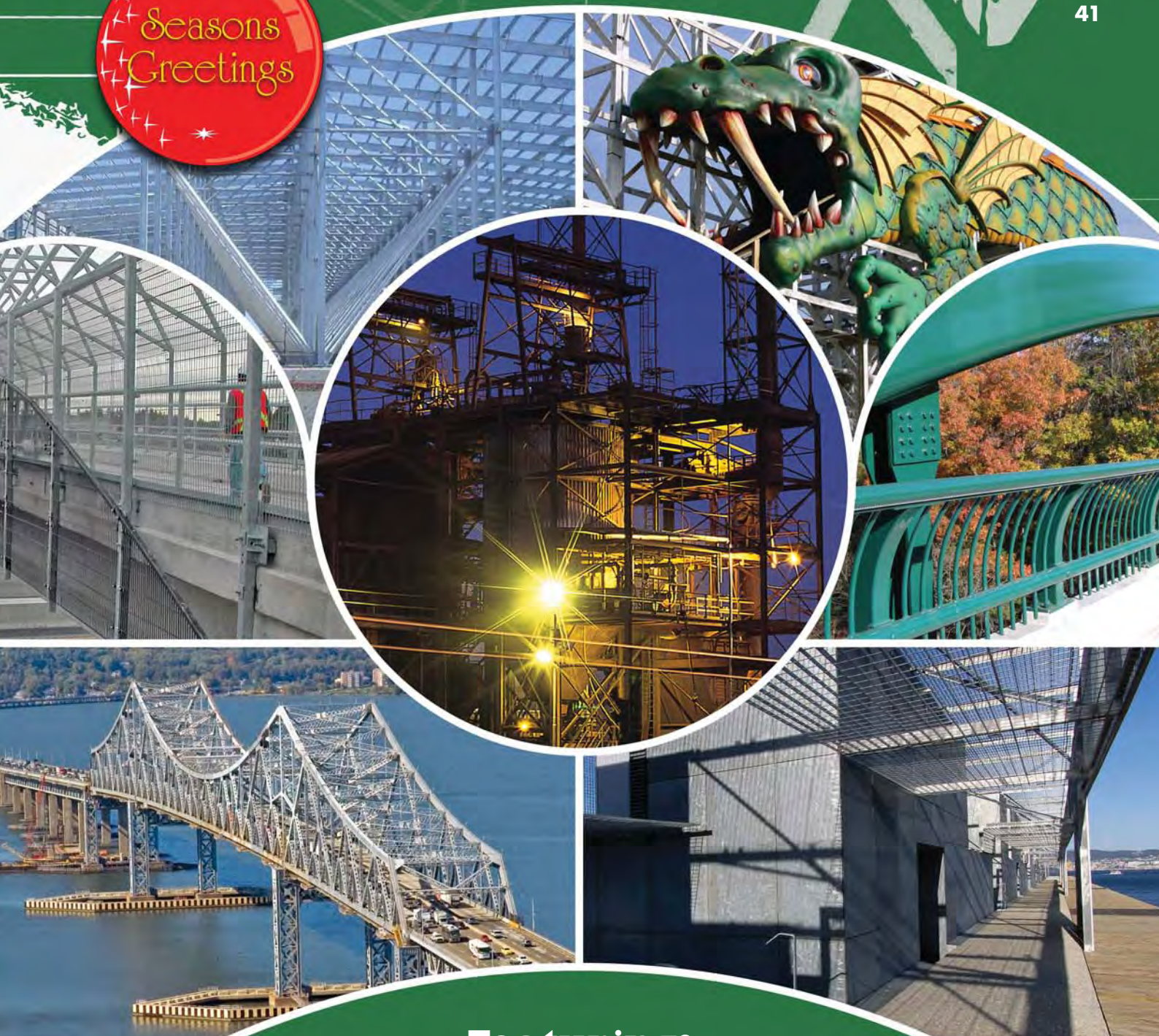
HOT DIP
GALVANIZING TODAY
2009 Volume 6 Issue 4
HOT DIP GALVANIZERS ASSOCIATION Southern Africa
41

Seasons Greetings



Featuring:

The world of hot dip galvanizing around us, including Europe, USA and Australia

'Greening' of the hot dip galvanizing industry!

Guest Writer – 'Utilising ISO Standards and best engineering practices in order to ensure long term cost effective corrosion control'

'On the Couch'

ZINC

steel
SOUTHERN AFRICAN INSTITUTE OF STEEL CONSTRUCTION

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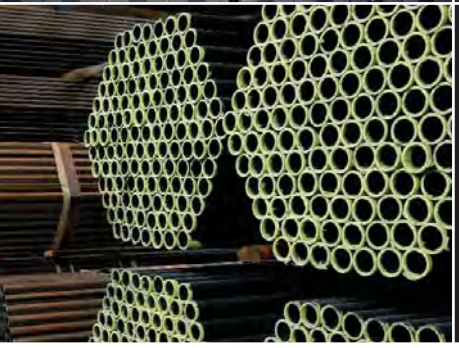

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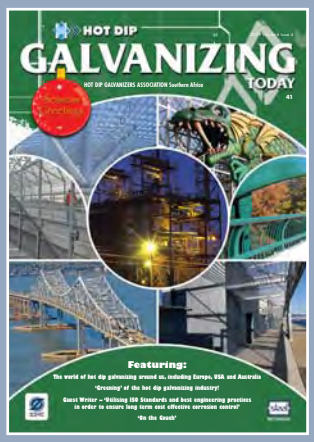

The Association is a technical information centre established for the benefit of specifiers, consultants, end users and its members

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Front Cover: *A kaleidoscope of photographs showing some really interesting projects and our local acid regeneration plant from our two features.*

Hot Dip Galvanizing – Adding value to Steel

Executive Director's Comment

As we approach the end of another year, we reflect on activities of the past 12 months. Apart from our normal annual events, such as our awards evening, golf day, quarterly Executive meetings, various technical presentations; the one significant activity we experienced was a continued requirement for our two days Inspectors Course. Over the period of the past 12 months, we have been encouraged by the positive reaction received from players within the corrosion protection industry and in particular from third party inspectors.

During most other years, we would plan for and present this course 4 or 5 times in a 12 month period. However, over the last 12 months we have presented the course on 14 different occasions with 127 people attending. Clearly this statistic highlights a need for educational training.

As one of our Association's major objectives, we strive to position ourselves to satisfy this apparent demand for training. We are, in conjunction with the International Zinc Association (IZA), in the process of finalizing a galvanizing plant operator's course. This is a computer based interactive course for plant operators. Trainees will require access to a computer and the web and who will be able to progress and learn at their own pace. Included in this course is a series of practical orientation exercises that are aimed at familiarising the candidate with an understanding of basic terminology that will be required during later training.

We are also in the process of revamping and upgrading our inspector's course with an introductory course for candidates that do not necessarily posses the technical knowledge that is required for the more intense and technically demanding upgraded inspector's course. This development is the result of our experiences gained while presenting our current course. We find that candidates have too wide a range of educational standards resulting in exceptional high marks and an unacceptable failure rate. We believe that we need to accommodate people that lack the technical knowledge required for what after all is a technically demanding two day course.

Bob Wilmot

Note from the Editor

Corrosion protection will always be achieved if suitably cleaned, correctly designed and ventilated steel is dipped into molten zinc. However, for optimum coating quality, in terms of an extra-ordinary hot dip galvanized finish, it is important to stress to specifiers making use of SANS 121 (ISO 1461), that certain vital information is required to be declared by the purchaser in terms of Annex A of the specification, before finalising a contract with the galvanizer. These include:

- The composition (Si & P) and any properties of the basis metal that may affect hdg;
- An identification of 'significant surfaces', by either drawings or suitably marked samples;
- A drawing or other means of identifying where surface unevenness will make the coated item unacceptable for its intended purpose;
- A sample showing the required finish;
- Special pre-treatments, such as the application of a mask for local exclusion of the coating;
- Any special coating thickness (within the constraints of achieving this!);
- Any after treatments, such as if it is to be painted. Should this be included, the galvanizer must advise the purchaser of the method used for coating repair, if repair is found to be necessary;
- Any inspection arrangements;
- Whether a certificate of conformance is required in terms of SANS 121.

Up front communication with the galvanizer is encouraged particularly when these extraordinary finishes such as 'architectural hot dip galvanizing' is required.

An extra-ordinary finish is simply not achieved by a flick of a switch on the side of the bath from 'general' to 'architectural galvanizing'!

At the Association we pride ourselves in providing cost effective advice in the use of our coatings and are always happy to be involved in the evaluation and inspection of previously exposed and weathered hot dip galvanized or duplex coated components.

Should a reader require this evaluation and inspection service, kindly contact Bob, Hendrik or myself.

Our **feature** for this issue includes the **'World of hot dip galvanizing around us'** with the European General Galvanizers Association awards winner and three highly commended entries, many interesting projects from the USA and one from Australia.

Our second **feature** includes **'Greening of the hot dip galvanizing industry'**.

Education and Training, expands on our certificated coating inspectors course, an essential requirement in any coating inspectors portfolio. The final part of what's important when taking coating thickness readings is also included.

Guest Writer, Gerald Haynes of CTC chats about **'Utilising ISO standards and best engineering practices in order to ensure long term cost effective corrosion control'**, prior to compiling a new project specification.

'On the Couch' includes an interview with one of the woman in the industry, Heike van den Eijde, MD of Galvadip.

Should a reader wish to express an opinion or provide us with an article, or comment on our articles, positively or negatively, kindly contact me.

We take this opportunity to thank readers, advertisers and members for their ongoing support throughout the year in spite of difficult times and wish them a safe, happy and prosperous festive season and 2010!

Enjoy the 'magazinc'.

Terry Smith

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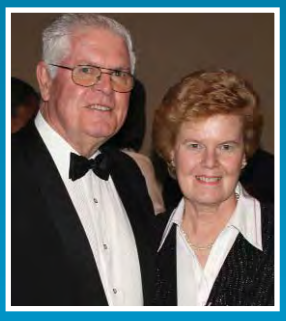
2009 HOT DIP GALVANIZING AWARDS EVENING

Photos taken at the 2009 Annual Hot Dip Galvanizing Awards Evening showing some of the Awards recipients, some members and a number of our esteemed guests.




Welcome to the
2009 HOT DIP
GALVANIZ
Awards

The European Galvanizing Awards

Winning entry

Fisherman's Wharf Warehouses, Cangas Harbour, Pontevedra, Spain

An exciting architectural project, Fishermans' Wharf Warehouses, Cangas Harbour, Pontevedra, Spain by architects Irissari and Piñera is the winner of the newly launched European Galvanizing Awards.

The award ceremony took place at the Intergalva 2009 conference in Madrid, attended by an international audience of industry executives and researchers. It was organised by the European General Galvanizers Association.

Entries were evaluated for their effective and innovative use of galvanizing in architecture and civil engineering, as well as the functionality and aesthetics of the structure. Special attention was given to demonstration of the contribution of galvanizing to sustainable construction. Their approach towards galvanizing and its incorporation in the design stages was also considered important.

The warehouses were created for local fisherman and sit along on a busy, public jetty at Cangas Harbour, Pontevedra. Batch galvanizing (after fabrication) was used because of its durability in harsh marine conditions, while the transparent quality of the steel lattice grids allows views of the historic city and landscape to be preserved.

Mr Manuel Salvadores, President, EGGA said, "We are delighted to present this award to Irissari and Piñera architects. The warehouses demonstrate a sensitive use of galvanised materials in a very beautiful and at times hostile environment. We hope it will raise awareness among architects of the exciting possibilities of galvanized steel and its ecological benefits."

Accepting the award, Mrs Guadalupe Piñera of Irissari + Piñera Arquitectos said, "We are delighted. We wanted to work with galvanized steel both aesthetically because its colours harmonised with the blue, grey skies over the harbour and its very adaptable nature. We were working with a very small footprint but we were able to construct most of the units on the mainland and then bring them to the jetty."

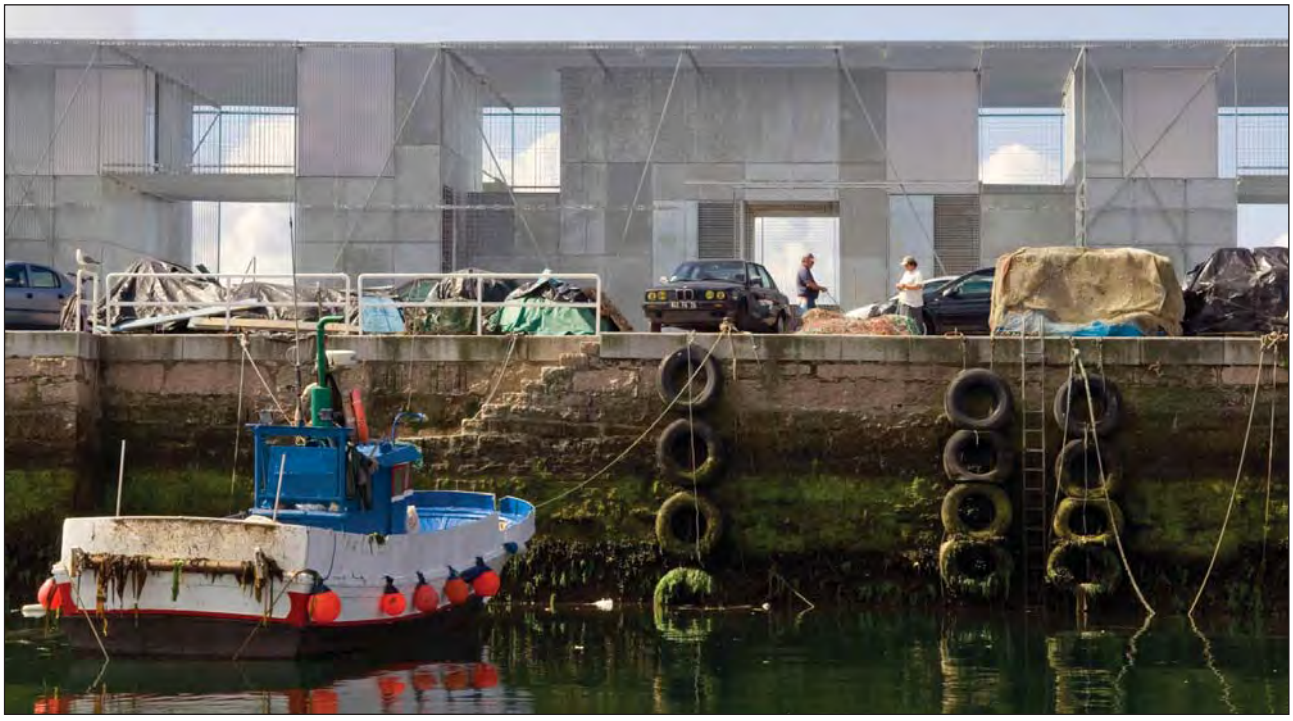
The winning project and the nine Highly Commended projects were voted for by the members of the EGGA. Architectural projects were nominated by the National Associations, many of whom organise well-established and respected national awards for the use of batch galvanizing.

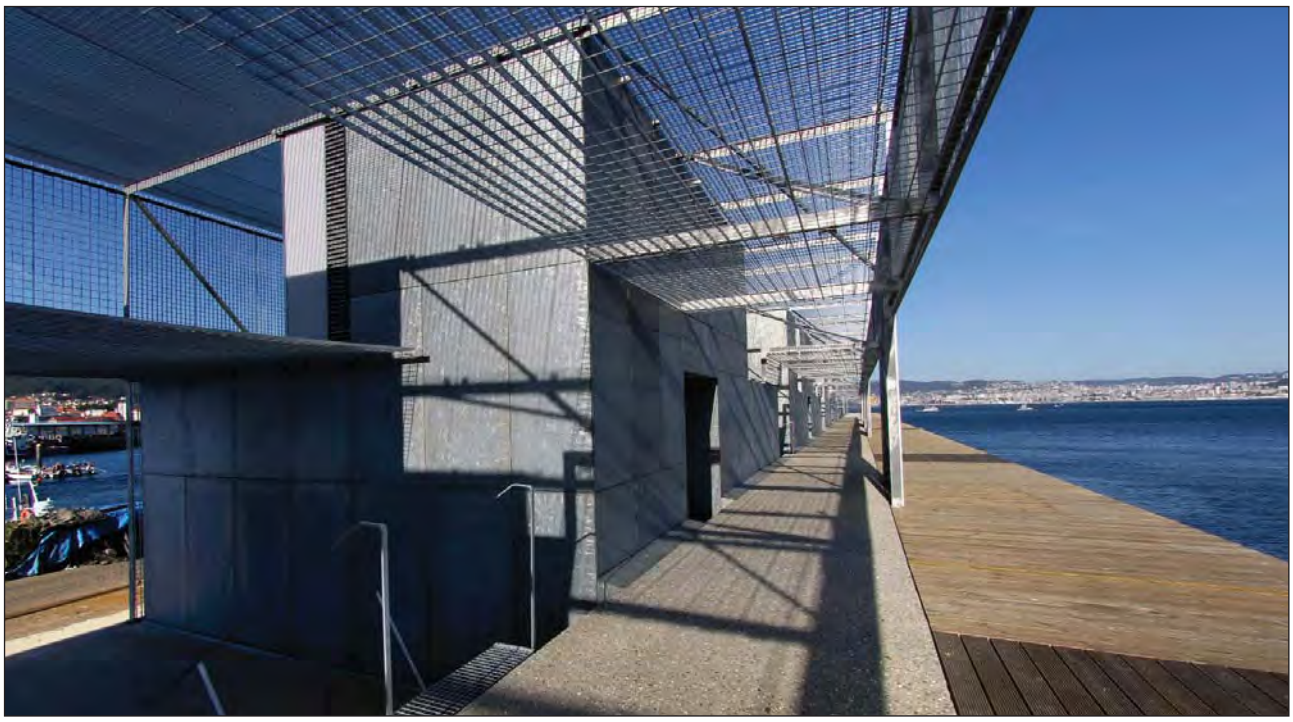
Due to space constraints, only the winning and three of the highly commended projects have been included in this feature.

Highly commended entry

Cittadella del Vino, Mezzocorona, Italy

The Cittadella del Vino in Mezzocorona, with its cellars for wine storage and bottling, offices, shop, auditorium and display space is the largest wine-making complex in Europe.





Occupying 12 hectares, its 500-meter long frontage creates a glass and aluminium embankment that runs through the Adige River Valley.

The project, devoid of any monumental rhetoric, demonstrates how it is possible to construct a large industrial complex that is in symbiosis with its surrounding landscape.

Built in three phases, at a total cost of 130,000.00 Euro, the citadel is not only a site for the production and sale of wine, but also a programme for contemporary architecture.

An industrial area, which once violated and polluted the environment, can be transformed into a site that is in harmony with the surrounding territory and landscape.

A mono-functional building for a specialised activity can become a building complex where the activities of production are joined with those of free-time, exhibits, cultural events and conferences. A new, complex urban reality.

A qualitative architectural project, capable of receiving numerous

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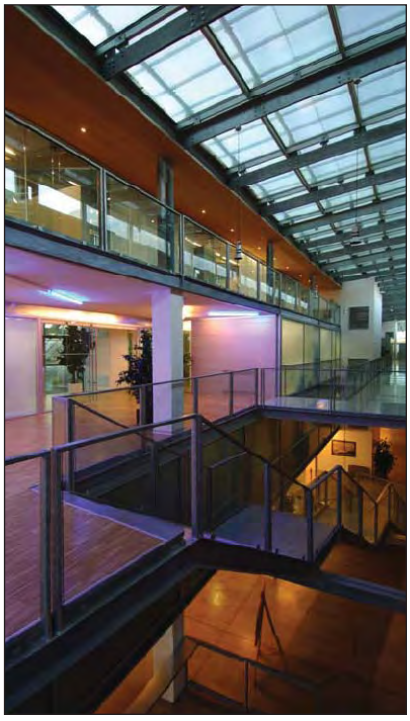

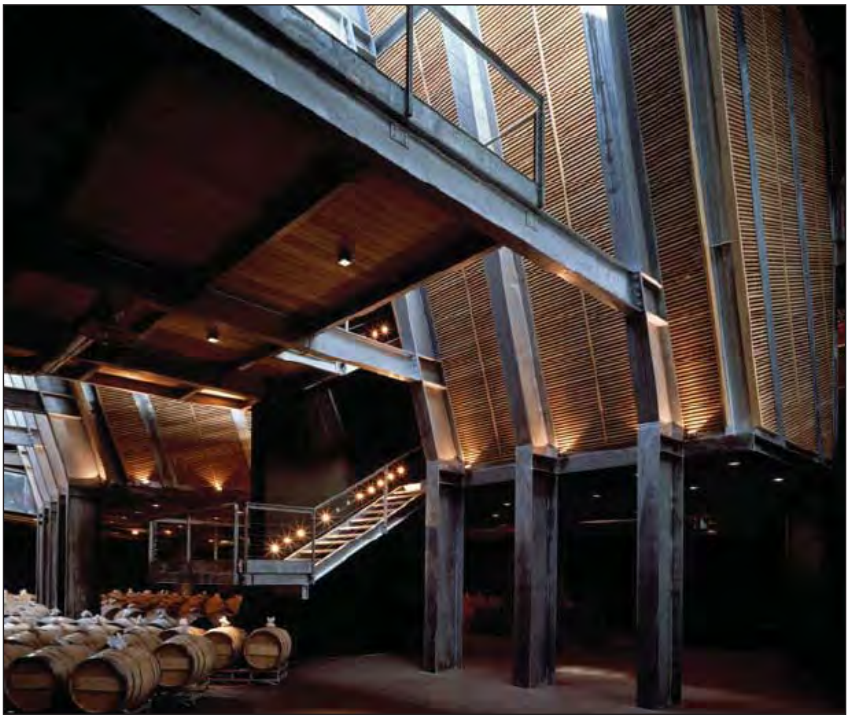

awards and mentions and being presented in international architectural exhibits can attract interest and consensus and be completed at industrial prices.

Hot dip galvanized steel has been extensively used throughout the internal and external elements of the complex.

Highly commended entry

Gare d'Orléans, Paris, France

At Orléans, the central railway station did not await the arrival of the High Speed Train to achieve its breakthrough. The original building, a construction from the sixties, set within a more recent shopping centre, has given way to an overhead concourse that faces avenue de Paris.

This metal and glass architecture that presents its profile to the town, recalls the tradition of the great railway glass domes of bygone days, no longer to contain the plumes of smoke of the locomotives, but to welcome the crowd of travellers to a pleasant place and design an urban gateway. The train and the town mingle here in all transparency, linked by the tramway. Placed alongside the existing complex, the concourse offers enlarged, clearly identified spaces, prolonged into a new link both with the adjoining shopping centre and the tram station situated in front.

More than a reconstruction of the station, the project achieves a global re-qualification of the island by establishing the interconnection and marking the north entrance to the town, creating the missing façade on the avenue. The complexity of the interwoven urban fabric, coupled with the maintenance of the activity, required a knowledgeable phasing of the work. The most visible structure of this substantial operation, the travellers' concourse, is laid out like the old station at the end of the tracks. It stands erect over a previously constructed underground car park and opens up like a tympanum over the avenue. Its surface area, which includes the old railway, is in the common ownership of the property complex the ground floor of which, formerly a public car park, is reclaimed as a pedestrian subway 55 metres long and 16 wide, below the existing building.

Its profile rises in two waves up to 17 metres high. The articulation into two parallel aisles facilitates the organisation of the interior spaces and constitutes the transition between the large scale of the site and the traditional architecture of the avenue. The first accommodates walking travellers and access to the trains, the second the small service buildings of

the SNCF (ticket offices, offices and waiting room). At 44 metres wide, this double metallic concourse, which includes a central file of posts, stretches over 73 metres in length, including the 7 metre cantilevered canopy on the avenue. The intervention in the city centre and in the occupied site required a 'dry system' construction, light and prefabricated.

The double arches in arched pipes were opened and fitted 'blank' in the workshop, before being routed from Saumur as spare parts (4 sections per arch), then assembled on site by bolting, their junctions concealed under protective tubes. The bracings are provided by radiant ends of truss, crossed in the roofing plan, which visually preserve the whole of the volume. The secondary roof trusses in openwork PRS enhance the curves of the arch, and the perforated steel vats complete the acoustic treatment. The light dispensed by lanterns acts as a complement of the glazed tympanums held by vertical stiffeners. Opening onto the platforms and with ventilated roofing, this concourse simply claims to temper the ambiance and provide beautiful lighting in all seasons. Its shape especially makes it an identifiable marker signalling the multi-modal pole in the chaotic suburban landscape.

The majority of the steel roof structure, 73 x 44m, was hot dip galvanized and painted.

Highly commended entry

Acoustic Sound-barrier and Cockpit, Highway A2, *Netherlands*

Since last year a special sound barrier has been appearing along a length of 1 500m of the A2 national motorway in the Netherlands. The 7m high barrier is situated on an embankment and has been entirely constructed from triangular glass panels, each with their own unique dimensions. The space frame structure is clearly visible through the glass. No abrupt interruptions can be seen in the seamlessly flowing surface.

"Architecture is a game which is played by its users", said architect Kas Oosterhuis during the Game, Set and Match I conference in 2001. "During the life cycle of a building and a constructed environment the game is played by its users, the visitors and by the constructed environment itself". Making use of simulations, animations and interactive CAD/CAM, the parameters are varied until the design can meet all expectations. This approach, the parametric detailing, is used for the

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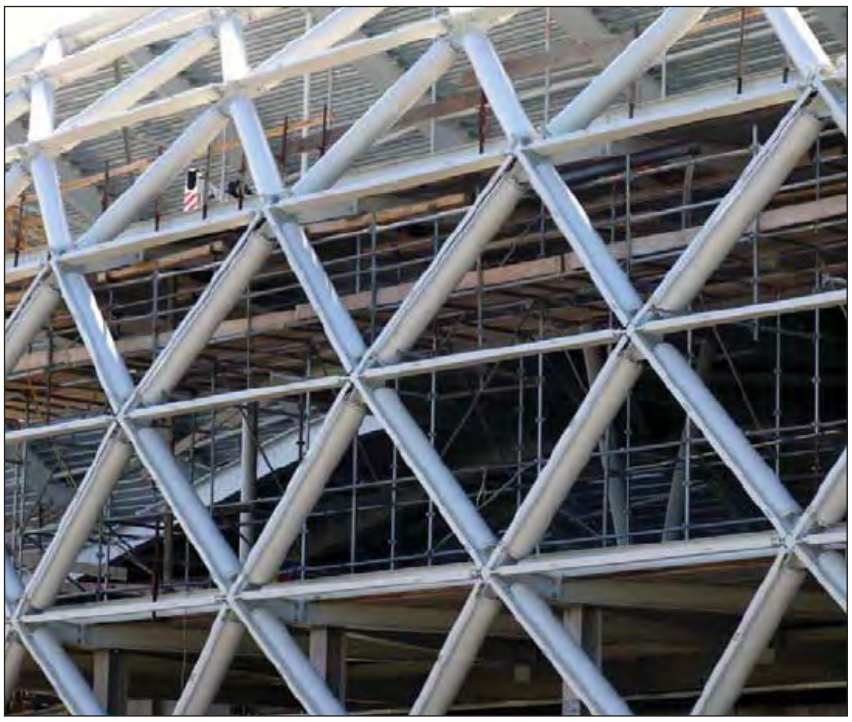

design of the sound barrier including the showroom on the west side of the A2 near Utrecht.

Showroom

The central piece of the flowing movement is a glass 'blob' which is used as the office building. This Cockpit houses a car company which brings exclusive brands such as Rolls Royce, Bentley, Lamborghini and Maserati onto the Dutch market. The Cockpit is 160m x 25m with a floor area of 5 000m^2. The showroom of the building on the motorway side is manufactured entirely from glass and is situated above the garage and workshop. The concept of the cockpit office building was inspired by the shape of the cockpit on a fighter jet.

It functions as a three-dimensional logo for the industrial site which is situated behind the sound barrier.

The most striking design principle of the showroom which is included within the sound barrier is the use of long continuous lines. No more than 3 elastic lines form the main shape of the cockpit. These lines do not have a definite start or abrupt end, the entire construction represents a distinct futuristic image. The shapes used in the barrier and the building and the proportions selected in the dimensional characteristics have resulted in a design which is related to the speed of the traffic roaring past. The construction is after all viewed from the perspective of the driver who associates the slim shapes and streamlining with speed.

Innovative

The design was recently rewarded with the prestigious Funda prize for innovation. According to the jury the Hessing Showroom and Sound Barrier are: "Beautifully designed – directly modelled using CAD/CAM – in combination with innovative technology: mass customisation. Individual production at a reasonable price. A promise for the future."

Construction

The challenge for steel manufacturer Meijers Staalbouw BV of Serooskerke was to manufacture the approximately 44 000 components, none of which were the same. The file-to-factory method has been used by this company for some time, so ultimately this did not present any huge problems. They also worked with ONL Architects in a similar way on the Delta expo Neeltje Jans en the Main Pavilion of the Floriade. The space frame structure of the sound barrier has been constructed from hot dip galvanized 80 x 80mm profiles and 82.5mm tubes in combination with various gusset plates.

Conservation

An extremely aggressive industrial climate prevails as a result of the very busy car traffic. In order to protect the new sound barrier in an effective and durable manner from corrosion, the frame structure is manufactured entirely from hot dip galvanized steel. The Cockpit office building which has been integrated into the barrier has a steel construction which has been coated. The galvanizers also played the role of stock controllers and distributors. The components were manufactured and then transported to the galvanizers by container. After galvanizing these components had to be returned and transported in exactly the same container in order to facilitate assembly at the construction site.

Project team

Design
ONL Architects, Rotterdam
Website: *http://www.oosterhuis.nl/quickstart/index.php?id=8*

Client
Projects Bureau Leidsche Rijn, Utrecht

Steel constructions
Mijers Staalbouw bv, Serooskerke

Glazing
Pilkington Benelux bv, Enschede

Engineering
ONL, Meijers Staalbouw and Pilkington Benelux

Interesting facts

Sound barrier
Length: 120m
Glass: 2 000m^2
Steel: 750 tons

Showroom
Length: 1 500m
Glass: 12 000m^2
Steel: 800 tons

The HDGASA wishes to thank staff and members of the EGGA for this contribution.

In the previous issue, we published an article on the new Steel Protection by Hot Dip Galvanizing and Duplex Coating Systems booklet and omitted to say that the publication is available in hard copy form at a nominal price from the Association as well as it can be freely downloaded from our web site.

Apologies for any inconvenience – Editor.

From the USA...

Tappan Zee Bridge

Spanning the Hudson River at one of its widest points, the Tappan Zee Bridge faces the harsh, corrosive effects of a moist river environment. The bridge's refurbishment in September 2008 included the utilization of more than 16.5 million pounds of galvanized steel fasteners, structural beams, dividers, diaphragms, and barriers.

Communication between the construction company, the Port Authority of New York, the fabricators, and the two galvanizing companies involved was imperative for successful completion of such a massive project. Beams in excess of 60 feet, averaging approximately 9 000 pounds each, required special effort to be galvanized properly.

The New York Department of Transportation (NYDOT) had not commissioned many galvanized bridges prior to this bridge rehabilitation; however, after noting the cost savings, quick turnaround, and durability of the hot dip galvanized steel, the contractor, NYDOT, and Port Authority are now looking for ways to incorporate the corrosion protection system into future projects. Now, the Tappan Zee, one of the oldest and largest bridges in New York City, will remain structurally sound and aesthetically pleasing for decades to come.

Tappan Zee Bridge.

Dragon Roller Coaster

The Dragon Roller Coaster is a famous Playland Amusement Park roller coaster in Rye, New York. The coaster has been a popular attraction for 75 years. Many people from New York City visit Playland during the summer, and because the Dragon coaster is so popular, it is important for it to last for many more years to come in the harsh environment. The amusement park is located on the shore of Long Island, so it is exposed to harsh winters and to the salt-laden air environment. Because the galvanized steel was used for the frame of the Dragon coaster, for safety reasons, no imperfections on the surface were acceptable. The structure was also required to withstand the strains of continual runs of the coaster. Hot dip galvanizing was specified because of its durability, uniform quality, and Corrosion Protection. These benefits of hot dip galvanizing will allow the Dragon coaster to handle the continued stress of the hurtling coaster and harsh environment, so the coaster can continue to be a popular attraction in the future.

Dragon Roller Coaster.

Morningside Pedestrian Bridge

Arcing for more than a half-mile over one of the busiest highways in Canada, the Morningside Pedestrian Bridge provides cyclists and pedestrians access to the Trans Canada Trail between Cambridge and Kitchener in Ontario. The arching metallic spine of the bridge reaches 25 feet at its highest point, allowing more than 50 000 motorists to pass underneath on Highway 401 each day.

Originally proposed as a nondescript, mesh enclosed cage-like structure, the plan for the bridge was decried as an eyesore by the community and local officials. Regional Councilor Jean

Haalboom pronounced the original bridge would be seen as "Ontario's largest chicken coop." After consulting with the community, a team of architects, engineers, and landscape artists was assembled to reconfigure the bridge into its current aesthetically pleasing design.

With a price tag of CAN $1.7 million, the city desired an aesthetically pleasing structure that would require little or no maintenance and last for generations of hikers, bikers, and pedestrians to enjoy. Utilizing hot dip galvanized steel for the structural elements of the bridge will protect the structure from the unsightly and potentially hazardous effects of corrosion, while the zinc coating will remain maintenance-free for decades.

Durability was especially important when considering the future of the bridge. Conestoga College, Ontario's number one ranked public college, is located directly on the west side of the Highway 401 and the Morningside Pedestrian Bridge. With plans to expand by building a second campus on the east side of the highway, more than 10 000 students are expected to regularly use the bridge. Hot dip galvanized steel will keep this architectural investment beautiful, maintenance-free, and structurally sound well into the future.

Morningside Pedestrian Bridge.

Blue Heron Pedestrian Bridge

The Blue Heron Pedestrian Bridge is part of a nature train in Newton Massachusetts. The bridge was galvanized because of the visual appearance and quality of hot dip galvanized steel. Because the bridge is

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Blue Heron Pedestrian Bridge.

Philadelphia Airport parking.

along a nature trail, maintenance and/or replacement are expensive and difficult. Hot dip galvanizing was specified because the client desired very low maintenance and a long lasting structure, and hot dip galvanized steel met both of these requirements. Because the structure is located in such a nature-rich environment, the client chose to paint over the entire galvanized bridge to help blend it into its surroundings. This duplex system will not only help integrate the bridge into the environment, but will also help the structure avoid corrosion up to 2.5 times longer than the sum of a galvanized or painted bridge alone.

Thurston Ave Bridge

The Thurston Avenue Bridge is located on the campus of Ivy League school Cornell University in Ithaca, New York. The renowned school, visited from scholars around the world, is highly visible to the public. The bridge sits atop a treacherous gorge, and is passed over daily by students, and up to approximately 8 500 vehicles, 950 pedestrians, and 60 bicycles per day. With the bridges appearance of utmost importance, the decision was made to apply hot dip galvanizing to the steel rails atop the bridge and finish the top coat with a powder coated duplex system.

After completing a cost analysis that revealed utilizing hot dip galvanizing was equal or less expensive than a three-part paint system, hot dip galvanizing was an easy choice for the specifier. In addition to having great durability, hot dip galvanizing was the perfect choice to maintain the look and feel of the design, as well as to protect the bridge from corrosive road salts used in the winter. With the quick turnaround time and quality of the duplex powder coat; the bridge will enjoy years of corrosion protection and serve as an example of how hot dip galvanizing and the duplex system compliment each other to provide superior long-lasting maintenance free life.

Philadelphia Airport Parking

Situated across two major hotels, Philadelphia Airport's new parking entrance is both eye-catching as well as durable. Hot dip galvanizing was always included in the plan in order to ensure corrosion protection; however, the hot dip galvanized finish alone was considered too industrial. In order to paint over the structure with powder coating, a smooth hot dip galvanized finish was required.

The airport parking was an accelerated project with a minimal time frame, which necessitated the fabricator, architect, galvanizers and painter to work together efficiently. Together they achieved a beautiful and corrosion resistant duplex system. This system, and all hot dip galvanized coatings provides both cathodic and barrier protection. The barrier protection simply isolates the steel from the potentially corrosive

Thurston Avenue Bridge.

environment of Philadelphia. The cathodic protection, also known as sacrificial protection, comes from zincs ability to sacrifice itself so small areas of exposed steel are guarded. The powder coating of the duplex system provides an extra layer of barrier protection. Ultimately, Philadelphia's goal to boast an unforgettable and durable airport entrance was fulfilled.

Springstar Sculpture

Located on the traffic island at the entrance to the Golden Springs Development Company property, the Springstar sculpture is supported by 12 assemblies of hot dip galvanized plate, pipe and cable anchors that would be inaccessible after installation. The desire to never have to maintain the base and the complete zinc coverage throughout the base assembly were important factors in the decision-making process.

Also key to the success of the sculpture was collaborative teamwork between the artist, engineer, fabricator and galvanizer to ensure quality corrosion protection without compromising the sculpture's dimensions and shape. The sculpture seeks to embody feeling of up-welling, ascending from the earth and rising spirits that are implicit in the name and history of the Golden Springs Development Company.

Wild Wood Ski Lift

The winter weather of the mountains can be severe at times; this is why hot dip galvanizing is the preferred corrosion protection for ski lift manufacturers. The ability to resist the wet snows of the high mountains gives skiers and snow boarders the joy of traversing the slopes

Springstar sculpture.

for generations to come. Also the ski lift manufacturer can be sure that the structural integrity of the lift is not compromised from rust and weather-

continued on page 16...

Wild Wood Ski Lift.

related wear. Thousands of customers can feel safe riding these lifts for decades to come in some of the harshest environments on earth.

This ski lift had over 150 tons of steel components galvanized. The large tower cross-arms that help support the wire rope network were all galvanized. Also dipped were handrails, chair bails, and restraints that keep passengers inside the chair. These items are all touched by the bare hands of passengers, so special attention was placed on quality to ensure a smooth galvanized coating. This particular lift transports four skiers per chair up the mountain at a capacity of 2 400 people per hour. The lift will be free from rust and unsightly corrosion – very important, as they are very visible to the resort customers.

Beacon Street MBTA passenger shelters

Painting over hot dip galvanized steel as part of the design of these bus shelters makes them more than functional. Not only are they complementary to the overall color scheme of the 'Green Line', but they're durable enough to withstand constant passenger use as well as the harsh Massachusetts winters.

All of the structural steel of the shelter, miscellaneous steel, and adjacent fencing were delivered to the site with Colorgalv – a patented system of hot dip galvanizing and paint. Convincing the Massachusetts Bay Transit Authority (MBTA) to specify the Colorgalv system for the shelter steel was based on the MBTA's past experience with its excellent performance and durability and the competitive economics on an initial-cost basis. Considering the synergistic effect between the paint and zinc of the Colorgalv system, additional economic benefits will be delivered each year in the form of attractive shelters needing zero maintenance.

The resulting success of these 'Green Line' shelters and their aesthetic appeal in this urban transit architecture application was later leveraged into specification of Colorgalv shelters for the MBTA's other lines – Blue, Red, and Orange.

The HDGASA *wishes to thank the staff and members of the* AGA *for this conribution.*

Beacon Street MBTA passenger shelters.

Sydney Desalination Plant – shoring up the future

Introduction

The new Sydney Desalination Plant is located on the Kurnell Peninsula, bounded by Botany Bay and the ocean in NSW.

The desalination plant has been commissioned by Sydney Water and is being delivered by Blue Water, a joint venture between John Holland and Veolia. The 18km pipeline that will distribute the water produced at the plant is being built by the Water Delivery Alliance. This group includes Sydney Water, Bovis Lend Lease, McConnell Dowell, Kellogg Brown & Root, Worley Parsons and Environment Resources Management.

What's it all about?

The Sydney Desalination Plant will be capable of supplying up to 15% of Sydney's water requirements. The plant will take seawater and produce fresh water via a process called the reverse osmosis system. This involves an initial screening and filtering process and then the seawater is pushed at a very high pressure through reverse osmosis membranes. There are 36 000 membranes in the Sydney Desalination Plant! The membranes remove salt and other particles, leaving only fresh water to pass through to the other side. The resulting fresh water is stored in tanks prior to distribution and treated in the same manner as water from natural catchment areas. The by-product of the process is a

seawater concentrate (also known as brine) that is twice as salty as natural seawater and slightly higher in temperature. This brine is then released back into the ocean and the process has been designed to have minimal impact on the surrounding environment.

Powering up the green way

In keeping with the overall objective of the project to minimise its environmental footprint, the power required to run the plant is being offset by the construction of a 67 turbine wind farm at Bungedare, NSW. The wind farm is being built by Renewable Power Ventures and will have a capacity of 140 MW. This will increase the production of wind power in NSW by 700%. The aim is to ensure that the plant offsets 100% of its power with the development of renewable power resources.

How will it help Sydney?

The population in most urban centres of Australia is increasing. Sydney is no different and its population is expected to increase by 30-40% over the next 30 years. The prolonged drought and the predicted changes to the global climate have resulted in diminished rainfall and a subsequent reduction in the level of water in our dams. This has meant that authorities need to look at alternative methods of securing the supply of water to the public, industry and agriculture. The Sydney Desalination Plant will initially supply 15% of Sydney's water requirements by producing 250 million litres of water a day. Sydney Water has also looked to the future by ensuring that the plant can be easily scaled up to produce 500 million litres a day when and if this is required.

Nuts and bolts of the structural side

The reverse osmosis building is the heart of the Sydney desalination project. The building is 235m long and 75m wide. For those from the 'rectangular pitch states', that equates to approximately two football fields. There are also other associated assets, such as a prescreening facility, water storage tanks and others.

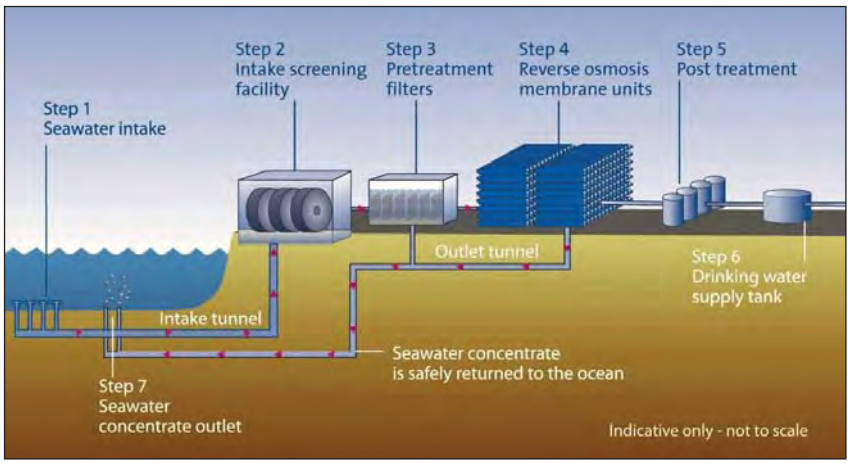
Structural steel showing extra corrosion protection at base of columns.

The project requires over 60 000 cubic metres of concrete, 13 500 tonnes of reinforcement steel and 3 000 tonnes of structural steel.

Beating corrosion – how did they do it?

As discussed above, the reverse osmosis building is a very large structure and its coastal location and

continued on page 18...



Sydney Desalination Plant (courtesy of Sydney Water).

application make durability a critical part of its design. A steel portal frame building was assessed as the most practical economic design due to its large area and the wide spans required to house the necessary plant and equipment. However, the coastal nature of its location required that a superior corrosion protection system was specified and used to ensure durability, economical operation and minimal maintenance, all while keeping the initial cost as low as possible.

Galvanized steel was used for practically all of the structural and associated steelwork. The use of galvanized steel meant that the fabrication could be done offsite. This increases the speed of fabrication and considerably reduces the number of people required onsite. The flexibility of galvanized steel was also important because the project was fast-tracked and speed of fabrication and erection are inherent advantages of such a structural system that requires corrosion protection.

Gian Gucciardo is the Managing Director of GB Galvanizing. "We always thought that galvanized steel would be the best option for such a project. In fact, the GAA had only recently finished a survey of galvanized steel on some of the port terminals in Botany Bay. Their data showed that galvanized steel light towers on the water's edge had performed well without maintenance for over 27 years and there was still a significant level of protection remaining."

Where extra protection was required due to the aggressiveness of specific microclimates, the galvanized steel was over-coated with an epoxy mastic paint.

The flexibility and ease of use of galvanized steel is demonstrated by the fact that much of the fabrication and galvanizing was undertaken outside of Sydney. In fact, the major structural items in the reverse osmosis plant, about 1 600 tonnes of steel, were fabricated by Alfasi Steel Constructions and galvanized by GB Galvanizing, both based in Melbourne. Their excellent cooperation and logistical coordination resulted in the fabrication, galvanizing, transport and erection all being conducted in a timely and economical manner.

Australian made for Australian conditions

An important aspect of the structural steel in the reverse osmosis plant is that it was sourced, fabricated and galvanized in Australia. The capability of the local steel industry coupled with the ingenuity and coordination skills of Alfasi Steel Constructions and GB Galvanizing meant that the project was able to proceed smoothly. The access of all the stakeholders to each other has played a significant part in the success of the project.

Structural steel at the Sydney Desalination Plant

Both Alfasi and GB Galvanizing showed that local product and local industry are able to meet the demanding and exacting requirement of challenging and iconic infrastructure projects.

Now in Sydney, they can all drink to that for well into the future!

Project team

Client:
Sydney Water

Project Management:
Blue Water JV

Structural Engineering:
SKM/Maunsell (AECOM) JV

Steel Fabrication:
Alfasi Steel Constructions
KERMAC Welding and Engineering
New World Engineering
Silo Constructions
S & L Steel

Coating:
GB Galvanizing Service

Logistics played a large part in the project. Galvanized steel can cope with transportation due to its robustness.

Acknowledgements

Alfasi Steel Constructions; GB Galvanizing Service; Australian Steel Institute; and Blue Water JV.

By Emmanuel Pimentel – Technical Manager, Galvanizers Association of Australia.

The HDGASA wishes to thank the staff of the GAA for this contribution.

Guest Writer

Our guest writer for this edition is Gerald Haynes, Corrosion Technology Consultants (CTC)

Utilising ISO standards and best engineering practices in order to ensure long term cost effective corrosion control

The corrosion protection of structural steel and ancillary steel components against corrosive atmospheric environments can be achieved in a number of ways. These include the selection of suitable materials, correctly designing the corrosion protection system, reducing the corrosivity of the environment or the use of barrier protection in the form of protective coatings.

The selection process regarding the most appropriate corrosion protection method is comprised of several steps. These steps include correctly characterising the product, determining the design and service life, knowing the complexity of the corrosive environment and other important aspects such as durability, serviceability, future accessibility and maintenance.

The International Organization for Standardization (ISO) defines serviceability with respect to corrosion, as "the ability of a system to perform its specified function(s) without impairment due to corrosion". ISO also defines the service life with respect to corrosion, "as the time during which a corrosion system meets the requirements for serviceability". The design service life is the principal factor utilised in terms of selecting the corrosion protection method for the structure. However, many protective coating systems cannot often meet the 'service life' without several maintenance cycles.

The environmental conditions need to be comprehensively defined, as

detailed in ISO 9223 "*Corrosion of metals and alloys – Corrosivity of atmospheres – Classification*". The latter specification provides a means for classifying the corrosivity of atmospheres based on four standard metals (carbon steel, zinc, copper and aluminium). The general controlling factors are defined in terms of the total 'wet' time, the deposition of soluble chlorides, the presence and magnitude of sulphur dioxide and other airborne corrodants. Other important factors relating to the environment are radiation from the sun (relating to UV degradation of protective coatings) and temperature extremes (diurnal or seasonal – relating to cracking, stress, etc., of protective coatings).

In order to accurately classify the areas, as defined in ISO 9223, there are two methods one may follow in order to achieve this.

The first ISO 9223 method relates to defining an area which may be classified in terms of the wetness duration (time) and 'pollution'. The measurement of pollution is covered under ISO 9225 "*Corrosion of metals and alloys – Corrosivity of atmospheres – Measurement of pollution*". ISO 9225 essentially specifies three methods for measuring the deposition rates of sulphur dioxide and air-borne salinity. However, it does not cover concentration measurements. It does however include measuring methods which apply to the characterisation of the corrosivity of the test site. In terms of these specific ISO 9225 assessments in RSA, there do not appear to be any accredited laboratories or test houses that are able to carry out these pollution measurements. Furthermore, there are many aspects which are also subjective, such as 'time of wetness', 'calculated time of wetness' and the assessment of the 'electrolytes and their ability to cause corrosion'.

The second ISO 9223 method permits the corrosivity of the environment to be determined based upon the corrosion rate of standard test specimens. The determination of the respective corrosion rates is very well covered and the requirements adequately documented in ISO 9226 "*Corrosion of metals and alloys – Corrosivity of atmospheres – Determination of corrosion rate of standard specimens for the evaluation of corrosivity*".

Therefore, in RSA, it is more pragmatic and achievable to accurately determine the corrosivity of an area or industrial site, by properly implementing ISO 9226. The latter ISO standard determines the corrosivity of a location or industrial site based upon the well established mass loss per unit area of the standard specimen based on tried and tested methodologies. Mass loss

has been established as an acceptable method in determining corrosion degradation of iron, zinc and copper alloys. The process may be readily assessed and determined by local Consulting Engineers and laboratories. Samples are prepared in accordance with ISO 8565 "*Metals and alloys - Atmospheric corrosion testing - General requirements for field tests*". At least three metals of each alloy must be exposed for at least a one year period. The commencement of the testing should coincide with the beginning of the worst corrosive period of the year. The samples are then assessed in accordance with ISO 8407 "*Corrosion of metals and alloys - Removal of corrosion products from corrosion test specimens*".

It is often argued that project time constraints do not permit the time required to carry out the ISO 9226 assessments correctly. The latter constraints may be more plausibly explained in terms of poor planning and a possible lack of understanding in terms of the consequential costs that will be arise as a result of this. ISO 9225 is seldom if ever implemented in RSA, and this is typically based upon the costs and other "technical issues". Therefore to simplify these ISO 9225 assessments, areas are also generally classified in terms of their "wetness", as well as the performance of "historical coatings". There is generally no ISO 4628 "*Paints and varnishes - Evaluation of degradation of paint coatings*" assessment that takes place regarding the failed coatings. The actual ISO 9223 corrosivity classification is therefore never satisfactorily established either via ISO 9225 or ISO 9226, but rather inferred via these crude and simplistic approaches.

If one were to assume that the corrosivity of the environment had been established based upon Table 4 (ISO 9223) using best engineering practices and either ISO 9225 or 6, then one would be permitted to select the most appropriate corrosion protection system, utilising ISO 14713 "*Protection against corrosion of iron and steel in structures - Zinc and aluminium coatings - Guidelines*" and/or ISO 12944 "*Paints and varnishes - Corrosion protection of steel structures by protective paint systems*" (*Parts 1 to 8*). As soon as the corrosivity of the environment has been correctly determined, then the most appropriate corrosion protection system can be determined, taking into consideration important aspects such a life cycle costing, under-film corrosion risks, etc.,

There are corrosion rates tendered for Hot Dip Galvanized (HDG) steel which are based upon the ISO 9223 C1 to C5 atmospheric classifications. It's salutary to remind ourselves that HDG steel can readily achieve a 30 year coating life before any "first maintenance" is required, even on smaller steel sections (thinner zinc coatings). On the larger steel sections (thicker zinc coatings), 20 years can also be attained in C4 (High Corrosivity) environments before any first maintenance is required. More importantly is the fact that there are changes that occur in atmospheric environments as time passes. A substantial reduction in pollution, especially in sulphur dioxide has occurred world-wide in the past 30 years. This means that the present corrosion rates as detailed in ISO 14713 Table 1 are somewhat higher than those currently being experienced in the field. This is due to the fact that each environmental category is much lower than the historical rates (established prior to 1995) and therefore even lower rates can be expected in the future if the pollution rate continues to fall.

continued on page 22...

Hot dip galvanized coating failures are also a lot simpler to visually identify upon completion of the galvanizing process, and so to is the assessment of the surface preparation prior to hot dip galvanizing.

ISO 12944 "*Paints and varnishes – Corrosion protection of steel structures by protective paint systems*" (Part 1 to 8) covers the type of protective paints that may be applied to bare steel surfaces (uncoated), surfaces coated with zinc or aluminium metal spray, hot dip galvanized steel surfaces, etc, in order to protect them in the more corrosive atmospheres.

ISO 12944 also considers three different durability ranges, as per Section 3.5 Clause 4, viz low (L) 2 - 5 years, medium (M) 5 to 15 years and high (H) greater than 15 years. However, before these ranges can be truly implemented the level of coating failure needs to be agreed upon upfront by all parties, utilising ISO 4628 (Part 1 to 5) "*Paints and varnishes – Evaluation of degradation of paint coatings*". This would therefore appear to be significantly more complex than the "durability" values as tendered for HDG coatings in ISO 14713 and the longevity of the protective paints, appears to be significantly shorter than the coating life tendered on hot dip galvanized steel components.

The protective coatings must be further subjected to ISO 12944 Parts 2 to 8, in order to ensure that the correct system is implemented. Clearly, the latter also attracts significantly more consulting revenue and inspection service revenue, when compared to that required in order to effectively implement hot dip galvanizing.

Therefore taking due cognisance of the steel section (thickness), a hot dip galvanized section can readily outperform even a high (H more than 15 years) durable paint system in a C1 to C4 environment. Closer scrutiny of structures like transmissions towers and electrical substation components also allows one to determine how similar steel components or hot dip galvanized components would behave if exposed in that or a similar environment.

There is no good reason as to why many areas which are deemed to be 'corrosive atmospheres' (C1 to C4) cannot simply be protected using hot dip galvanizing. There is also no good reason as to why Duplex Coatings (hot dip galvanizing and protective coating) cannot be used on the smaller steel sections in the more aggressive C4 and C5 environments. It's also important to note that once the protective paint has been damaged, the corrosion rate of bare steel is orders of magnitude higher than hot dip galvanized steel, which should intuitively imply that a Duplex System would be the most viable and cost effective (and robust) system in a C4 and C5 environment.

Due to project time constraints (in certain cases) and the possible lack of understanding regarding how these corrosive atmospheres should be properly classified, protective paints are often solely used, which can result in more frequent maintenance, additional planning, as well as unwarranted additional costs.

Therefore if the ISO 9223 atmospheric corrosivity classification can be properly established using ISO 9226 (or ISO 9225 if suitable local laboratories can be utilised), then the most appropriate and viable corrosion protection system can be correctly implemented, with long term cost savings and environmental benefits.

Smoke-free/ low-smoke flux

Our philosophy at STT (Surface Treatment Technologies) is to not only to be a proactive chemical manufacturing company but to also be one that is environmentally friendly.

For many years we have had to put up with the excessive smoke that is produced when articles are dipped in the kettle. These fumes are not only an irritant but can also be harmful to your workers as well as the environment as a whole. With this in mind STT have developed a new range of low and non fuming/smoking fluxes to compliment their current flux range that they successfully supply to the galvanizing industry.

These products still retain their low iron build up (reducing dross by up to 40%) and lower zinc pick up while at the same time providing an excellent flow and finish.

STT also supplies environmentally friendly, low temperature degreaser that is biodegradable.

Hi Saskia and Terry,

Thanks for the latest HDGASA Journal. We have a problem: Missing Pages "HD Galvanizing Today No 40 (2009 Volume 6 Issue 3)" Pg 9, 10, 11, 12, 25, 26, 27, 28. And Duplicated Pages 13, 14, 15, 16, 21, 22, 23 and 24.

Could you please forward a complete copy to me?

Regards

Chris McKay Pr Eng
Coastal Division Manager
SKCMasakhizwe Engineers (Pty) Ltd.

Editors comment
While we believe the problem is relatively minor, we do apologize for this inconvenience and invite readers to inform us if they have had a similar experience.

The treatment of acidified rinse water in hot dip galvanizing plants

Traditionally, the main purpose of rinse water in a galvanizing process, is to prevent carry over of residual acid into the subsequent process chemicals, ie the fluxing solution. The acid contains iron originating from the pickling process which contaminates the flux causing an imbalance in the chemical make-up of the fluxing solution. The presence of excessive iron alters the surface tension of the flux and as a result, affects the ability of the solution to coat an item successfully. This in turn results in associated quality issues during the actual dipping process. A more important aspect of excessive iron in the flux, is that it is a major contributor to dross formation in the molten zinc. The dross, if not properly controlled, will lead to drastically reduced life expectancy of the kettle as well as frequent down time to allow for removal.

The water used for rinsing post pickling, is acidified continuously as a result of carry over of acid from the pickling tanks. At some point, the acidified water needs to be refreshed by the addition of fresh water, most likely from a municipal source. The spent water however needs to be either reused or needs to be disposed of. The main reuse option is for acid make-up where the volumes needed are calculated according to the final acid strengths required. In this case, the total volumes generated may well exceed the actual amount required for acid make-up. The next step is the actual disposal of the excess amount. This is normally done by a certified waste contractor who will remove the water and treatment will commence offsite. This practice is costly to the galvanizer and is considered a waste of a valuable resource.

It should however be noted that in extreme cases, the rinse water is neutralised and discharged into sewer or storm water systems. This practice is not only hazardous to the environment but is also highly illegal in terms of the National Water Act and relevant municipal by-laws, and if detected, can result in severe penalties, imprisonment or even closure of the offending facility.

With the ever increasing emphasis being placed on the preservation of natural resources it has become a moral obligation for everyone to reduce their footprint on the environment. On the flip side of the coin there are often some operational advantages to embracing this greener philosophy.

Armed with just good intentions the process starts by going through a frustrating EIA process whereby informing local authorities and obtaining the necessary permission. This is followed by detail design and specification of the required plant. Both of these processes can be significantly streamlined by outsourcing to competent professionals in these fields.

A Water Treatment plant is designed to continuously draw acidified rinse water from the rinse tanks where it is then subjected to a pH treatment using lime or caustic soda. It should however be noted that in this specific design, the

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degrease rinses are also utilized as an additional diluting and neutralizing agent therefore reducing the amount of lime required. The increase in pH results in the precipitation of iron and other heavy metal out of solution. The precipitate is then flocculated and allowed to settle out in specially designed clarifiers. The clarified water is then ready for reuse back into the rinsing tanks. The settled iron sludge is subjected to a filtering process where the filtrate is reused and the filter cake, which mainly consists of iron, is disposed of at a suitably certified facility. This process only consumes a relatively small volume of fresh water which is mainly used for the control of water levels in the rinse tanks. It is important to note that this whole process is fully automated (controlled) requiring minimal human intervention. The only human involvement is to remove the filter cake from the press twice a shift or when required. The photograph on page 23 shows the layout of the facility.

In addition to the obvious reduction on environmental impacts, other very important advantages in using a treatment facility can be realized by the galvanizer. The advantages are listed below:

- reduction in water consumption
- reduced iron carry over into the flux resulting in a more stable solution
- reduced reject rates on galvanized products
- reduced iron carry over into the molten zinc which in turn results in less dross formation
- reduced down time needed for drossing operations.
- reduced overall zinc pick-up
- elimination of costly disposal costs and related legal issues
- reduced environmental footprint

South Africa is rapidly becoming a water scarce country and it is therefore clear that efforts should be made to preserve this resource as best we can. The use of water is generally regarded in environmental terms as a high risk aspect and should be treated as such.

The HDGASA wishes to thank Robor Galvanizers for this contribution.

Environmentally friendly fluxes and passivation systems

Brief description of Galvogard EF3 – environmentally friendly passivator

Galvogard was created with the environment in mind but at the same time, not compromising passivation capabilities.

Galvogard EF3 is a liquid concentrate passivator for zinc surfaces, which contains no heavy metals or toxic compounds.

Galvogard EF3 provides excellent protection against the formation of white rust while leaving the treated surface bright and free from discolouration.

Galvogard EF3 **does not contain hexavalent chromium,** it is **non-toxic,** and it is the preferred product to use in areas where limitations are imposed on the use of hexavalent chromium.

Due to Galvogard EF3 being non toxic, considerable costs are saved on disposal of a passivator bath compared to baths containing hexavalent chromium. Any remaining sludge is rich in zinc and may be sold off for zinc recovery.

The active ingredient in Galvogard EF3 reacts with elemental zinc, zinc compounds and (to a lesser extent) superficial zinc on steel to form an organo-metallic complex with a pH specific solubility. Once soluble the wet galvanized pieces, after passivation, evaporate the water and deposit this metal complex as an inert white power on the steel surface. Note that this is not 'white rust'.

Periodic addition of Galvogard EF3 will precipitate this metal complex out of solution while keeping bath strength up which is in line with bath maintenance.

To eliminate this metal complex from promoting a dull product the following should be adhered to:

- Zinc ash or molten zinc splash should be prevented from contaminating the bath.
- A cooling tower should be installed as to lower the bulk temperature of the passivation bath as to allow the wet passivated piece to drain dry as opposed to evaporate dry.
- Passivation dipping time should be kept to a minimum.
- Assuming above points have been adhered to, a fresh bath (0.32% – 0.40% Galvogard EF3) should be made up based on factors such bath throughput and mean dipping time. As a rule of thumb every 4 – 6 months.

Brief description of Fluxor FFS – fume free/splash free flux

There is nothing worse than the fuming and splashing that occurs in the hot dip galvanizing environment. It is because of this that Chemplus has come out with a Flux that will eliminate most of this.

Fluxor FFS is a compounded concentrate consisting of soluble eutectic inorganic salts, tenso-active agents, sequestering agents, buffer index stabilizers and desludger's.

Said flux allows steel to be galvanized without corrosive smoke evolution or molten zinc splash generally associated with zinc bath dipping. This is complemented by its tendency of arresting the generation of bottom dross and zinc ash layer on the surface of the zinc bath.

This compounded with its ability to reduce zinc pick up translates into a welcome cost saving.

Since the iron tolerance of a Fluxor FFS bath is much higher than alternative baths, normally a considerably longer bath life may be achieved.

Any bath can be converted to a Fluxor FFS bath. A sample of the bath is taken, analysed in the Chemplus lab, and a live algorithm is generated which will indicate the exact calculations as to how much product would be needed to do so as well as the length of time for a full conversion.

The quickest and easiest way would be to make up a fresh bath containing Fluxor FFS.

Reviewing the hot dip galvanizing process and risk analysis

What protective action should be taken when dealing with noise and dust pollution?

Activity: Shot blasting

Mechanical surface preparation.

Hazard

- Noise pollution from grinding or blasting.
- Dust pollution.
- Collection of spent shot materials.

Action taken

- Wear ear, eye and protection equipment.
- Wear dust masks and install dust extraction if required.
- Re-cycle or waste to authorized site.

NB: Shot blasting is only used in the case of certain castings, removal of old paint or heavily contaminated mill scale or grease and is not normally required prior to hot dip galvanizing.

What protective action should be taken when dealing with degreasing?

Activity: Degreasing

- Acid degreaser usually 6 to 16% HCl at a temperature of < 25°C.
- Alkaline degreaser, usually 5 to 6% caustic soda based.

Hazard

- Chemical exposure – alkaline or acid.
- High consumption of degreaser due to poor maintenance.
- Heat loss due to poor insulation.
- Purification of degreaser bath.
- Drag out solution.
- Disposal of sludge.

Action taken

- Wear acid resistant overalls, acid resistant elbow length gloves, face shields, hard hat and respirator.
- Daily monitoring of chemicals and

continued on page 26...


Shotblasting.


Degreasing.


Acid pickling.

control and disposal of oil and sludge to authorised site.

- Maintenance of heater and bath insulation.
- Continuous, degreaser never discharged.
- Follow correct operating procedures.
- Removal by authorised contractor.

What protective action should be taken when dealing with acid pickling?

Activity: Pickling

Usually HCl at room temperature (25°C) or heated H2SO4 (60°C).

Hazard

- Chemical exposure (HCl or H2SO4).
- HCl fumes from the pickling bath and corrosive nature of these fumes.
- High consumption of acid due to poor maintenance.
- Drag out solution.
- Disposal of spent acid and acid recovery.

Action taken

- As per degreaser safety equipment.
- Use fume extraction equipment, liquid anti-fuming blanket and respirator for operators.
- Daily monitoring of chemicals and control of iron content and acid concentration.
- Follow correct operating procedures.
- Use approved waste removal, neutralise or recycle through Metsep.

What protective action should be taken when dealing with water rinsing?

Activity: Water rinse (after degreasing and acid pickling)

Water rinsing.

Hazard

- Use of excessive water rinsing.
- Optimisation of rinsing procedures to save water.
- Treatment of and disposal of wastewater.
- Disposal of sludge from wastewater.

Action taken

- Circulate between alkaline and acid rinse water baths.
- Use correct operating procedure, limit drag out and the use of a cascade system.
- As per pickling acid disposal or neutralisation.
- As per degreasing sludge disposal.

What protective action should be taken when dealing with fluxing?

Activity: Fluxing

Zinc ammonium chloride. Usually triple salts is preferred i.e. ZnCl2+2NH4Cl or ZnCl2+3NH4Cl.

Hazard

- Chemical exposure.
- High consumption of flux due to drag out.
- Flux purification, control of parameters.
- Heat loss due to poor bath insulation.
- Sludge disposal

Action taken

- As per degreaser safety equipment.
- Follow correct operating procedures.
- Daily monitoring of iron, pH, SG and balance of zinc chloride and ammonium chloride.
- Maintenance of bath and heater installation.
- As per all sludge removal requirements.

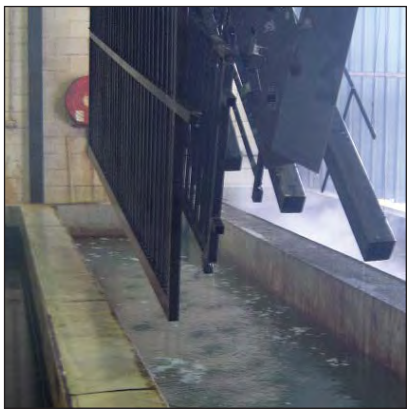
What protective action should be taken when dealing with hot dip galvanizing?

Activity: Hot dip galvanizing

Molten zinc (Zn) at 450°C.

Hazard

- Exposure to fumes and heat from the molten zinc.
- High zinc consumption due to excess dross, ash, wet and dry powder.
- High zinc consumption due to excess pick-up.
- Molten zinc burns due to splashing and exposure around the galvanizing bath.
- Damage to zinc bath due to poor drossing and ashing practice, heating controls and monitoring of equipment.



Water rinsing.

Water treatment process.

Fluxing.

- Heat loss due to poor furnace insulation.
- Loss of zinc and conversion costs due to rejects.

Action taken

- Use of issued safety equipment, overalls, leather jackets/aprons, face shields, hard hats, leather gloves and safety boots. Fume extraction equipment.
- Maintain correct operating procedures for drossing, ashing and maintenance of plant.
- Control immersion times, bath temperature, speed of immersion and withdrawal, withdrawal angle and where possible chemical analysis of steel.
- Follow procedures for drossing and ashing and ensure security of heating equipment and related controls.
- Maintenance of equipment.
- Follow pre-treatment plant operating (cleaning) and zinc bath operating procedures.

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Hot dip galvanizing.

Passivating and quenching.

Bulk chemical storage tanks.

Notes:

1. *Typical ammonium chloride fumes (composition by % wt.):*
   - *Ammonium Chloride* (NH4Cl) 68.0%
   - *Zinc Oxide* (ZnO) 15.8%
   - *Zinc Chloride* (ZnCl2) 3.6%
   - *Ammonium* (NH3) 1.0%
   - *Oil &/or Carbon* 1.4% *to* 2.8%
   - *Water Vapour* 2.5%

What protective action should be taken when dealing with passivating and quenching?

Activity: Passivate and quench

- Passivating solution usually 1% sodium di-chromate (100% when dried).

Hazard

- Chemical exposure.
- Use of sodium di-chromate passivating solution contains toxic chromium (Cr+6).
- Disposal of sludge
- Cooling of water and passivating quench solutions.

Action taken

- Use of safety equipment as per pre-treatment plant.
- Use of alternative passivating solutions. Consult HDGASA for advice.
- As per pre-treatment plant requirements.
- Use of cooling tower and circulation system.

How are the various chemicals handled?

Activity Chemical Controls

- Of all the chemicals used in the hot dip galvanizing process, the acid (HCl or H2SO4) requires specific control. Provision is made for storage of incoming fresh or regenerated acid as well as the outgoing spent acid. Provision has to be made for pumping, control of spillage and the handling by authorised personnel. Road tankers are used to transport fresh and spent acid to and from the acid re-generating (re-cycling) plant.
- Other chemicals, such as flux salts or degreasers, should be stored in a dry environment, clearly demarcated and kept separated from each other.

  Where these chemicals are received in liquid form, they are usually discharged direct to the process tank or stored in drums.
- Zinc ingots, due to their monetary value, are delivered to a secure store and issued against authorised.

Safety equipment

Safety equipment issued by the company must be worn when working in the pre-treatment plant area. This includes equipment such as:

- Acid resistant overalls
- Hard hats including face shields
- Acid resistant, elbow length safety gloves, leather for zinc bath crews

Zinc ingots securely stored.

Safety equipment.

Safety shower.

- Safety shoes / boots
- Safety showers
- Respirators

Jigs and handling equipment

All jigs and handling equipment must be registered on the prescribed Plant Lifting Register and subject to routine safety inspections. No unregistered jigs and handling equipment should be used in the plant. A logbook should exist in which all inspection and maintenance records are kept.

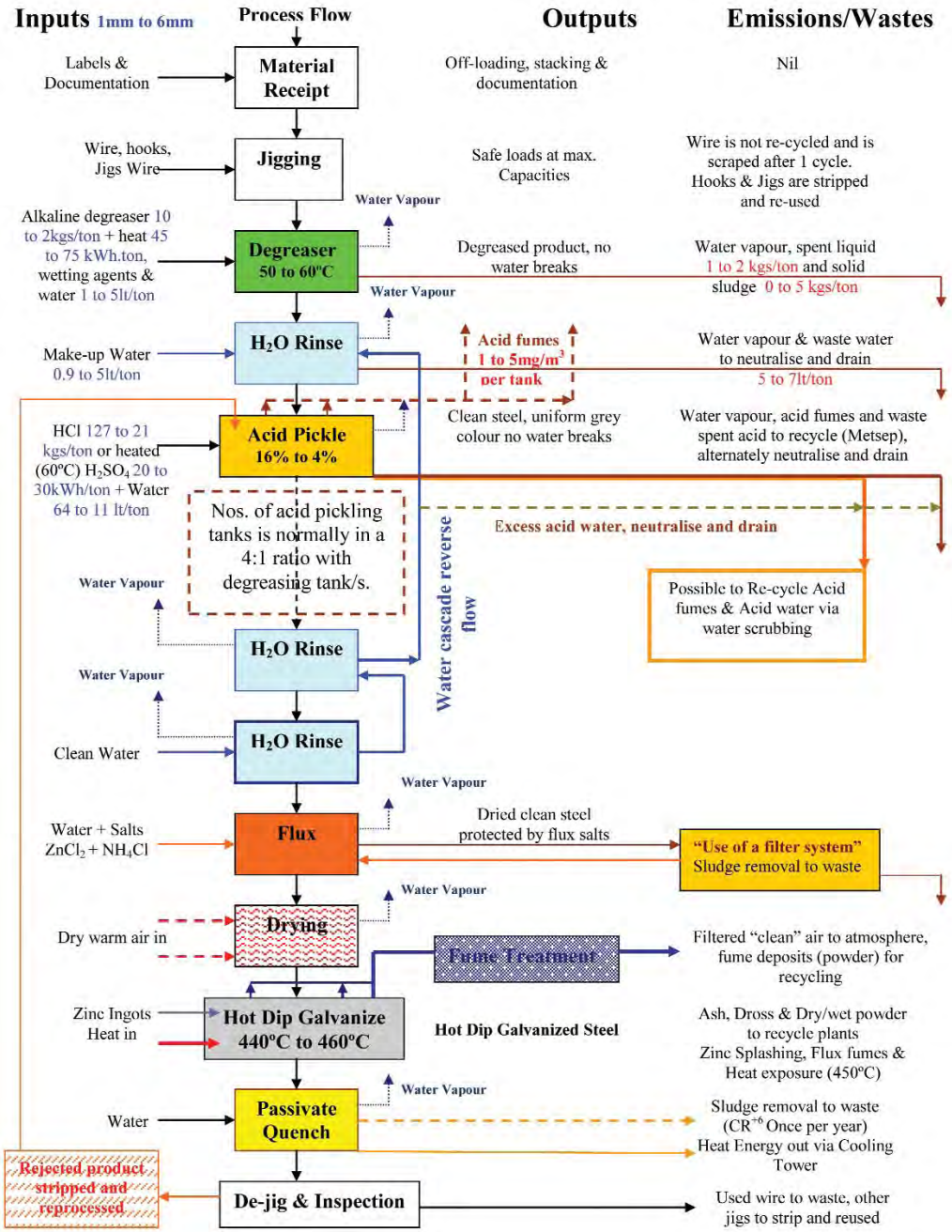
All jigs and lifting equipment, where possible, must have the Safe Working Load (SWL) clearly displayed and visible from the working positions. SWL are in tons and kilograms and must be adhered to.

Jiggers must complete the official plant orientation, health and safety course and participate in the plant safety program. If you haven't, ask your Line Supervisor, Foreman or Plant Manager about your plant safety program!

A diagram to illustrate the Inputs, Outputs and Emissions/Waste Flow in terms of a typical hot dip galvanizing process is shown below. This flow diagram should be viewed in terms of the foregoing narrative.

Bob Wilmot

OUTPUTS AND EMISSIONS/WASTE FLOW IN TERMS OF THE HOT DIP GALVANIZING PROCESS



Metsep's acid regeneration process

Making acid last longer!

The sensible waste-acid management solution – introduction

Metsep offers their customers a complete and cost-effective waste-acid regeneration service for the galvanizing industries. Through a combination of world-class technology and proven, customer-focused services, Metsep saves the customer money, time, inconvenience and the risks associated with hazardous waste.

Today's galvanizer has a complete solution to what is often considered to be their biggest problem: how best to manage their spent hydrochloric acid. Metsep, through a series of dedicated, customer-focused services and processes, helps galvanizers to dispose of their waste acid simply, efficiently and cost-effectively without risking the well-being of their production personnel or the environment. Metsep's core objective is to enable companies to manage, with optimum effectiveness, the waste acid generated from steel treatment processes. This is especially relevant for companies that have high standards for their quality and environmental management programmes.

Metsep supplies an acid regeneration service to the South African galvanizing industry. Metsep owns and operates acid regeneration plants which provide a service to galvanizers and steel fabricators which either cannot economically justify an acid regeneration plant on site or do not want the problems associated with owning and operating an acid regeneration plant on a steel fabricating site.

It is standard Metsep practice to deliver a consignment of regenerated acid that is fully inhibited to customer requirements. All deliveries are timeous and to an agreed specification with an accompanying certificate of analysis

Taking their customer's commitment further, they provide a series of complimentary technical advisory and support services. For example, their technical advisory team can provide valuable information on acid-resistant materials and fittings, pickle bath construction and procurement, and plant layout and operation. Their facilities include laboratories with state-of-the-art analytical equipment to ensure all batches are analysed accurately, reliably and efficiently. All analytical data is supplied to customer's confidentiality. All-in-all, these services are customised to customer needs to strengthen their competitive edge.

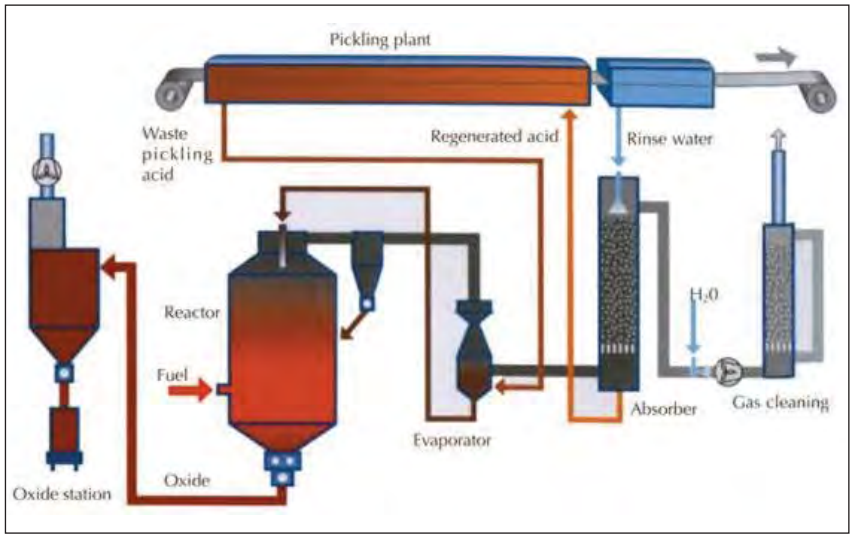
In addition to acid regeneration, Metsep provides a further service to customers, in that it operates waste water effluent treatment plants. Metsep is well placed to provide this service by taking over existing plants or will own and operate new, custom, designed waste water effluent treatment plants for the customer.

Metsep Technology

Metsep uses the internationally proven spray-roaster acid-regeneration process technology. Metsep has over 30 years experience in operating, maintaining and developing ARPs.

The Process

- When steel is pickled with hydrochloric acid a chloride solution is produced:
  FeO + 2HCl = FeCl2 = H2O
- In the regeneration system, the iron chloride (FeCl2) is converted into hydrochloric acid and iron oxide by hydrolytic decomposition.
- 2 FeCl2 + 2H2O + 1/2O2 = Fe2O3 + 4HCl
- This reaction takes place in the reactor at temperatures ranging from 600°C to 800°C.
- The iron chloride containing waste



pickling acid from the pickling system is conveyed to the evaporator, where it comes into direct contact with the hot waste gases from the reactor and concentrated.

- This concentrated iron chloride solution is sprayed into the spray roasting reactor.

  At reaction temperatures between 600°C and 800°C, the iron chloride solution is converted into hydrogen chloride and iron oxide by means of a chemical reaction with water vapour and atmospheric oxygen.
- Via the cyclone, the hydrogen chloride gas, water vapour and combustion gases are routed to the evaporator and on to the absorption column, where the HCI gas is absorbed adiabatically by adding rinse water from the pickling plant.
- The resulting azeotropic acid (18% of weight) is recycled to the pickling process. The gas from the column is cleaned in a scrubber stage in accordance with environmental

requirements and then discharged to the atmosphere.

- The exhaust fan keeps the system under vacuum, preventing the HCI gas from escaping and allows changing of spray booms, while still operating.
- Iron oxide powder in the reactor is transported to bunkers and then filled into big bags.

A *cleaner environment*

As the acid loop between the pickling plant and the regeneration system is closed, and the rinse water from the pickling plant is re-used in the

continued on page 32...

regeneration system, the pickling system can be operated largely without producing waste water. Before Metsep, galvanizers were forced to use 32% strength hydrochloric acid and manage their own waste, (spent pickle liquors) and would have to dump their waste with costly waste disposal sites which can handle hazardous substances or alternatively release to drain or sea resulting in potential contamination of natural resources.

The off–gases from the HCl regeneration system consist of water vapour and the combustion gases from reactor heating. The HCl, Cl2 and dust emission values conform to legal requirements.

As a signatory to the worldwide principles of Responsible Care®, Metsep is committed to sound safety, health and environmental management practices.

Product - The hydrochloric acid advantage

The Metsep technical team advocates the use of hydrochloric acid because it has numerous economic, technical and other advantages to steel manufacturers and processors when compared with sulphuric acid:

- Layers of iron oxide scale are more soluble in hydrochloric acid. Suitable inhibitors eliminate the risk of overpickling.
- Hydrochloric acid pickles steel more swiftly than sulphuric acid.
- Hydrochloric acid produces a cleaner, smoother finished surface. This benefit occurs because of three advantages:
  - the metal is attacked less by hydrochloric acid than sulphuric acid, resulting in greatly reduced pitting;
  - rolled-in scale deposits are removed easily when using hydrochloric acid, whereas drastic over pickling of the rest of the part may occur when using sulphuric acid; and
  - steel rinses better when pickled with hydrochloric acid.
- Zinc consumption is reduced because of the pickled surface's smoother finish. This also greatly decreases the chances of steel having to be regalvanized due to dross formation and the occurrence of voids in the zinc layer being reduced significantly.
- Chloride salts, which may remain on the steel after rinsing, are more compatible with flux solutions than sulphates. This reduces the contamination of the flux baths, thereby providing further cost advantages.
- In an age of increasing pro-environmental initiatives, there is the added comfort of knowing that spent hydrochloric acid can be recycled, thereby obviating any requirement for dumping hazardous or toxic wastes and posing other risks to the health of people and the environment.

The HDGASA *wishes to thank Metsep for this contribution.*

OBITUARY

JOHN LEITCH

It is with great sadness that we report that John Leitch died unexpectedly after a routine operation.

While John was not a member or supporter of our industry, he was a friend to us via the Corrosion Institute and reasonably well known to many of our members.

John was born in Port Elizabeth. He obtained a BSc Honours from the University of Port Elizabeth in 1973 and a MSC in Applied Science from the University of Cape Town in 1987. He joined Hulett Aluminium (now Hulamin) in Pietermaritzburg as a research metallurgist in the same year. He became the Hulamin corrosion expert and was the leading expert in Southern Africa on the corrosion performance of aluminium alloys. John joined the Corrosion Institute 1988 and served on the KwaZulu Natal Region Committee for several years and was Chairman from 1997 to 1998.

John will be sorely missed by all his friends and colleagues.

Environmentally sensitive since 1981!

When the Cape Galvanising plant was built in 1981 it had several features that currently most existing plants today do not enjoy. The new Cape Galvanising plant was built to a stringent overseas specification at the time after the chairman and founder A. Buus visited several new European installations.

Some of the new features included the following:

- Fume extraction over the galvanising bath and acid bath.
- A closed loop rinse water treatment plant which allowed the purification of the rinse water chemically which was then fed through a filter press and re circulated back into the rinse tank.

- A freeze room where the spent sulphuric acid was pumped to extract the iron in the form of ferrous sulphate crystals and to purify the sulphuric acid which was then re used in the pickling solution.

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The need for an acid recovery plant was twofold. The waste removers at the time were charging 5 times the cost that was required to make up a new tank and no regeneration plant such as Metsep existed in the Cape. The only way to dispose of acid was to pay an exorbitant fee or to provide an in-house operation to recycle the effluent.

Cape Galvanising chose the latter but soon found it difficult to dispose of the ferrous sulphate crystals which were donated to various chemical producers, who added the product into animal feeds.

After several years of running this operation which had become very labour intensive with no financial reward it was decided to take the operation one step further to produce ferric sulphate, which was being used by the City Council in all their local Cape dams for water treatment as a flocculent.

A chemical engineer was employed by the company and a plant similar to an existing overseas plant was designed and built at great cost to the company which today supplies in excess of 250 tons of iron in solution for use in dams.

The spent pickling acid is pumped into tanks and iron and acid added to the spent ferrous sulphate solution to reach an optimum level. The ferrous sulphate is then oxidised and filtered to remove any solid matter and is converted to ferric sulphate before being tankered to the dams for purifying the water. The solution is used to remove dirt and silt from the water through a controlled area of the dam.

After the dirty water is dosed and the iron takes out the dirt the clean solution is then filtered and pumped into a reservoir for distribution to end users.

The HDGASA *wishes to thank Iain Dodds for this contribution.*

NOW WITH CPD POINTS

Galvanizers Inspectors Course

Hot dip galvanizing is one of the most widely used methods of protecting steel from corrosion. As a final step in the process, the hot dip galvanized coating is inspected for compliance with the appropriate specifications.

This Galvanizers Inspectors Course has been designed to provide delegates with sufficient knowledge to test, inspect and interpret test results.

Following the course and successful result in a three-part exam, the delegate will be issued with a certificate, and if required, registered as an approved HDGASA inspector. Registration will be confirmed on an annual basis. Successful inspectors will become Individual members of the Association for the year.

The course is usually run from the Hot Dip Galvanizers Association in St Andrews, Bedfordview but from 2009 it will be available in Cape Town. Bookings are limited to 10 people on a first-come-first-serve basis.

COURSE CONTENT

- Introduction to corrosion
- Inspection before hot dip galvanizing
- Quality assurance in coating applications.
- Understanding zinc coatings
- Inspection after hot dip galvanizing

COURSE DURATION

This is a 2-Day Course comprising lectures on the first day, a Plant Tour in the morning of the second day, and the qualifying examination in the afternoon.

DATE AND TIME

Courses commence at 08h00 sharp and end at 16h30. Lunch and refreshments will be provided. Comprehensive course notes can be collected from our offices two weeks before the course.

Johannesburg:
February 16 - 17; March 16 - 17; April 20 - 21; May 18 - 19; June 22 - 23; August 17 - 18; October 5 - 6 and November 23 - 24.

Cape Town:
For course dates contact the Association.

COURSE COST AND PAYMENT TERMS

R2 800.00 per person inclusive of VAT. Should you have 2 or more delegates from the same company, course costs will be R2 600.00 per person inclusive of VAT. Please note that payment is due on the first day of training. Cheques to be made payable to "Hot Dip Galvanizers Association SA". Members qualify for a discount.

SHOULD YOU BE INTERESTED, KINDLY CONTACT SASKIA SALVATORI AT THE ASSOCIATION.

NOTE: All professional Engineers, Technologists, Technicians and Certificated Engineers are required to achieve a certain number of points for Continuous Professional Development (CPD). By attending the Association's two day Coating Inspection Course, you will obtain 2 points (accredited by ECSA).

Measuring coatings on metal substrates (Part 6)

Statistics

Microprocessors have little difficulty in calculating simple sums at the same time as everything else they do inside a gauge. By having a dynamic recalculation of statistics after each reading, the operator can see stability or any trends. Before digital displays were used, the slight movement of a meter needle gave this information (anyone remember the Elcometer 150H?), but then there was no display of highest and lowest reading, standard deviation, coefficient of variation or number of readings taken. Now, all these are available at the press of a key.

Statistic terms

Average or mean: The sum of all readings in a group divided by the number of readings.

Standard deviation: A measure of the spread or the scatter of readings around the mean of a normal distribution.

Coefficient of variation: The standard deviation divided by the mean and shown as a percentage.

Storage

It is not that often that single readings of the thickness of a coating are made. More often, groups of readings are taken and results must be presented in a report of conformance to specification. Writing numbers on paper is avoided by having them collected automatically in the gauge's memory as groups or batches. The transfer of these readings into a computer for storage is then followed by a report. Keeping the numbers in electronic form is convenient. It means analysis is quick and errors in transcription are avoided. Sometimes it is demanded.

Elcometer Data Transfer Software (EDTS) is a software bridge between various gauges and a spreadsheet.

Elcometer Data Collection Software (EDCS) is a database or archive of measurements and can provide reports in your own style.

Gauges

Two popular coating thickness gauges available today include the Elcometer 456 family, general-purpose gauges that work with many different probes. There is a Top version to store many groups of readings, a Standard version with less memory and a Basic version with no storage but with statistics.

The Elcometer 355 coating thickness gauge has a higher specification and is more robust. The difference between its Top and Standard versions is mainly storage capacity. Various probes can be connected to it.

So, we have seen how the thickness of coatings on metals of many shapes, sizes can be checked, and the results analysed and stored.

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

On the couch with

Heike van Eijden of Galvadip

In this edition we head to Pretoria to speak to Heike Van Eijden, Managing Director of **Galvadip (Pty) Ltd**, a name synonymous with quality and service in the hot dip galvanizing fraternity.

How did you get into the Hot Dip Galvanizing Industry? Initially I was appointed as financial controller to various businesses, under the same roof, but not linked except by the people who owned them and had interests in the others. One day Bill Garvie (the original owner of Galvadip) came into my office and asked me if I could help him with a problem and from then on I guess I was involved! When Bill Garvie retired three years ago, we acquired the company via a management buy-out.

You are one of a few prominent females in the South African hot dip galvanizing industry, certainly the only female Managing Director in the country. What challenges would you say you face as a woman in this industry? Survival every day from an economic perspective to the general management of the plant and staff, deadlines, quality, production – the list is endless!

What is your day-to-day role at Galvadip? My partners and myself operate like a well oiled engine, all our efforts are rewarding in the long term. (I would however have enjoyed telling you that on a day-to-day basis, I just like putting my feet up and having a good time!)

Your company, Galvadip, is synonymous and notorious for excellent quality in the hot dip galvanizing industry. Please tell us about that: Bill Garvie always said: " A service is as good as the person doing it" and he was GOOD – the best! At Galvadip we give the customer what he wants, not what we think he wants! Galvadip's management team strive to maintain the quality and good service which is the legacy left to us by Bill Garvie. We need our customers; shoddy workmanship on our part would take them elsewhere in a heartbeat; so it is up to us to provide the quality and service that they require.

What is the project that you are most proudly associated with in-so-far as hot dip galvanizing? Several projects come to mind and to mention but a few: The Industrial Radiators for BEHR Engineering, which was a huge experimental process until we got it right. The Post Box Project for Roland Technical Services as well as a long standing project for scaffolding which was exported to Belgium.

When Heike goes home... I enjoy the fact that I have a home and loved ones to come home to!

For more information contact Galvadip on (012) 803-5168

The Association wishes to thank Desere Strydom for this contribution.

An innovative system for the joining of steel piping

Cable-Lock Pipe is a new innovation from EPNS Engineering and has been developed as a quick and easy way to join steel piping. It uses the same tried and tested socket system as used in plastic pipes, with the addition of a retaining or flex wire incorporated in front of the seal to lock the two pipes together.

The flex wire is inserted through an aperture in the socket end groove, into a matching groove on the spigot end. The wire travels 360° around the groove firmly locking the pipes together. Once the pipes are locked together, the system will withstand the axial pressure loads.

The system can take pressures up to 25bar and has been pressure tested to 75bar, which exceeds normal safety requirements. Once it is pressurised, the pipes will not push apart and there is no need for thrust blocks.

Cable-Lock Pipe is hot dip galvanized to SANS 121 (ISO 1461) and can be externally coated and internally lined to suit specific conditions. The pipes are suitable for above and below ground installations.

1 300 metres of Cable-Lock Piping was recently installed at Weltevreden Mine in the Orkney district to aid in the dewatering of the decline at the mine, as well as an overland line installation. The project was carried out by Hennie Crous from Micoles Mine Dewatering,

and was completed in three days, saving much unnecessary down-time.

Says EPNS general manager Leon van Honschooten, "We have always prided ourselves on being the leaders in innovation and design and this system adds another product to our wide range of goods from the EPNS Engineering stable".

Lula Pipe

The Lula Pipe was another successful design from EPNS. Developed in a joint venture with Macsteel, the Lula Pipe is a steel pipe rolled to plastic pipe sizes. The system, which is tested to 50bar pressure, is totally interchangeable with plastic pipes and all related fittings. It can be added to a PVC pipe system because it uses the same thrust blocks and design criteria as for PVC. However, unlike plastic pipe systems, the Lula Pipe will not split under water hammer and pressure surges.

The Lula Pipe system is universally used in the water reticulation industry in South Africa.

EPNS Engineering makes the full range of fittings for this light-weight system which is easily transported to outlying areas. The system includes T-joints, end-caps, reducers, flange adaptors and straight couplings.

"The pressed steel fittings have a dual protective coating with hot dip galvanizing as a base coat and a finishing coat of "Ravenol" from abe Construction Chemicals, a bitumen based coating designed for use in pipes and tank linings for potable water," says Leon. "The two coats together work synergistically to enhance corrosion control, reduce mechanical damage and onsite abuse. The system has a 30 year-plus guarantee and has been SABS tested to 500 hours in a salt bath."

PROPOSED FEATURES FOR 2010

Febuary/March (No 42):

- Fasteners and availability matrix
- Safety and security
- Reviewing the protection by hot dip galvanizing on the new soccer stadiums
- Continuous sheet and wire galvanizing.

May/June (No 43):

- Tubes, pipes and scaffolding
- Masts and poles
- Water storage
- Heat exchangers and cooling fans

August/September (No 44):

- Awards
- Cable ladders and trays

November/December (No 45):

- The world of hot dip galvanizing around us
- Sustainability of the industry

NOTE:
FEATURES MAY BE SUBJECT TO CHANGE

HOT DIP GALVANIZING MEMBERS

GALVANIZER	LOCATION	TEL. NO	SPIN	NO. OF LINES	BATH SIZES (L x W x D) (m)
GAUTENG					
ArcelorMittal South Africa	Vanderbijlpark	016 889-9111		3	Sheet galvanizer
Armco Galvanizers	Isando	011 974-8511		1	13.2m x 1.5m x 2.2m
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
Cape Gate (Pty) Ltd	Vanderbijlpark	016 980-2270		#	Wire galvanizer
DB Thermal SA (Pty) Ltd	Nigel	011 814-6460		In-line	16.0m x 1.0m x 1.0m
Galvadip (Pty) Ltd	Waltloo	012 803-5168		2	7.2m x 1.7m x 2.2m 7.0m x 1.5m x 2.5m
Galvrite Galvanising (Pty) Ltd	Randfontein	011 693-5825		1	6.5m x 1.3m x 2.0m
Galvspin Galvanizers cc	Boksburg North	011 894-1426	●	2	2.0m x 1.2m x 1.5m 1.5m x 1.0 x 1.5m
GEA Air Cooled Systems	Germiston	011 861-1571		In-line	11.5m x 1.0m x 1.0m
Lianru Galvanisers cc	Nigel	011 814-8658		2	7.2m x 1.3m x 1.6m 4.5m x 1.3m x 1.6m
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	3.2m x 1.1m x 1.5m 3.0m x 1.1m x 1.2m
Robor Galvanizers (Pty) Ltd	Germiston	011 876-2900		3	14.0m x 1.35m x 2.5m 10.0m x 2.0m x 4.0m
				Tube	Dia 42mm to 114mm max tube length 6.7m
Robor Tube	Elandsfontein	011 971-1600		1	Tube & pipe galvanizer
Supergalv	Alrode	011-908-3411		1	6.0m x 1.2m x 1.8m
NORTH WEST					
Andrag Agrico	Lichtenburg	018 632-7260		#	In-line galvanizer
FREE STATE					
Harrismith Galvanizing & Steel Profile	Harrismith	058 623-2765		2	12.0m x 1.2m x 2.5m
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
Pro-Galv cc	Stikland	021 945-1803		1	7.2m x 1.3m x 2.6m
South Cape Galvanizing (Pty) Ltd	George Industria	044 884-0882		1	3.7m x 0.94m x 2.3m
EASTERN CAPE					
Galvanising Techniques cc	Port Elizabeth	041 486-1432		1	12.0m x 1.3m x 2.3m
Galvaspin (Pty) Ltd	Port Elizabeth	041 451-1947	●	1	3.0m x 1.2m x 1.8m
Morhot (Pty) Ltd	East London	043 763-1143		1	7.0m x 1.5m x 2.5m
KWAZULU/NATAL					
A&A Galvanisers	Pietermaritzburg	033 387-5783	●	1	3.3m x 0.9m 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	●	2	14.0m x 1.4m x 2.5m 3.0m x 1.2m x 1.2m
Pinetown Galvanizing	Pinetown	031 700-5599		1	9.0m x 1.2m x 3.0m
Voigt & Willecke (Pty) Ltd	Durban	031 902-2248		1	14.0m x 1.3m x 2.5m

 # Sheet, wire, pipe and other in-line galvanizing members dedicate their plants to the galvanizing of their own products.

Note:

- *Where more than one galvanizing line is available, the number of lines and the significant bath dimensions are listed, ie. widest, longest and deepest.*
- *For specific contact names (e.g. sales or production personnel) and mobile telephone numbers, contact company receptionist.*
- *The bath sizes are inside dimensions and not maximum component size (length, width and depth). Kindly take note of the expansion of the component when dipped into molten zinc, or discuss with relevant galvanizer.*