* was written.

Several masts were inspected including (5) that were already erected and (6) that were on the ground. The inspection was carried out at the site *(see photos 35 - 37)*.

Photo 35. The erected masts.

Photos 36 and 37 (above) – two of the six still to be erected masts.

Coating Repairs

Most coating repairs have been carried out in accordance with our recommendations in the previous reports, however, it was noted that in the case of several of the repaired areas, the DFT of the coating (Zincfix) was less than the specification requirements, i.e. 115µm *(see photos 38 - 41)*.

The coating repair material Zincfix, is designed to have a pot life of about 25 minutes, it is therefore imperative that all damaged areas on the mast be prepared beforehand so as to minimise waste and ensure that the product is cost effective. Application should be done using a paintbrush or flexible spatula and generally when applying a single coat will result in a coating DFT of 150 to 200µm.

Thinning of the coating material using an epoxy thinners or making use of one's finger for the application clearly reduces the resultant DFT to less than that required by the specification. In terms of SANS 121 (ISO 1461) the hot dip galvanizing coating repair thickness, for steel thickness greater than 6mm must be, the specified hot dip galvanizing coating thickness (mean of 85µm) plus 30µm = 115µm.

The coating thickness for most of the repairs was in accordance with the specification *(see photos 42 and 43)*.

Finally, as mentioned in my previous reports, even though most of the coating repairs have been carried out according to our recommendations and in terms of the specification are acceptable in terms of size, the various transportation contractors should be strongly disciplined as to the long term implications in the market for both the hot dip galvanizing and the mast manufacturing industries.

Conclusion
(Report No. 3)

Apart from the need to over coat several repaired areas where the repair material has been applied insufficiently, the coating is acceptable.

In terms of performance, however, the repaired coating will not provide the same service free life that hot dip galvanizing on its own will and will require maintenance after about 8 to 10 years.

It is therefore our suggestion that the future maintenance cost be borne by the various transport contractors.

Final Overall Conclusion

(not included in the original report)

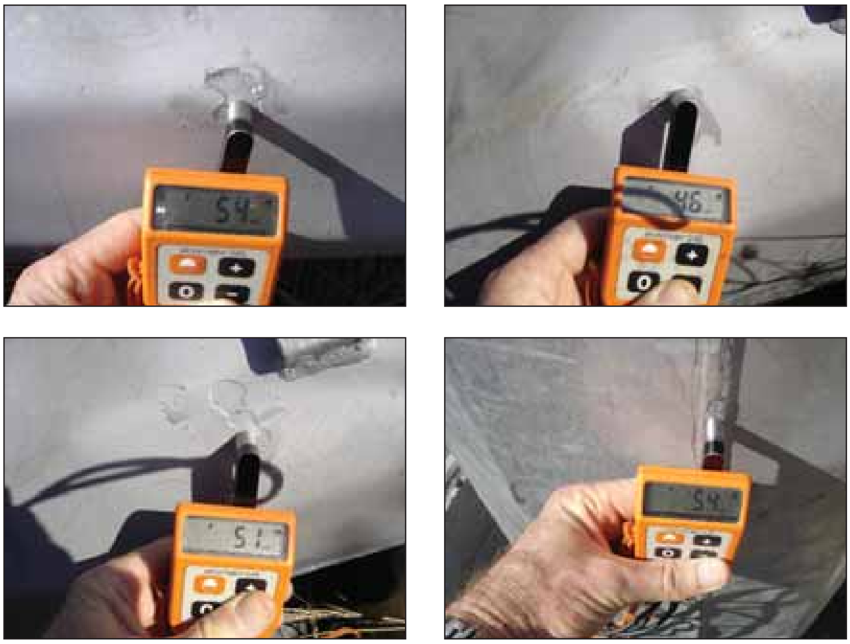
Despite the excellent abrasion resistance that the iron/zinc alloys of a hot dip galvanized coating provide, the client should insist on appropriate materials handling throughout the manoeuvring of the masts. This can be specified at the outset by referring to a specification such as HDGASA 03 –2006, introduced for this purpose and available from the Association. In this instance and in our opinion the masts were recklessly handled during loading, unloading transportation and stacking by the transporter.

The addition of suitable lifting lugs in the correct places, used by all parties, would in our opinion also result in less coating damage.

Before fabrication of the masts, appropriate steel with the correct chemical composition should be specified and will generally ensure that the hot dip galvanized coating is not excessively thick and hence brittle.

Repair of any subsequent damage should be carried out in accordance with SANS 121 using the appropriate materials. Should "Zincfix" be used, it should be applied in accordance with the manufacturer's instructions. Using ones finger to apply the coating or thinning the product by adding a chemical, is not acceptable.

The irresponsible mishandling of these masts that has largely contributed to the extensive mechanical damage of the hot dip galvanized coating *(see photo 46)*, can have major negative effects on all parties, including Eskom – the client, the mast manufacturer and finally the galvanizer and should not be taken lightly.



Photos 38 to 41 (clockwise from top left): Thinning of the coating material using an epoxy thinners or making use of one's finger for application, is not acceptable.

Photos 42 (left) and 43 (right) The coating thickness for most of the repairs was in accordance with the specification.

Photo 44. A damaged area on one of the erected masts. This should be repaired.

Photo 45 shows the paint coating that is added to this area of the masts to prevent differential aeration (necking corrosion) at the final soil/atmosphere interface. To prevent this type of corrosion in the long term, the paint coating needs to be reinstated.

Photo 46 reflects the extensive damage that had to be repaired.

MISCONCEPTIONS

Miss Conception puts it "straight"

"Miss Conception" rectifies incorrect impressions concerning hot dip galvanizing.

Hot dip galvanized structures buried or partially buried in soil such as cellular masts, electricity pylons and street lighting poles will lead to toxic levels of zinc leaching out and into the surrounding earth over a period of time.

True or false?

This statement is based on misguided theory, which is tantamount to smear mongering by a few misinformed environmentalists.

It is entirely correct to say that a hot dip galvanized coating will react with corrosion inducing substances and moisture, present in soil, over a period of time, zinc oxide and zinc hydroxide compounds so formed could well be leached into the surrounding soil. The quantity of zinc present in the soil will in any case be extremely small while it could result in the more prolific growth of surrounding surface grass since traces of the metal are nutritional and are essential for healthy growth and continued existence of both plant and animal life. In the case of humans, the daily intake of 15mg of zinc is considered to be essential. If a healthy diet is adhered to, supplementary zinc intake is normally unnecessary since most foodstuffs contain traces of zinc.

In contrast, some agricultural soils are deficient in zinc with the result that zinc in the form of zinc sulphate is required as an essential ingredient in fertiliser for these soils. To illustrate, the zinc deficiency in soil is corrected by way of zinc additives in fertiliser required for the prolific maize growing district between Ventersdorp and Lichtenberg.

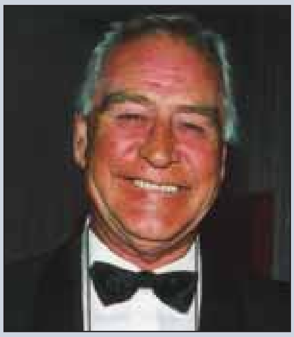
The misconceptions regarding the potential toxicity of zinc are no doubt brought about by its correct identification as a heavy metal. This term has developed an unfortunate connotation, which would seem to have become synonymous with the word toxic. Some so-called heavy metals such as lead and cadmium do indeed possess harmful properties but this is not necessarily the case with all metals. To illustrate, excess zinc that, for whatever reason may be present in the body is rapidly excreted until a healthy balance is reached. In contrast, absorbed lead is not excreted with the result that a build up of retained lead in the system eventually leads to so called lead poisoning.

To be entirely objective, it is necessary to determine whether other elements that could have an environmentally harmful impact, may be present in a hot dip galvanized coating. Traces of cadmium are present in zinc used for hot dip galvanizing but the quantity of cadmium present within the deposited coating is so low that any harmful effect is not possible. Aluminium is present in galvanized coatings with a concentration up to about 0.2% in continuously hot dip galvanized sheet. Aluminium has no unfriendly environmental impact and in any case, it is one of the most common elements present in virtually all the soils in the earth's surface.

As far as lead is concerned, it is necessary to consider that lead is added to the molten zinc in the general galvanizing industry for several essential technical reasons. Not all are associated with the final quality of the applied coating and lead is incapable of forming an alloy with either iron or zinc. However, in the molten zinc present in a galvanizing bath used for general hot dip galvanizing purposes, the lead present in the zinc will be at the saturation level of between about 1.2 and 1.4%, depending on the zinc temperature. This does not apply to the continuously hot dip galvanized sheet or wire processes where lead is not considered to be an essential additive to the zinc.

In the deposited zinc coating, lead is totally absent in the Fe/Zn phases while the surface zinc layer may contain only a trace (<0,01%) lead. At these low lead levels, a hot dip galvanized coating will not remotely have any adverse impact on the environment or for that matter constitute a threat to the well being of humans and other animal life. Any assumptions to the contrary are motivated by a misconception of scientific facts as well as perhaps a degree of sensationalism by misinformed parties who, to give them credit, could well have sincere motives.

A well-known hot dip galvanizer reluctantly decides to call it a day!!!!



Some forty-five years ago, Bill Garvie was introduced to hot dip galvanizing when he was employed as a production supervisor in a plant, which specialised at the time in galvanizing and centrifuging small components including threaded articles.

After twelve months of shift work, it became apparent that his control of quality standards and efficient levels of production were exemplary, hence, he was promoted to the position of Production Manager. This was followed in time by transfer to larger general hot dip galvanizing operations, which specialised in galvanizing structural components and where Bill eventually rose to the position of Works Director.

Eventually Bill's entrepreneurial nature took control and he formed the well-known general galvanizing company Galvadip that is situated east of Pretoria in Silverton. The undoubted success of Galvadip throughout the years can be attributed to the consistently high standards of service and quality for which the company has developed a reputation.

There is no doubt that the standard of workmanship set by Galvadip is an exemplary target at which all galvanizers would do well to aim. While the prime objective of the hot dip galvanizing process is to provide corrosion control, aesthetic appearance and a pleasing surface finish are of considerable importance when it comes to developing a market. By providing both these aspects, Bill has made a significant contribution towards the growth in demand for hot dip galvanizing throughout the years.

No doubt reluctantly in some respects, Bill has handed the company over to the well-trained team that has worked harmoniously with him for many years.

In acknowledging the significant role that Bill Garvie has played and his valuable contribution to the industry, it has been unanimously agreed to award him Honorary Life Membership of Hot Dip Galvanizers Association Southern Africa.

We wish him good health and tranquillity during his retirement years.

Guest Writer

Bob Andrew, our guest writer, is a consulting value engineer and Honorary Life Member of this Association.

Like light, people and companies can be different things at the same time

One of the strangest ideas of quantum physics is the 'wave-particle duality' of light. Photons, which make up light, exist as particles and waves at the same time. They are both particles and waves.

The characteristics of waves and particles are necessary for a full description of what light is. As observers, however, we cannot measure this duality, we cannot see what light is really like. If we treat photons as particles, we can determine their exact position but not their energy. If we treat them like waves, we can determine their energy but not their position. They are indeterminate and become only what we measure them to be.

In the quantum world, both descriptions of light are equally valid and complementary. Neither description is complete in itself. There are circumstances where it is more appropriate to talk of light as particles and circumstances where it is better to think of waves. This schizophrenic personality of light is called 'complementarity'.

The 'both/and' character of light is far removed from our mechanistic and deterministic world, which has an 'either/or' nature about it. In our world, we think of objects as definite things, which we can accurately measure. While the environment might change them, they do not change internally- they do not become something else; they remain what we see them as.

Quantum theory means uncertainty. We can never be sure what we are measuring since the act of measurement affects the thing being measured. The more accurate the measurement, the more the item is affected. The measurement defines the thing being measured. The measurer influences the measurement.

New Age philosophers, like Danah Zohar and Ian Marshall (The Quantum Society) have begun to realise that people may also possess complementarity. They can have more than one characteristic: they can be both one thing and another at the same time; it depends on what we measure them as. We cannot, however, measure them completely; we cannot fully describe them. Whatever we describe people as there will always be some indeterminacy about the person-something we can never describe. The way we measure people will define the characteristic we are measuring.

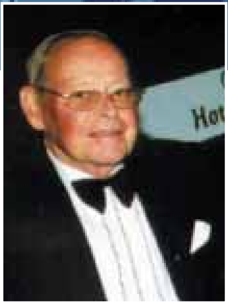
In quantum theory terms, there is no point in judging people by measuring their intrinsic properties, such as IQ, dexterity, literary comprehension, etc. These measurements will always be incomplete. People should rather be measured by their behaviour in given circumstances. When they are judged on their behaviour alone, the quantum uncertainty of their personality disappears for that set of conditions we place them in.

Quantum theory also suggests that two people can have different views of the same matter and yet be equally right. It is therefore illogical to judge people on their views. The people doing the judging will influence the views.

Alfred Korzybski, as long ago as 1933, (Science and Sanity) recognised that viewing people in quantum theory terms required a new language, which he called 'English-Prime' or 'E-Prime'. In E-Prime, the word 'is' is removed. Instead of saying: "John is lazy", in E-Prime we would say: "John appears to be lazy in the office today". "John is a racist" would become "John has some racist ideas which I find offensive" and so forth. One can never be sure exactly what a person is really like and our language should reflect this.

Quantum theory can destroy the myth that a company has to be one thing or another. Many companies brutalise themselves by sticking to the seemingly rational policy that they can't be two things at the same time. Stability or progress, conservative fiscal policies or entrepeneurship, home-grown managers or imported skills is the dilemma that many companies face. In the quantum world, companies do not have to wrestle with these paradoxes; they do not have to worry about being 'either/or', they think along 'both/and' lines. They seek opportunities in both directions.

The classical ideal of a secure deterministic world, waiting out there to be analysed and exploited, does not fit into quantum theory. Instead, we must regard ourselves as inalienable participants in an indeterminate world.



Walter's Corner

How does hot dip galvanizing perform in immersed conditions?

Have you ever stopped to consider the remarkable properties of water? Without it, there would be no life in any form, whether plant, animal or human. It appears in nature as a solid, liquid or vapor within a fairly modest temperature range. It conveys life sustaining substances and nutrients essential for life in every form. It possesses interesting features for example; it cannot be compressed while in the form of steam, it generates extreme levels of energy, capable for example of wiping out an entire island, witness Krakatoa in the Pacific Ocean.

And yet this precious substance is merely made up of two atoms of hydrogen combined with one of oxygen.

As far as we know, the Romans were the first to develop the concept of piping in order to convey water. Their choice of lead as a piping material was unfortunate, leading to widespread lead poisoning, which some have speculated was the main cause of the demise of the Roman Empire.

With the multiplicity of uses and the essential need for water, adequate storage and conveyance facilities are of paramount importance. Plainly, corrosion and the costly damage that it can cause, demands in-depth investigations with a view to the selection of the most appropriate materials of construction which will frequently vary from one project to another.

The corrosive effects of water can vary from moderate to extremely severe depending on numerous factors such as pH levels, temperature and the degree of corrosion inducing impurities present in the water.

Corrosion control is achieved either by the use of materials which resist specific forms of corrosion or alternatively by barrier protection provided in the form of a coating.

Zinc in the form of hot dip galvanizing is no doubt the most frequently used metal coating which prompts the question how effective is it for long term corrosion control in water? The answer can vary from excellent, moderately good to poor or unsatisfactory. Corrosion rates are established by analyzing the water to determine the presence and to what extent of corrosive substances such as chlorides and sulphates. The pH level and hardness properties of water also play a significant role.

When considering zinc, it is important to appreciate that, unlike iron, it is an amphoteric metal, i.e. it corrodes both at low pH levels (<5.5) and again at pH levels of 12.5 and above. Aluminium is also amphoteric but the more corrosive range for this metal is from pH 3.5 downwards and from pH 8.5 upwards.

The scale forming properties of water can influence the corrosion rate significantly with calcium carbonate deposits providing a degree of natural barrier protection in the harder waters as opposed to soft water where the rate of corrosion is frequently inclined to be higher regardless of chemical analysis.

The Langellier and Ryzner indices have been developed to determine the hardness levels of water. It is important to appreciate that these formulae merely provide the scale forming properties of water and not its corrosive nature. The municipal water supplied by the Rand Water Board is scale forming and hence on the hard side as any man who shaves in the conventional manner will confirm. There are many documented examples of the excellent performance of hot dip galvanized steel in contact with this water.

At the Old Fort in Hillbrow, there is a hot dip galvanized Braithwaite pressed steel water storage tank, which was installed some seventy six years ago during my year of birth. A recent inspection has shown that the original hot dip galvanized coating continues to provide protection to the underlying steel. My residence in Bedfordview which is some fifty years old is fitted out entirely with hot dip galvanized piping, including the hot water system. To date, no leaks have occurred in this entire galvanized system.

Of course, the situation is different in areas such as East London, Durban and Cape Town where municipal water is substantially softer with the result that the life of hot dip galvanized coatings in certain applications may be somewhat reduced.

In the mining industry, subterranean water is frequently encountered where the chloride content is high. In some applications natural mine water is recycled with a consequential build up of chloride levels resulting in a highly aggressive situation towards zinc. This is largely controlled by regular bleed off and replenishment with fresh water.

Here now are some interesting lesser known behavioral facts concerning zinc in contact with water:

- An 80µm thick hot dip galvanized coating totally immersed in sea water will yield a rust free life of about 10 years while the same coating suspended in the spray zone is unlikely to provide 2 years life. This is because magnesium chloride in sea water has an inhibiting effect on the corrosive nature of sodium chloride. The level of magnesium chloride in sea water will vary from one site to another affecting the corrosion rate of the coating.
- At elevated temperatures of 65°C and above, there is a potential reversal which may result in a hot dip galvanized coating becoming electro positive to exposed steel which would then constitute the anode in a corrosion cell. At the same time, the protective surface film of zinc carbonate becomes gelatinous and more permeable at elevated temperatures. On the other hand, if water temperatures are controlled at a maximum of 55°C or at the most 60°C which is generally more than adequate, these problems will not be encountered.
- High water flow rates can have an erosive effect on a hot dip galvanized coating thus removing the protective surface film present on the coating. This applies particularly where the suspended solids level of water is high. As a rule of thumb, it is recommended that flow rates in hot dip galvanized pipelines should not exceed 3.0 metres per second.
- Finally, water should never be allowed to remain stagnant in a hot dip galvanized system or any other system for any length of time. Depletion of oxygen leads to the development of the anaerobic type sulphate reducing bacteria. The presence of this organism can lead to severe metal corrosion within a relatively short period of time. If water is not to be circulated regularly in a system, the solution is to drain away during periods when the unit is out of service.

HOT DIP GALVANIZING MEMBERS

GALVANIZER	LOCATION	TEL. NO	SPIN	NO. OF LINES	BATH SIZES (L x W x D) (m)
GAUTENG					
Armco Galvanizers	Isando	011 974-8511		1	13.2 m x 1.5m x 2.0m
Armco Galvanizers – Dunswart	Dunswart	011 914-3512	●	3	5.2m x 1.2m x 2.0m 3.0m x 1.0m x 1.5m 2.0m x 1.0m x 1.5m
Babcock Nthuthuko Powerlines (Pty) Ltd	Nigel	011 739-8200		1	12.0m x 1.4m x 1.8m
Barloworld Galvanizers (Pty) Ltd	Germiston	011 876-2900		2	14m x 1.35m x 2.5m 10.0m x 2.0m x 4.0m
				Tube	Dia 42mm to 114mm max tube length 6.7m
Barloworld Robor Tube	Elandsfontein	011 971-1600		1	Pipe plant
Cape Gate (Pty) Ltd	Vanderbijlpark	016 980-2270		#	Wire galvanizer
DB Thermal SA (Pty) Ltd	Nigel	011 814-6460		#	In-line galvanizer
Galvadip (Pty) Ltd	Waltloo	012 803-5168		1	7.2m x 1.5m x 1.8m
Galvrite Galvanising (Pty) Ltd	Randfontein	011 693-5825		1	6.0m x 1.0m x 1.8m
GEA Air Cooled Systems	Germiston	011 861-1571		#	In-line galvanizer
Lianru Galvanisers cc	Nigel	011 814-8658		2	7.2m x 1.3m x 1.6m 1.95m x 0.83m x 1.2m
Mittal Steel SA	Vereeniging	016 889-8816		#	Sheet galvanizer
Macsteel Tube & Pipe	Boksburg	011 897-2194		In-line	13.5m x 1.6m x 2.4m
Pro-Tech Galvanizers (Pty) Ltd	Nigel	011-814-4292	●	2	3.0m x 1.1m x 1.2m 3.2m x 1.1m x 1.5m
Supergalv	Alrode	011-908-3411		1	6.0m x 1.2m x 1.8m
MPUMALANGA					
Chevron Engineering (Pty) Ltd	Barberton	013 712-3131		1	Dia 0.7 x 1.2d
NORTH WEST					
Andrag Agrico	Lichtenburg	018 632-7260		#	In-line galvanizer
WESTERN CAPE					
Advanced Galvanising Corp.	Bellville	021 951-6242		1	8.0m x 1.5m x 3.0m
Cape Galvanising (Pty) Ltd	Parowvalley	021 931-7224		1	14.0m x 1.6m x 2.6m
Galvatech (Pty) Ltd	Bellville	021 951-1211		1	7.5m x 1.5m x 2.6m
Helderberg Galvanizing	Strand	021 845-4500		1	5.5m x 0.8m x 2.4m
South Cape Galvanizing (Pty) Ltd	George Industria	044 884-0882		1	5.5m x 1.0m x 2.6m
Zincgrip Galvanizers & Coatings	Stikland	021 949-7630		1	4.5m x 1.0m x 2.5m
EASTERN CAPE					
Butterworth Metal Industries	Butterworth	047 401-3600		1	1.2m x 0.6m x 0.8m
Galvanising Techniques cc	Port Elizabeth	041 486-1432		1	12.4m x 1.4m x 2.6m
Galvaspin (Pty) Ltd	Port Elizabeth	041 451-1947	●	1	1.8m x 1.2m x 1.4m
Morhot (Pty) Ltd	East London	043 763-1143		1	6.0m x 1.2m x 2.5m
KWAZULU/NATAL					
A&A Galvanisers	Pietermaritzburg	033 387-5783	●	1	3.3m x 0.95m x 1.9m
Bay Galvanisers	Richards Bay	035 751-1942		1	5.0m x 1.2m x 2.5m
Phoenix Galvanizing (Pty) Ltd	Phoenix	031 500-1607	●	3	14.0m x 1.4m x 2.5m 7.0m x 1.2m x 3m
			●		2.5m x 0.9m x 1.2m
Voigt & Willecke (Pty) Ltd	Durban	031 902-2248		1	9.0m x 1.2m x 2.5m
ZIMBABWE					
Tube & Pipe Industries Ltd	Harare	092634-611721		1	7.0m x 1.2m x 1.2m

The bath dimensions provided in this schedule are actual dimensions. Please check with your galvanizer the actual component size that can be accomodated, either in a single dip or by double end dipping.

 # Sheet, Wire, Tube and In-line galvanizing members dedicate their plants to the galvanizing of their own products.

For specific contact names (eg. sales or production personnel) and mobile telephone numbers, kindly contact the company receptionist.