HOT DIP GALVANIZING TODAY

2006 Volume 3 Issue 4

HOT DIP GALVANIZERS ASSOCIATION Southern Africa

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HOT DIP GALVANIZING TODAY

Featuring:

The 2006 Eskom Hot Dip Galvanizing Awards evening

The use of hot dip galvanizing in general mining and the fastener industries

Gold, platinium and coal mining case histories

Coating Report: Hot dip galvanizing of light weight wire mesh

ZINC

Southern African Institute of Steel Construction

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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 mining and fastener related photos plus the piper that entertained guests of the Eskom Hot Dip Galvanizing Awards event by walking among the guests at the start of the evening.*

Hot Dip Galvanizing – Adding value to Steel

Executive Director's Comment

As we move towards the end of 2006, a brief review of the past year would seem to be in order.

Without doubt, 2006 has been a year filled with a great deal, and a large variety of different activities, for the Hot Dip Galvanizers Association.

In reviewing the year, my immediate impressions are of a year where we have experienced a significant increase in demand for hot dip galvanizing, and at the same time, dramatic zinc price increases. We have also seen a world shortage of zinc, due to International market demands, mainly from China. It is significant that even with the increases in the international price of zinc, engineers continue to recognize the corrosion control benefits provided by hot dip galvanizing. It is also significant that the local price of hot dip galvanizing remains competitive against the other methods of corrosion control. This benefit is further highlighted should one conduct a simple life cycle cost analysis, which will demonstrate the value of hot dip galvanizing as a corrosion control system.

Association staff have been actively engaged in formal technical presentations, road shows, technical seminars, numerous site visits, as well as reporting on issues of coating quality, corrosion control methods, including and beyond the use of hot dip galvanizing and Duplex coatings. Earlier in the year, we published a technical information CD to be used by consultants, specifiers and fabricators on the benefits, design, and appropriate use of hot dip galvanizing and Duplex coatings. Additional free copies of this CD are available from the Association offices. A visit to our website will allow interested parties to view, and if necessary download, back-issues of all our magazines, as well as numerous case studies and other technical information.

Current indications are that 2007 will be just as busy with numerous development projects under construction. To all our supporters, readers of our magazine, consulting engineers, fabricators and project developers, may we wish you well for the coming festive season and a successful new year.

Bob Wilmot

Note from the Editor

There was a time when specifiers believed that a hot dip galvanized coating would be inadequate for the protection of steel in corrosive underground environments, while paint was the automatic choice for both underground and less corrosive surface applications. This misconception was no doubt due to a lack of appreciation of the substantial cost of maintenance painting during the service life of the structure. By monitoring the performance of the hot dip galvanized coating on structures which have been in service for a number of years, it is possible to provide guidelines for the benefit of specifiers, including reliable predictions of the service life of hot dip galvanizing and when to provide added protection by means of an organic coating.

The magazinc starts off with a pictorial account of the Eskom Awards, our annual gala evening where honoured guests, members and their customers were entertained by the well known comedian Marc Lottering.

The features for this issue are Mining and Fasteners, with the former being introduced with “Hot dip galvanized steel in the Mining Industry” by Bob Andrew a Consulting Value Engineer and Honorary Life Member of this Association including several case histories, where we show the performance of the coating in arduous conditions.

Fasteners again include a matrix of what is available in hot dip galvanizing and where they may be sourced?

Duplex Coatings includes a reader's response to the previous article on “How to select Zinc Silicate Primers”, sent in by Rob Watson of International Paint. The debate of long-term cathodic protection by an inorganic zinc rich paint ranges on!

The “Coating Report”, addresses the hot dip galvanizing of lightweight mesh and the lack of communication with regard to the customers expectations and the galvanizers assumptions in understanding his customers needs.

Our guest writer discusses Johnny Cash's “Piece by Piece Motor Car and Knowledge”, whereas Miss Conception addresses “The hot dip galvanizing process has a deleterious effect on special steels?”

In Walter's Corner, Walter discusses “The Introduction and History of hot dip galvanizing to the Mining Industry”.

I am extremely happy to see that we have several comments from members, in “Members News”, including Owen Tennant of Zinc Corporation of South Africa, setting the record straight with regard to a zinc shortage in SA.

Should a reader wish to comment on the contents, wish to express an opinion or provide us with an article, kindly contact me - enjoy the magazinc.

Finally, even though the magazinc should be on your desk a month away from the festive Season, on behalf of the HDGASA may we wish all our readers a safe, happy and healthy festive season, may you all return to work refreshed for a prosperous 2007!

“Magazinc” no its not a spelling error it just fits in well with “Zinc”

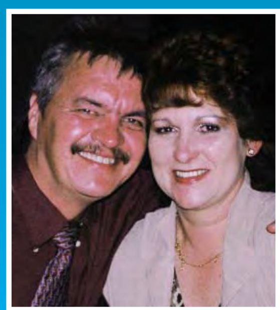
Terry Smith

Photos taken at the recent annual Eskom Hot Dip Galvanizing Awards Evening include the presentation of the Association's Honorary Life Membership Award to Bill Garvie of Galvadip for his contribution to the industry and on the occasion of his retirement from the industry (top left), some of the award winners and a number of our esteemed guests.





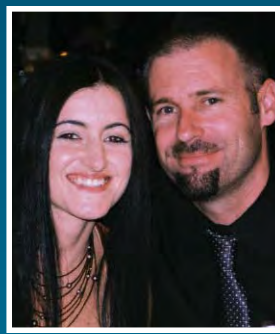


Eskom Hot Dip Galvanizing Awards Evening 2006











The Architectural Category winner in this years Awards event was Mitchells Plain Transport Interchange and as most of the recipients could not attend the official event, an informal gathering was held at the site where Maddie Mazaza (4th from the left, standing), the Director of Transport for Cape Town, handed out the award certificates.

Hot dip galvanized steel and mining

Bob Andrew, who currently practises as a value engineer, is an honorary life member of this Association and well known in the mining industry, sums up his view based on his extensive experience of the performance of hot dip galvanizing in the mining industry.

Introduction

One of the disadvantages of hot dip galvanized steel is that it is most commonly perceived as a protective coating applied to steel, which it indeed is, but totally different from other types of protective coatings. Because of this, hot dip galvanized steel is generally compared to other forms of coatings, especially protective paint coatings.

In the mining industry, where atmospheric corrosive conditions generally always occur to a greater or lesser extent, it has been proved that hot dip galvanized steel is a most appropriate material of construction and will generally out perform all other types of economically and technically acceptable protective coatings under virtually all circumstances in which corrosive conditions are present.

The only apparent disadvantage that hot dip galvanized steel has is that its procurement, or supply chain, is often perceived to be highly complex and, in the eyes of the owner and user, problems arising during procurement that are capable of increasing the risk to the project in terms of schedule, budget and quality can be unacceptable constraints.

Advantages of hot dip galvanized steel in mining

Hot dip galvanizing, affords steel with corrosion protection, in a wide variety of mining environments, by means of the presence of a surface layer of pure zinc and zinc-iron alloys. In contact with zinc, steel is cathodically protected on account of a potential difference forming between steel and zinc in the specific environment. In this way, the zinc and the alloys on the steel surface are sacrificially attacked by the environment for as long as they are present on the surface, with the steel itself exhibiting no corrosion. The corrosion mechanism is enhanced by chemical reactions between zinc and oxygen or carbon dioxide in the environment to form various zinc oxides or zinc carbonates that effectively seal any pores in the zinc layers. The cathodic protection capability of the zinc or zinc alloys in contact with the steel also provides protection at points where discontinuities in the zinc layers exist. This capability provides the hot dip galvanized steel with a significant level of tolerance against manufacturing defects or mechanical damages that arise during the steel erection process. The capability is also extremely valuable at protecting the steel at coating defects that have arisen from mechanical damage during service. Another significant feature of hot dip galvanized coatings, when compared to other forms of zinc coatings, e.g. zinc metal spray, electroplated zinc, as well as other types of protective coatings, e.g. paint coatings, rubber linings, etc, is that the bond between the hot dip galvanized coating and the underlying steel surface is a 'metallurgical' or diffusion type of bond in which zinc diffuses into the surface of the base iron as a result of the hot dip galvanizing process in which steel is immersed into a bath of molten zinc. All other commonly used protective coatings depend on a superficial or adhesive type of bond.

In underground mining conditions, including vertical and inclined shafts, which are probably the most corrosive of all mining conditions, the tolerance of hot dip galvanized steel to pre- and post- erection damage is especially important. Routine maintenance of steel, whether replacement or refurbishment, is in most cases virtually impossible owing to the conditions under which such maintenance needs to be performed, including accessibility, and the extremely limited periods that can be allocated to maintenance. Any major refurbishment or replacement of steel in service will undoubtedly necessitate production downtime and economic losses. The ability of hot dip galvanized steel to tolerate unavoidable damage to the zinc coating, either by production circumstances or arising from mechanical activities, provides hot dip galvanized steel with a valuable capability of achieving long service lives with minimum maintenance costs and minimum production losses.

Although the conditions in surface facilities, like ore processing plants and material handling installations, are less corrosive, the capability of hot dip galvanized steel to produce minimum maintenance and production costs are still vitally important. In most surface plants where hot dip galvanized steel has not been used or cannot be used, e.g. where highly acidic liquid or gaseous conditions are present, regular refurbishment or replacement of steel can represent a very significant portion of the installation's operating expenditure.

The special characteristics of mine shaft conditions during both installation and operation, e.g. the special stage-wise processes that are required during installation, the extreme difficulty in carrying out maintenance during operation, the long expected life of the mine shaft which can often be in excess of 25 years and the highly corrosive nature of large sections of the shaft are well accommodated by the use of hot dip galvanized steel. Test work as well as experience has shown that hot dip galvanized steel is both technically and economically superior to most other alternative materials or corrosion protection systems. Where hot dip galvanized steel is used for mine shaft steelwork, the benefits of the material make a very important contribution to the profitability and safety of the mining operation.

Painted steel

Unlike hot dip galvanized steel, painted steel, generally irrespective of the paint system used, does not tolerate damage and in corrosive mining conditions will be highly susceptible to corrosion. Unlike other conditions where painted steel, or paint coatings in general, are beneficially used, e.g. in buildings, residential homes or for roof cladding, in underground mining conditions and other mining conditions like ore processing plants, painted steel will require regular and frequent maintenance to the coating in the form of either repair of the coating or replacement of the coating. As stated previously, in these conditions, maintenance is often impractical, very costly and, importantly, inefficient, as the conditions are far removed from those optimally required for repainting. The conditions under which maintenance has to be performed are very different from those under which the original coatings were applied. In the case of shaft steel, damage to the coating can occur to erection or construction and accordingly corrosion could be initiated before the installation has even been commissioned. Even if a very optimistic view is taken, any calculation of life cycle costs, which includes the predicted future maintenance painting routines, if this is possible, will be high and very much higher than comparative life cycle costs for hot dip galvanized steel.

Local damage to protective paint coatings will initiate localised corrosion, the final consequence of which is corrosion pitting. Corrosion pitting, especially where relatively thin gauge steel is used, is extremely concerning as it is difficult to monitor and negates the concept of a 'corrosion allowance' which assumes general or uniform corrosion. A very good example of this is the case of shaft buntons or hollow sections used for shaft guides. Here, hot dip galvanized steel has a major benefit in that the inner sections are zinc coated. Where welds may contain defects, or where mechanical damage causes perforations, the subsequent ingress of water to provide stagnant water conditions are extremely harmful and can only be efficiently protected against by the interior zinc coating.

Painted steel is generally not an appropriate material of construction for the harsher mining conditions like underground shafts and haulages as well as for most types of ore processing plants and material handling facilities. If painted steel is used for these conditions, the life cycle costs are usually very high as are the production, economic, safety and environmental risks.

Procurement of hot dip galvanized steel

As stated previously, the only apparent disadvantage of hot dip galvanized steel in mining conditions is the perception by the user, owner or project manager, that the procurement process of the material is complex and difficult, and very likely to cause problems in achieving project objectives.

The complexity of specifying, designing, producing and transporting hot dip galvanized steel, where this complexity refers to the number of players in the process and the relationships between the players does, indeed, complicate the procurement process. Unless the process is properly managed and controlled, problems will undoubtedly occur, such as late delivery times, articles getting lost or misplaced, inappropriate fabrication processes that lower the efficiency and effectiveness of the coating and galvanized articles being severely damaged in the transport process. Effective management of the procurement process is essentially based on ensuring that the relationships between all parties are 'open' so as to allow an effective exchange of information. In most cases where such problems have occurred, it is generally because information and knowledge has not been properly disseminated to all parties. In too many cases, the fabricators do not even know that the steel they are fabricating needs to be hot dip galvanized. It is obvious that in these cases, the necessary fabrication steps, like dressing the welds, ensuring adequate ventilation holes, eliminating tight crevices that may preclude the entry of molten zinc, having down-turned sections instead of up-turned sections to avoid solid and liquid accumulation during service, are applied. In many cases too, transport and site storage of the hot dip galvanized steel products have caused unacceptable defects, which in the bigger picture are really the result of poor communication between the project manager and the transport and erection contractor and not per se transport or erection incompetence.

Conclusion

In the experience of the writer, hot dip galvanized steel has proven to be a most superior material of construction in a wide range of structural steel applications in a wide range of mining conditions. Only where highly acidic or 'intense' chemical exposures are present, such as sulphuric acid plants, plants where a high level of condensable sulphurous gases exist, such as base metal smelters, chemical and reagent storage areas and plants which have a high level of acidic gas emissions, e.g. base metal refineries and chlor-alkali plants, should hot dip galvanized steel on its own not be considered. In underground mining conditions, the superiority of hot dip galvanized steel produces very favourable life cycle costs for maintenance and/or replacement and low risks of steelwork failure. When 'failure' of hot dip galvanized steel is reported it is highly likely that the cause of failure is not related to the properties of the hot dip galvanized steel but rather as a result of some inefficiently managed aspect of the procurement process.

Bob Andrew can be contacted at anneve@iafrica.com

Moab Khotsong

(Vaal Reefs No. 11 shaft)

The application

Having joined the Association and Walter Barnett, then the Executive Director in 1996 and his involvement with Errol Drake the Engineering Manager of No. 11 shaft as it was then called, I was introduced to the real world of inevitable corrosion in mining and preventative measures to curtail this often times costly phenomena. Errol considered using hot dip galvanizing for the protection of the mine's shaft guides and buntons, over a fairly lengthy period. Finally when the decision was taken, a shuttle service between the mine (where the uncoated shaft guides were lying) to the galvanizer and then to the steelwork contractor, who cut and marked the shaft guides in Potchefstroom, and finally back to the mine, was undertaken to ensure fast tracking and efficient use of transport. The hot dip galvanized coating thickness on the shaft guides, because they were free of mill scale and fairly rusted after being in the veld for about two years, would in all likelihood attract a fairly thick hot dip galvanized coating and because of this the acceptable coating thickness was limited to a maximum average coating thickness of 300µm. A maximum coating thickness has never been stipulated in any general hot dip galvanizing specification, even the SABS 763, which was then in use. The limitation of the coating was considered necessary to prevent brittle coatings, which would be more prone to mechanical damage. The buntons, which were new, resulted in a coating thickness of about 250 to 280µm.

As the fixing method of the buntons and angle cleats called for a Huck type of bolt, which when arrived were reported to be only mechanically plated with a coating thickness of about 25µm. We knew this would not last anywhere as long as the bunton and shaft guide coatings. After discussion it was decided to generously over coat all these bolts with two coats of a coal tar epoxy after assembly, resulting in a duplex coating, which most probably would considerably extend the service life of the bolts.

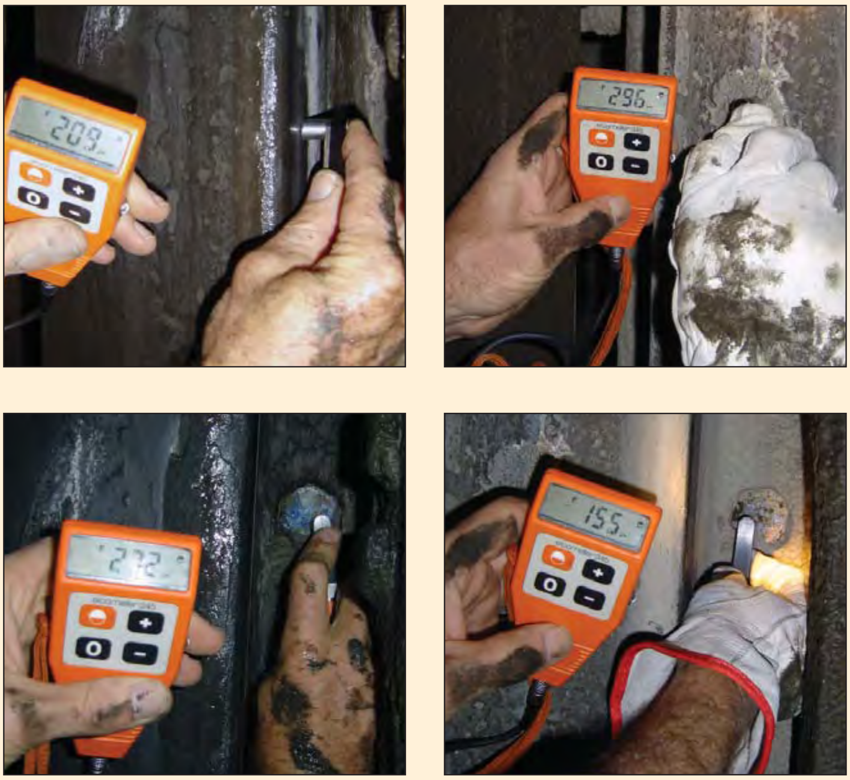
Hot dip galvanized shaft guides correctly laid out on site, awaiting installation in the shaft.

Coal tar epoxy was selected for its resistance to wet conditions, likely to be encountered in the mine.

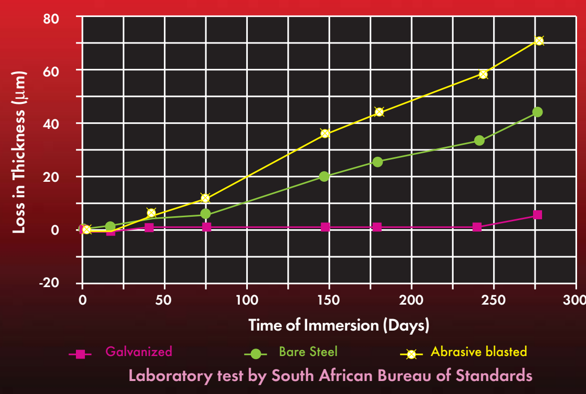
Due to stringent straightness tolerances in both planes of the shaft top hat guide, many of the shaft guides had to be straightened after hot dip galvanizing in a special machine made particularly for this purpose, this took place with good results.

Environmental conditions

As we did not know what the ultimate underground environmental conditions of the mine would likely be, we decided to undertake some accelerated tests using the waters of the mine. The South African Bureau of Standards (SABS) assisted us to test hot dip galvanized and uncoated steel samples in natural and service mine water. The natural mine water came from No. 11 and the service



Coating thickness indicated on various parts of the shaft guides, proved that the original predicted service life of 25 years would be achieved.



DETERMINANDS	METHOD REF.	RESULTS	
		NATURAL	SERVICE
pH at 25°C	SABS11	8.9	7.3
Conductivity at 25°C in mS/m	SABS 1057	157	801
Dissolved solids at 180°C in mg/l	SABS 213	821	5 720
Calcium as Ca in mg/l	SABS 1265	9.7	502
Magnesium as Mg in mg/l	SABS 1265	6.6	50
Sodium as Na in mg/l	SABS 1050	300	1 210
Potassium as K in mg/l	SM 3500	7	55
Chloride as Cl in mg/l	SABS 202	348	1 270
Sulphate as SO4 in mg/l	SM 4500	20	1 700
Total alkalinity as CaCO3 in mg/l	SM 2320	193	47
Langelier index at 20°C	No Method	+0.7	ND (1)
Ryznar's index at 20°C	No Method	7.5	ND (1)

ND (1) – Not determined due to high dissolved solids – above 1 000mg/l

Average loss of coating thickness graph - service mine water (above left) and analysis of natural and service mine water table (above right).

The hot dip galvanized coating thickness on station steelwork proved to be in good condition.

water from No. 8 shaft. It was felt that subjecting the samples to these two water types over a period of nearly two years, would provide the desired results on which to predict the corrosion rate of zinc and hence recommend the ultimate service life of the coating. *See water analysis table and coating performance graph.*

Our findings

Installation of the shaft steelwork took place from early 1997 and this survey of the coatings and case history was undertaken in September 2006, about 9 years after installation. The hot dip galvanized coating on some of the station steelwork and some pipework was showing signs of corrosion but the main water pipes, shaft guides and buntons are in remarkable condition, despite the rather heavy calcerous layer that has over the years been deposited on the components and had to be removed in order to measure the coating thickness. The coating inspections took place on four different levels in the mine.

The coating thickness on shaft buntons at four different levels were inspected but as they were similar in residual coating thickness, only two have been reported. The calcerous growth in most instances was removed prior to measuring the residual coating thickness.

Conclusion

Although the conditions underground can alter over the years for a number of reasons, the coating on the shaft guides and buntons has stood up to the arduous mining conditions and will provide the expected life originally predicted at about 25 years with no maintenance. The mechanically coated Huck type bolts will in the medium term have to be addressed in order to realise the desired life of the mine.

The Association wishes to thank Mr Bill Pautz and Mr Kevin van den Berg of AngloGold Ashanti for the opportunity to record this case study.

Bunton replacement project at TauTona Mine

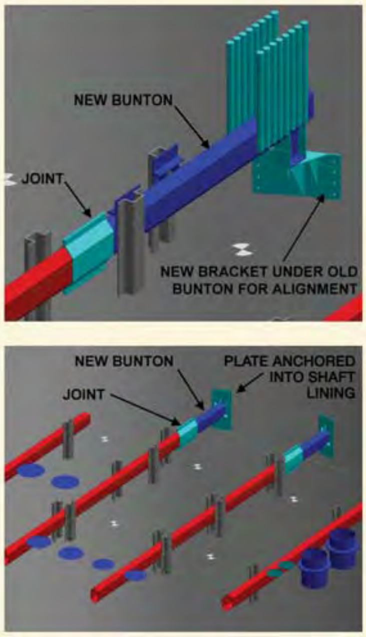
Introduction

TauTona Mine is one of AngloGold Ashanti's older and most profitable operations. It has exceeded its original planned life of a mine and plans are to extend the operating life. Due to its age, shaft infrastructure is being rehabilitated, which includes a bunton replacement program to ensure continued safe and efficient shaft operations.

Background information

TauTona Mine is a 3 shaft system comprising of a main, sub and tertiary shaft. In order to compile a bunton replacement program all the shafts had to be examined carefully to ensure that the bunton sets requiring immediate replacement were identified and prioritised accordingly. During inspections it was identified that most of the buntons were corroded near the shaft wall due to leaking water pipes and fissure water, while the rest of the bunton section was still in good condition. TauTona Mine has also implemented a SIMM program (Structure Inspection & Maintenance Management database) in order to identify and replace safety critical structures in the shaft.

Whilst the need to urgently replace badly corroded buntons was recognised by all stake holders, the Engineering staff at TauTona Mine also faced another challenge in terms of available shaft time allocated for maintenance purposes. The other challenge was that the rate at which buntons were being replaced could not keep up with the rate at which they were corroding. In light of this, Engineering Design Services was tasked to come up with a design to expedite the replacement of buntons in the shaft.



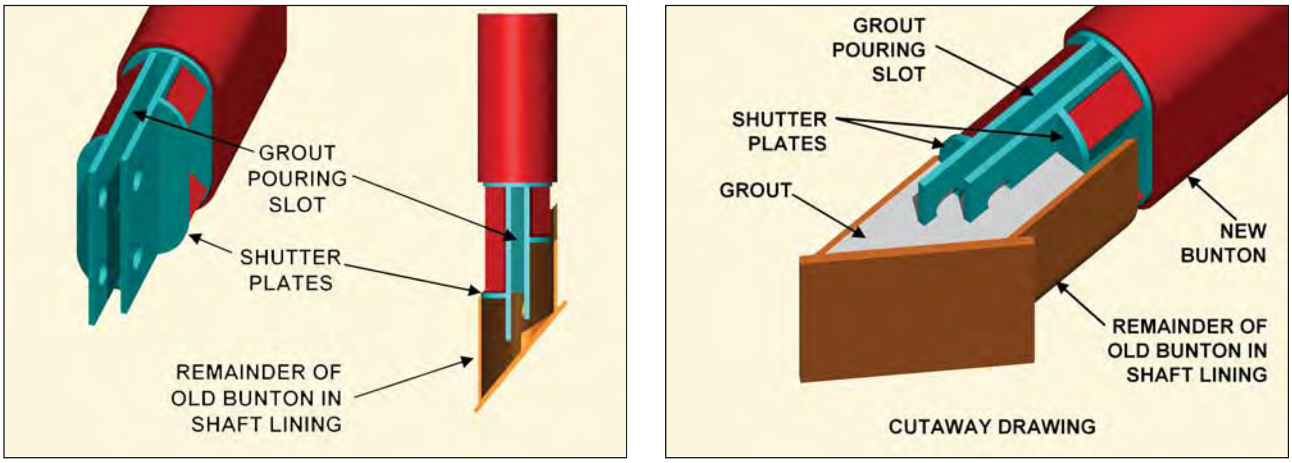
Various bunton configurations were considered.

Description of current bunton replacement methods

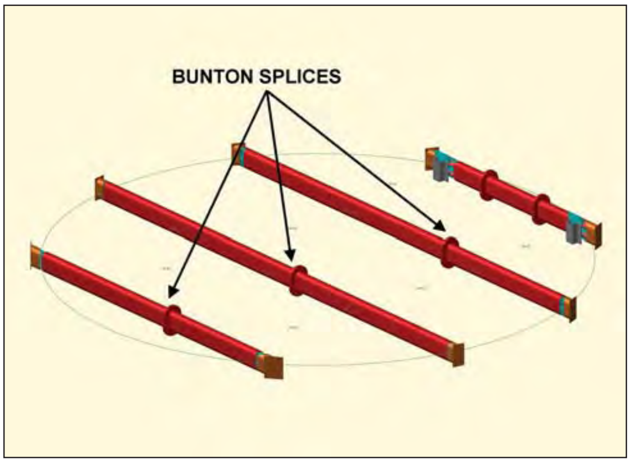
Over the years, basically two methods have been adopted to replace corroded or damaged buntons in the shaft. The one method requires that the existing bunton which is cast into the shaft side wall, be moiled out in order to remove the bunton. The other method was to drill holes into the shaft lining and to bolt a bunton bracket to the shaft wall. Once the

NEW DESIGN	CURRENT DESIGN
No moiling of bunton pocket required. Existing bunton is simply cut off to expose hollow bunton section in the shaft lining.	One shift required to moil one bunton pocket. When end plate is used, drilling of shaft lining requires one shift.
No shaft preparation time is required. All bunton preparation work is done on surface.	Shaft preparation includes moiling and/or drilling of shaft lining.
New design is self aligning.	Bunton needs to be aligned properly.
Shuttering is inherent in the design.	Shuttering required to install new bunton.
Small quantity of grout required which is easily mixed and poured on site.	Considerably more grout required and shuttering can only be removed after grout is set.
Effective use of shaft time as more buntons are replaced in the same time period.	More than one shift is required to replace one bunton.

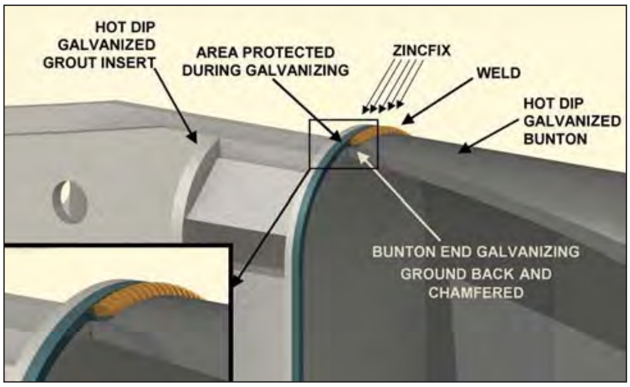
Summary of new design verses current design.



Although several bunton replacement methods were discussed the above idea proved to b the most cost effective.



A further view of the accepted bunton replacement method.



In order to facilitate the use of the already galvanized stock of buntons which were to be fixed to the new hot dip galvanized bunton brackets, welding had to be carried out and the damaged coating re-instated before transporting and installing underground.

bracket is installed the existing bunton would be cut off at the shaft wall and the new bunton would be bolted to the bracket. In some cases only the corroded part of the bunton is replaced and fixed to the existing bunton by means of a bolted splice plate.

Moiling of the bunton cast in pockets is a very tedious process and it takes the maintenance crew one shift to moil one bunton pocket. Once both ends have been moiled out, the new bunton has to be properly aligned before it is grouted in position. Due to the big opening, shuttering for the concrete has to be put in place and once the concrete is set, the shuttering has to be removed.

The other method of drilling is also a long and sometimes dangerous method of replacing buntons. Due to shaft space constraints drilling is often a difficult process and clearance from high voltage cables needs to be provided to ensure safety of maintenance personnel. The design of a much bigger bunton bracket is therefore required to clear the cables.

Description of new bunton bracket design

The new design is a much faster and efficient way of replacing buntons. The new design makes use of the remainder of hollow section bunton which is left in the shaft sidewall when the old bunton is cut off. The new bracket is designed in such a way that it fits into the hollow part of the old bunton. When the new bunton is placed in position, no alignment is necessary as the system is self aligning. Moreover no bulky shuttering is required as well as the amount of grout required is much less than the previous method. A non shrink pourable grout is then poured into a slot provided in the new bracket to fill all the cavities between the bunton bracket and the hollow section of the bunton in the shaft lining. AngloGold Ashanti's Civil Engineering department was consulted to ensure that the grout used in the design conforms to AngloGold Ashanti specifications and quality criteria. This method of replacing buntons has led to an efficiency improvement of 300%.

Specialised input from the Galvanizers Association was sought to assist the Engineering Design Services Department with the corrosion protection of the on site

A close-up photo showing the new bunton bracket welded to the bunton, ready for slinging down the shaft.

The bunton has now been cut off and the new bunton is ready to be installed

welding of the bracket to the new bunton.

From a design point of view welding of galvanized components has always been problematic and therefore needs to be avoided where possible. However, the mine has already in stock galvanized bunton sets, and therefore the bunton brackets had to be galvanized separately and then welded to the buntons. The solution from the Galvanizers Association was to protect the welding area on the bracket before it is galvanized and to paint the area with a coating of Zincfix after the bracket is welded to the bunton. This will ensure that there is no weakness in the design as far as corrosion protection is concerned.

Editorial Comment:

Repair of the hot dip galvanized coating will always result in lessor protection in comparison to hot dip galvanizing. However, in our experience, limiting the repaired area as well as making use of a tried and tested product, such as Zincfix, will always provide a reasonable durable life. We wish to thank Moses Madondo and Benjamin van Rooyen of AngloGold Ashanti for this article.

PGM Concentrator – Case History

The application

Although the hot dip galvanized steelwork at this PGM Concentrator is not that old (having been built in 1996/1997) in terms of the coating life of some Eskom pylons (60 years), the coating performance is no less significant in that there are several relatively corrosive micro environments at the concentrator, which have had a significant effect on painted surfaces whereas hot dip galvanizing in these areas has performed admirably.

Photo 1: Comparison between hot dip galvanizing and paint in the reagent area.

The original decision to hot dip galvanize the steelwork at the concentrator (some 6 500 tons) was partly based on the coatings performance in many previous underground applications where the environment is considered to be significantly more corrosive.

Several coating evaluations have already taken place at the Concentrator over the last 9 years, proving that the choice of coating in all circumstances was the correct one at the time.

Overall coating performance

In general terms, the performance of the coating in all the areas of the plant including the Milling, Flotation, Crushing Plant Conveyor Steelwork, Screening and Reagent Areas has been significant. Apart from complete protection of the steel, the rate of deterioration of the zinc coating thickness has been extremely low. By taking coating thickness measurements we have been unable to detect any significant removal of the coating and the steel in most instances is in the same condition as when it was installed. While the design life of the hot dip galvanized steel was set at 25 years, it is apparent that apart from any unforeseen circumstance arising in the future, the future life of the steel will be well in excess of the design life.

Environmental conditions

The reagent area

Because of the concerns and possible doubts, as well as lack of data, regarding the long term performance of hot dip galvanized steel in the reagents area on account of the presence of relatively small quantities of alkaline and acidic reagents, the specification for steel in this area excluded the use of hot dip galvanizing. Instead the use of a 3-coat vinyl co-polymer system over a Sa2½ abrasive blasted surface was preferred.

Photo 1 shows that in comparison to the coating on the hot dip galvanized bolt (128µm), the performance of the paint system has been marginal. Although the use of hot dip galvanizing in this area was excluded, some installed components and structures were hot dip galvanized and have performed extremely well. The performance of the coating in this area suggests that

Damaged coating in reagent loading area.

Coating thickness at damaged area in reagent loading area *(#1)*.

Hot dip galvanized water pipe in the reagent area.

Coating thickness of a hot dip galvanized water pipe in the reagent area.

Coating damage and inadequate repair in the reagent loading area.

hot dip galvanized steel would have been the better option than the paint system originally selected.

Due to the fact that reagents may be altered over the life of the plant and that other concentrators may use a different suite of reagents, it may be more prudent in other cases to consider a duplex coating system.

The milling area

Hot dip galvanizing has performed extremely well in this area, which is an open building with no roof. In other similar plants where open mill buildings are used, painted steel structures undergo relatively high corrosion and frequent maintenance is required.

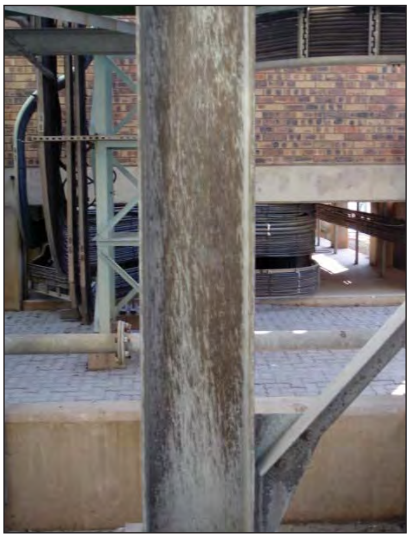
The flotation building

Flotation plants are usually considered the most corrosive areas in typical platinum concentrators. Spillage and the generation of corrosive atmospheres often give rise to high rates of corrosion of painted steel.

Coating thickness on structural steel adjacent to the reagent area.

Underground steelwork

The hot dip galvanized steelwork in these areas was, due to time constraints not evaluated but in past surveys the performance of the coating in these areas has been equal to that achieved in the plant environment.



Hot dip galvanized structural steel adjacent to the reagent area.

Our findings

Having walked throughout the plant, apart from a bit of discoloration at a welded and non-repaired area on a bracket and a damaged coating in

Hot dip galvanized structural steel supporting the crushing plant conveyor.

Hot dip galvanized structural steel in the milling area.

Hot dip galvanized structural steel in the wet screening area.

Coating thickness on the hot dip galvanized nuts on the crushing plant conveyor steelwork.

Coating thickness on structural steel in the milling area.

Coating thickness on structural steelwork in the wet screening area.

Coating thickness on the hot dip galvanized crusher conveyor steelwork.

the Reagent Loading area, both of which should ideally be repaired, the coating in general is performing extremely well. Coating thickness readings ranged from 59µm # on water piping to 267µm on structural steelwork. The specification requires that for structural steel the local coating thickness should be 70µm and the mean 85µm.

 # – Hot dip galvanizing of plain ended tube is done in accordance with SANS 32 (EN 10240) *which requires a minimum coating thickness of* 55µm *for* A1 & A2 *coating qualities for the conveyance of gas and water.*

Conclusion

The hot dip galvanized coating in all the areas of the concentrator has performed exceptionally well and provided the conditions at hand do not change for the worse in the future, the coating should provide a service free life of well in excess of the original design life of 25 years.

#1: In most instances where hot dip galvanizing gets damaged at edges due to excessive coating thickness, a residual iron/zinc alloy layer remains which generally measures between 25 and 60µm.

#2: The Association wishes to thank Mr Jurie van Brakel and Mr Ralph Mophuting of Amplats for their assistance in recording this case study.

Hot dip galvanized structural steel in the floatation area.

Coating thickness on structural steel in the flotation area.

Douglas Colliery

Coating evaluation of overland conveyors V3, V4 and V5

The application

As overland conveyors form the lifeblood of the supply of material used in many process plants, their general lack of future coating maintenance due to the dusty conditions at hand and unlikely adequate surface preparation for maintenance painting, coupled to their often extraordinary length, suggests that a material or coating that can offer extensive years of service free life, be used.

The V3, V4 and V5 overland conveyors at Douglas Colliery, are such a system. First reported in the ***Foreword*** of our booklet, "Steel Protection by Hot Dip Galvanizing and Duplex Systems", the original of which was produced in January 1997, these conveyors are estimated to be in excess of 20 years old.

Although the hot dip galvanized coating is performing admirably, (see our findings) the coatings on both the idler frames, which are painted and the fasteners, which are zinc electroplated, are in the process of failing.

Environmental conditions

From a general atmospheric corrosion perspective the conditions at hand are most probably a C1 to C2 category – ISO 9223 (Interior – Occasional Condensation; Exterior – Exposed Rural Inland), suggesting that the corrosion rate of zinc is about 0.1 to 0.7µm per year. In addition to the general atmospheric conditions, coal dust and particularly coal ash, coupled with moisture will be corrosive to zinc and therefore the coating may be prone to a more severe attack by way of corrosion.

General view of Douglas Colliery.

Conditions at hand at this site indicate that the corrosion of zinc is slow and that the hot dip galvanized coating is likely to carry on performing in a manner that has become the norm, expected from most specifiers, in their use of a hot dip galvanized steel.

Our findings

Having visited several parts of the V3, V4 and V5 conveyor steelwork we found the hot dip galvanized coating on the horizontal and vertical members to be in excellent condition, with coating thickness readings varying between 117 to 279µm with a mean coating thickness of 140µm. The coating thickness readings are still well in excess of that required by the specification SANS 121, for this thickness of steel. All together 108 coating thickness readings were taken on both the horizontal and vertical angle support steelwork.

Conclusion

The hot dip galvanized coating on the overland conveyor steelwork has over the 20 year period, performed exceptionally well and if required, based on the residual coating thickness, will provide a further 40 to 60 years of maintenance free life. If necessary, the painted idler frames, which are showing signs of corrosion, may be selectively removed, abrasive blasted to remove the residual paint coating and then hot dip galvanized, providing a durable, predictable coating of extended maintenance free life. All fasteners if necessary should soon be replaced with hot dip galvanized equivalents if it is decided that the idler steelwork is hot dip galvanized.

The Association wishes to thank Mr Ivan Pepler for his assistance and to Mr Mike Silcock both of BHP Billiton for the opportunity to record this case study.

The V3 overland conveyor has been exposed to the elements for in excess of 20 years.

The hot dip galvanized structural steelwork supporting the overland conveyor at an access road, is still performing exceptionally well after 20 years of service.

Coating thickness readings taken on the supporting structural steelwork at the access road were still in excess of that required by the specification.

Coating thickness readings taken on all the horizontal and vertical overland conveyor steelwork were still in excess of that required by the specification.

Bolt & Engineering Distributors

One of today's major national distributors of fasteners, tools and equipment started off from humble beginnings in small rented premises in Wadeville, Johannesburg, in 1983.

Since then, Bolt & Engineering Distributors Group has built a successful business serving the gold, coal, diamond and platinum industries as well as the structural steel, engineering and agricultural sectors. The company has identified the needs of the businesses it serves and built its reputation on prompt delivery, service reliability and competitive pricing structures.

Each operation countrywide has its own fleet of delivery vehicles and on an average day the fleets cover over 2 500 kilometres, delivering over 40 tons of goods. While the in-house Service Centres are authorised to repair and service all products sold, the company also hold a comprehensive range of spares ex-stock, which assists in achieving quick turnaround times.

Bolt & Engineering Distributors' core specialisation is in fasteners. They hold a vast, quality range of both standard and specialised nuts, bolts, screws and anchors. The Group also sells a selection of allied products. These include handtools, powertools, pneumatic tools, compressors, welding equipment, safety equipment, bearings, industrial paints and more. More than 16 000 items in various materials are kept in stock and there is 95% stock availability on all products.

FEATURES 2007

FEBRUARY / MARCH
Safety and security incorporating sheeting; wire; palisade fencing; guard rails; steel wire ropes; etc.

MAY / JUNE
Architectural, agricultural and the world of hot dip galvanizing around us, also incorporating stadiums; staircases; furniture; wine industry; conveyance piping; heat exchangers; rebar.

AUGUST / SEPTEMBER
The Annual Awards Event; masts and poles; traffic signs and sign gantries; scaffolding.

NOVEMBER / DECEMBER
Mining and quarries; gratings; overland conveyors; fasteners.

Made in Africa, for Africa

One of the proud partners of The Foundation for the Development of Africa, Tel-Screw Products is a company backed by 35 years of experience and led by a team of highly qualified artisans.

The company manufactures special and standard fasteners as well as a large range of fastener-related products. Many of Tel-Screw Products' clients require stringent corrosion-resistant products and for these customers the company offers hot dip galvanized products to SANS 121 (ISO 1461).

All hot dip galvanized products are sent to SABS approved galvanizers and the work carried out is monitored by Tel-Screw Products using state-of-the-art electronic thickness testing equipment. The company also carries a wide range of hot dip galvanized products including bolts, nuts, washers, U-bolts, eye bolts, hook bolts, studs, running studs, foundation bolts, threaded rod and chemical anchors.

Special products can also be manufactured, hot dip galvanized, assembled and fitted at short notice, including a single, special hot dip galvanized fastener. Tel-Screw Products is proud to sell only South African products, using South African suppliers.

The difference between zinc electroplated and hot dip galvanized fasteners

The difference between zinc electroplated (also called "electro galvanized" and "galvanized") and hot dip galvanized are the following:

Zinc electroplated

- Plating is achieved by electrolysis whereby in simple terms an anode is used to supply the plating material into an electrolyte, such as zinc cyanide, the fasteners are the cathode and when the circuit is closed and a current is produced the plating takes place.
- Electroplating is usually limited to about 20 microns in coating thickness but in our experience due to inadequate control, etc. coatings may vary from about 5 to 15 microns.
- In the normal sequence of events a zinc coating will oxidise (zinc carbonate film) when exposed to carbon dioxide and moisture from the atmosphere. In this conversion, which is generally required for any reasonable service life, the conversion uses about 1 to 2 microns of the coating in the conversion, so if the coating is initially thin, the conversion will further reduce the coating life.
- Zinc electroplating is shinny and silver and appears as a more aesthetically pleasant surface.
- Nuts are coated with a similar coating on the inside of the threads.
- Zinc electroplating including Cadium is relatively soft and will damage to the substrate under extensive mechanical stress by a spanner.
- Cadmium coated electroplated bolts are not recommended due to environmental concerns. Should the coating be cut or welded the

The bolt and nut on the left are zinc electroplated and may look better but will corrode quicker than the hot dip galvanized bolt and nut on the right.

absorbed fumes can have disastrous health effects on the worker.

Hot dip galvanized

- Hot dip galvanizing is achieved by dipping fasteners into molten zinc at about 450°C at which time a chemical reaction takes place, which results in a metallurgical reaction and bonding of the coating to the steel. The coating comprises a series of hard abrasion resistant iron/zinc alloy layers overcoated by relatively pure zinc on the outside surface.
- Minimum coating thickness is about 45 microns for fasteners of M12 and less and 55 microns for above M12. Although not a requirement in terms of the specification SANS 121 (ISO 1461), it is recommended by this organisation that the coating on the bolt be limited to 70 microns. This is easily tested by turning an oversized nut onto the bolt, should this be relatively easy, the coating is generally acceptable.
- Nuts are usually hot dip galvanized as blanks and then oversized to accommodate the additional coating thickness on the bolt. Although the coating on the nut thread is removed when oversizing takes place this does not effect the long term corrosion performance of the fastener due mainly to the absence of oxygen at the thread interface when tightened as well as the surrounding zinc coating affording effective long term cathodic protection.
- The removal of about 2 microns of zinc in terms of the zinc carbonate conversion does not have a major effect on the long-term performance of the coating.
- The iron/zinc alloy layers provide an additional 30% better protection than that provided by pure zinc in most atmospheres.
- Hot dip galvanized fasteners are usually matt to dark grey in colour and slightly rougher and hence less aesthetically pleasing than the EP equivalents.
- The abrasion resistance provided by the hard iron/zinc alloy layers of hot dip galvanized steel (harder than mild steel) will not easily damage when subjected to mechanical handling by a spanner.

Coating thickness on the zinc electroplated nut is 14.4µm (in this instance about 6 times less protection than the hot dip galvanized equivalent).

Coating thickness on the hot dip galvanized nut is about 87µm.

The corrosion resistance of a zinc coated component no matter how applied is proportional to its coating thickness, in a particular environment. It therefore stands to reason that the thicker coating provided by the hot dip galvanizing process will last proportionally longer, in a given environment.

Types of fasteners and availability matrix

TYPE OF FASTENER	COMPANY	STEEL GRADE	SPECIFICATION	SPECIFICATION	AVAILABLE SIZES	HOT DIP GALVANIZED TO ORDER	HOT DIP GALVANIZED EX STOCK
LOCKING NUTS							
Half Lock Nuts	Bolt & Eng Distributors	MS				Yes	
	Global Bolt & Tool	MS4.6/Gr: 8			M5 – M36	Yes	
	Tel-Screw Products	MS/HT			M8 – M48	Yes	
	WLS Fastener Manufacturing Co. cc	MS/HT			M8 – M36	Yes	Yes
Hard Lock Nuts	Bolt & Eng Distributors	Gr: 8	No Spec			Yes	
Castle Nuts	Bolt & Eng Distributors	Gr: 8	Various			Yes	
	Global Bolt & Tool	Gr: 8	Various		M8 – M64	Yes	
	Tel-Screw Products	MS/Gr: 8				Yes	
Steel Hex Lock Nuts	Bolt & Eng Distributors	MS				Yes	
	Global Bolt & Tool	MS4.6/Gr:8			M6 – M36	Yes	
	Tel-Screw Products	MS				Yes	
	WLS Fastener Manufacturing Co. cc	MS				Yes	
Crimped Nuts	Global Bolt & Tool	Gr: 8			M12 – M36	Yes	
	Impala Bolt & Nut	MS				Yes	
	Tel-Screw Products	MS			M8 – M48	Yes	
Flanged Crimped Nuts	Impala Bolt & Nut					Yes	
Locking Washers	Bolt & Eng Distributors		DIN 127			Yes	
	Global Bolt & Tool		DIN6797 – ext / DIN 6798 – int			Yes	
	WLS Fastener Manufacturing Co. cc					Yes	
Nyloc Nuts	Most suppliers	Most smaller size Nyloc nuts are imported and are only available as electroplated					
	Global Bolt & Tool		DIN 985			Yes	
	Impala Bolt & Nut		DIN 985				Yes
Cleeve Lock Nuts	Global Bolt & Tool		DIN 980			Yes	
Prevailing Torque Hex Lock Nuts	Tel-Screw Products	Gr: 8 & 10	DIN 980V			Yes	
NORMAL NUTS							
Hex OS Nuts	Bolt & Eng Distributors	Gr: 8	DIN 934				Yes
	Bolt & Eng Distributors	Gr: 10	SABS 1282			Yes	
	CBC Fasteners	Gr: 8	DIN 934	ISO 4032	M6 – M30	Yes	Yes
	Global Bolt & Tool	Gr: 4 & 8	DIN 934		M8 – M64	Yes	Yes
	Impala Bolt & Nut	Gr: 8	DIN 934		M8 – M30		Yes
	Tel-Screw Products	Gr: 8,10 & 12	DIN 934			Yes	
	Tel-Screw Products – HS Friction Grip	Gr: 8 & 10	DIN 6915			Yes	
	WLS Fastener Manufacturing Co. cc	MS/HT			M8 – M64		Yes
Hex Long OS Nuts	Global Bolt & Tool	HT Gr: 8	TSP		M6 – M16	Yes	
	Rawlplug South Africa	MS			M6 – M16	Yes	
	Tel-Screw Products	MS / HT	TSP		M8 – M48	Yes	
	WLS Fastener Manufacturing Co. cc	MS			M8 – M36		Yes
Shear Nuts or Anti-vandal Nuts	Bolt & Eng Distributors	MS	No Spec			Yes	
	Global Bolt & Tool	HT Gr: 8				Yes	
	Impala Bolt & Nut	MS					Yes
	Rawlplug Sou th Africa	MS			M8 – M16	Yes	Yes
	Tel-Screw Products	MS			M8 – M16	Yes	
	WLS Fastener Manufacturing Co. cc	MS			M8 – M24	Yes	
Flanged Nuts	Global Bolt & Tool	HT Gr: 8			M8 – M36	Yes	
	WLS Fastener Manufacturing Co. cc	MS			M8 – M16		Yes
WASHERS							
Thru Hardened Washers	Bolt & Eng Distributors		DIN 6916				Yes
	Global Bolt & Tool	HT Gr: 8	DIN 6916		M10 – M64	Yes	
	Tel-Screw Products		DIN 6916			Yes	
	WLS Fastener Manufacturing Co. cc	MS			M8 – M36		Yes
Flat Washers	Bolt & Eng Distributors						Yes
	Global Bolt & Tool	MS	DIN 125		M4 – M64	Yes	
	Impala Bolt & Nut		DIN 120/125		M8 – M30		Yes
	Tel-Screw Products				M8 – M56		Yes
	WLS Fastener Manufacturing Co. cc	MS			M8 – M76		Yes
Square Flat Washers	Global Bolt & Tool	MS			M12 – M24	Yes	
	Tel-Screw Products	Specially manufactured to order			M6 – M24	Yes	
	WLS Fastener Manufacturing Co. cc	MS			M8 – M30		Yes
Square Curved Washers	Global Bolt & Tool	MS			M10 – M24	Yes	
	Tel-Screw Products	Specially manufactured to order			M6 – M24	Yes	

Impala Bolt & Nut S.A. (Pty) Limited is a manufacturer of mild steel and hi-tensile bolts and nuts, ranging from M6 right up to M30 in diameter.

We have established ourselves over the years as a reliable and quality conscious manufacturer who strives for customer satisfaction with every order.
We specialise in hot dip galvanized bolts and nuts and have a very large stockholding of these items.

Impala Bolt also has a specialised fastener division which manufactures for the motor industry and any specials that you, the client, might have.
We are available at any time to be of assistance and offer sound advice as to what product best suits your application.

All items manufactured are also available in zinc plated / hot dipped / CAD and trivalent coating as per the motor industry standards.

Our dedicated sales team will gladly assist you with all your requirements.

IMPALA BOLT & NUT S.A. (PTY) LIMITED

Manufacturers of Industrial Fasteners

48 Nagington Road, Wadeville, Germiston
P.O. Box 14766 Wadeville 1422
Tel.: (011) 824-3925 • Fax: (011) 824-3803

TYPE OF FASTENER	COMPANY	STEEL GRADE	SPECIFICATION	SPECIFICATION	AVAILABLE SIZES	HOT DIP GALVANIZED TO ORDER	HOT DIP GALVANIZED EX STOCK
WASHERS continued							
Spring Washers	Bolt & Eng Distributors		DIN 127				Yes
	Global Bolt & Tool	MS	DIN 127		M4 – M64	Yes	
	Impala Bolt & Nut		DIN 127		M8 – M30		Yes
	Tel-Screw Products				M8 – M24		Yes
	WLS Fastener Manufacturing Co. cc				M8 – M36		Yes
BOLTS AND SCREWS							
Hex Head Screws	CBC Fasteners	MS	DIN 933	ISO 4017	M18 – M30	Yes	Yes
	CBC Fasteners	Gr: 8.8	DIN 933	ISO 4017	M8 – M30	Yes	Yes
	Global Bolt & Tool	MS4.6/HT Gr: 8	DIN 558 / DIN 933		M8 – M36	Yes	
	Impala Bolt & Nut	MS	DIN 658		M8 – M24		Yes
	Impala Bolt & Nut	Gr: 8.8	DIN 933		M8 – M30		Yes
	Rawlplug South Africa	MS	DIN 933		M6 – M12	Yes	
	Tel-Screw Products	Gr: 8.8/MS			M8 – M39	Yes	
	WLS Fastener Manufacturing Co. cc	MS/HT			M8 – M36		Yes
Hex Head Bolts and OS Nuts	Bolt & Eng Distributors	MS	DIN 601		M8 – M30	Yes	
	CBC Fasteners	MS	DIN 601	SABS 135	M8 – M30	Yes	Yes
	Global Bolt & Tool	MS4.6		Lengths up to 300mm	M8 – M36	Yes	
	Impala Bolt & Nut	MS			M8 – M30	Yes	
	Tel-Screw Products	MS			M8 – M39	Yes	
	WLS Fastener Manufacturing Co. cc	MS			M8 – M36		Yes
Hex Head Bolts and OS Nuts (High tensile)	Bolt & Eng Distributors	Gr: 8.8	DIN 933		M27 – M56	Yes	
	CBC Fasteners	Gr: 8.8	DIN 931	ISO 4014	M8 – M30	Yes	Yes
	Global Bolt & Tool	HT Gr: 8.8	DIN 931		M8 – M36	Yes	
	Impala Bolt & Nut	Gr: 8.8	DIN 931		M8 – M30		Yes
	Tel-Screw Products	Gr: 8.8/MS				Yes	
	WLS Fastener Manufacturing Co. cc	HT			M8 – M36		Yes
Large Dia Bolts & OS Nuts	Bolt & Eng Distributors		DIN 601/934			Yes	
	Global Bolt & Tool	MS/HT	DIN 601555 / DIN 931/934		M36 – M64	Yes	
	Tel-Screw Products	Gr: MS/8.8				Yes	
	WLS Fastener Manufacturing Co. cc	MS/HT			M39 – M76	Yes	
Cup Head Square Neck Bolts & OS Nuts	Bolt & Eng Distributors	MS	SABS 1143		M8 – M20	Yes	
	CBC Fasteners	MS	SABS 1143		M8 – M20	Yes	Selected
	Global Bolt & Tool	MS	DIN 603555		M8 – M16	Yes	
	Impala Bolt & Nut	MS	DIN 603		M8 – M16	Yes	
	Rawlplug South Africa	MS	DIN 603		M8 – M12	Yes	
	Tel-Screw Products	MS			M8 – M30	Yes	
	WLS Fastener Manufacturing Co. cc	MS			M8 – M20	Yes	
C/Sunk Square Neck Bolts & OS Nuts	Bolt & Eng Distributors	MS	SABS 1143		M12 – M24	Yes	
	CBC Fasteners	MS	SABS 1143		M10 – M20	Yes	No
	Global Bolt & Tool	MS	DIN 608555		M10 – M20	Yes	
	Impala Bolt & Nut	MS	DIN 605		M10 – M16	Yes	
	Tel-Screw Products	MS			M8 – M30	Yes	
	WLS Fastener Manufacturing Co. cc	MS			M10 – M20	Yes	
C/Sunk Nib Bolts & OS Nuts	CBC Fasteners	MS	SABS 1143		M12 – M24	Yes	No
	Global Bolt & Tool	MS Gr: 4.6	DIN 604555		M12 – M20	Yes	
	Impala Bolt & Nut	MS	DIN 604		M10 – M20	Yes	
	Tel-Screw Products	MS			M8 – M20	Yes	
	WLS Fastener Manufacturing Co. cc	MS			M12 – M24	Yes	
Friction Grip Bolts & Nuts	Bolt & Eng Distributors	Gr: 10.9S	SABS 1282		M12 – M30	Yes	
	CBC Fasteners	Gr: 8.8S/10.9S	SABS 1282	ISO 7411	M12 – M30	Yes	No
	Global Bolt & Tool	HT Gr: 8.8 – 10.9	DIN 6914		M10 – M20	Yes	
	S.A. Bolt Manufacturers	Gr: 8.8/10.9S			M12 – M30	Yes	
	WLS Fastener Manufacturing Co. cc	HT			M12 – M30	Yes	
Hex Socket C/Sunk Head Screws	Bolt & Eng Distributors	Gr: 10.9	DIN 7991		M8 – M24	Yes	
	Global Bolt & Tool	HT	DIN 7991		M8 – M24	Yes	
	S.A. Bolt Manufacturers	Gr: 10.9/12.9			M6 – M48	Yes	
	WLS Fastener Manufacturing Co. cc	HT			M8 – M24	Yes	
Lockbolts	S.A. Bolt Manufacturers Pins & Collars	Gr: 6.8/8.8			M12 – M24	Yes	
Pigtails – 1 &1¹/2 Turn	Bascol (Pty) Ltd	MS			M8 – M12	Yes	Yes
	Bolt & Eng Distributors	MS			M8 – M12	Yes	
	Global Bolt & Tool	MS			M16 – M36	Yes	
	Tel-Screw Products				M8 – M76	Yes	
	WLS Fastener Manufacturing Co. cc	MS			M8 – M24	Yes	
3m – Threaded Rod	Bascol (Pty) Ltd	MS/EN8			M10 – M64	Yes	Yes
	Bolt & Eng Distributors	MS			M8 – M36	Yes	
	Global Bolt & Tool	MS/HT	DIN 975		M6 – M36	Yes, from M8	

TYPE OF FASTENER	COMPANY	STEEL GRADE	SPECIFICATION	SPECIFICATION	AVAILABLE SIZES	HOT DIP GALVANIZED TO ORDER	HOT DIP GALVANIZED EX STOCK
			BOLTS AND SCREWS continued				
3m – Threaded Rod continued	Impala Bolt & Nut	MS/HT	DIN 975		M8 – M24	Yes	
	Tel-Screw Products				M8 – M36	Yes	
	WLS Fastener Manufacturing Co. cc	MS			M8 – M36		Yes
1m – Threaded Rod	Bascol (Pty) Ltd	MS/EN8			M10 – M64	Yes	Yes
	Bolt & Eng Distributors	DIN 975			M12 – M30	Yes	Yes
	Global Bolt & Tool	MS/HT			M5 – M36	Yes, from M8	
	Impala Bolt & Nut	MS/HT	DIN 975		M8 – M24	Yes	
	Rawlplug South Africa	HT			M5 –M30	Yes	
	Tel-Screw Products	MS			M8 – M36		Yes
	WLS Fastener Manufacturing Co. cc	MS			M8 – M36		Yes
HD Bolts (Foundation Bolts) & OS Nuts	Bascol (Pty) Ltd	MS/EN8			M10 – M64	Yes	Yes
	Bolt & Eng Distributors	MS	NO SPEC			Yes	
	Global Bolt & Tool	MS			M2 – M36	Yes	
	Rawlplug South Africa	MS/HT			M8 – M36	Yes	
	Tel-Screw Products	MS			M8 – M72	Yes	
	WLS Fastener Manufacturing Co. cc	MS			M8 – M72	Yes	
			CONCRETE ANCHOR BOLTS				
Rawlbolts	Rawlplug South Africa	5.8	BBA	All International	M5 – M24	Yes	
SPT Construction Anchors	Rawlplug South Africa		EU	All International	M6 – M24	Yes	
R-KEM Chemical Bolts	Rawlplug South Africa	5.8/HT	BBA		M8 – M30	Yes	Yes
R-KEX Chemical Bolts	Rawlplug South Africa	5.8/HT	BBA		M8 – M30	Yes	Yes
R-CAS Chemical Bolts	Rawlplug South Africa	5.8/HT	BBA		M8 – M30	Yes	Yes
R-HAC Chemical Bolts	Rawlplug South Africa	5.8/HT	BBA		M8 – M30	Yes	Yes
Express Anchor Bolts	Fischer Upat Fixings				M10 – M24	Yes	
	Global Bolt & Tool	MS			M10 – M20	Yes	
	Rawlplug South Africa				M6 – M24	Yes	Yes
Chemical Anchors & Threaded Studs	Bascol (Pty) Ltd	MS/EN8			M10 – M64	Yes	
	Bolt & Eng Distributors	EN8	NO SPEC			Yes	
	Fischer Upat Fixings					Yes	

TYPE OF FASTENER	COMPANY	STEEL GRADE	SPECIFICATION	SPECIFICATION	AVAILABLE SIZES	HOT DIP GALVANIZED TO ORDER	HOT DIP GALVANIZED EX STOCK
CONCRETE ANCHOR BOLTS continued							
Chemical Anchors & Threaded Studs continued	Global Bolt & Tool	MS			M12 – M20	Yes	
	Rawlplug South Africa	MS/HT			M8 – M30	Yes	Yes
	Tel-Screw Products	MS			M8 – M36	Yes	Yes
	WLS Fastener Manufacturing Co. cc	EN8			M8 – M30	Yes	Yes
Kalm Chemical Anchor Bolt	WLS Fastener Manufacturing Co. cc	EN8			M8 – M30	Yes	
Trugrip Anchor Bolt	Global Bolt & Tool	EN8			M10 – M20		Yes
	WLS Fastener Manufacturing Co. cc	EN8			M10 - M30		Yes
Rawl Kemfix Chemical Anchor Studs - for use with all chemical anchoring (capsule and/or cartridge systems)	Rawlplug South Africa	Gr: 5.8	Imported	Imported	M8 – M30 Various lengths		Yes
Through Bolts/Stud Anchors/Wedge Anchors	Global Bolt & Tool	HT			M8 – M20	Yes	
	Rawlplug South Africa	Gr: 5.8	Imported	Imported	M8 – M24 Various lengths		Yes
MISCELLANEOUS							
Self Drilling Screws	Fischer Upat					Yes	
	Global Bolt & Tool		DIN 7504		5mm – 6.3mm	Yes	
	Rawlplug South Africa				Various	Yes	
	WLS Fastener Manufacturing Co. cc					Yes	
Cast-In Lifting Sockets	WLS Fastener Manufacturing Co. cc	EN8			M8 – M36	Yes	
SPECIAL FASTENERS							
Countersunk Machine Screws	Bolt & Eng Distributors	MS/HT	DIN 963			Yes	
	Global Bolt & Tool	MS	DIN 963 & 965		M3 – M12	Yes	
	Tel-Screw Products	MS				Yes	
	WLS Fastener Manufacturing Co. cc	MS/HT			M8 – M36	Yes	
Round U-Bolts	Bascol (Pty) Ltd	MS			M8 – M36	Yes	Yes
	Bolt & Eng Distributors	MS			M8 – M76	Yes	
	Global Bolt & Tool	MS			M6 – M30	Yes, from M10	
	Tel-Screw Products	MS			M8 – M76		Yes
	Tel-Screw Products	HT				Yes	
Square U-Bolts	Bascol (Pty) Ltd	MS			M8 – M48	Yes	
	Bolt & Eng Distributors	MS	NO SPEC		M8 – M24	Yes	
	Global Bolt & Tool	MS			M6 – M30	Yes, from M10	
	Tel-Screw Products	MS/HT			M8 – M76	Yes	
	WLS Fastener Manufacturing Co. cc	MS/HT			M8 – M36	Yes	
TV U- Bolts	Bascol (Pty) Ltd	MS			M8 – M16	Yes	Yes
	Global Bolt & Tool	MS			M6 – M30	Yes	
	Tel-Screw Products				M8 – M76		Yes
Hook Bolts	Bascol (Pty) Ltd	MS			M8 – M20	Yes	
	Bolt & Eng Distributors	MS	NO SPEC		M8 – M76	Yes	
	Global Bolt & Tool	MS			M6 x 50 – M6 x 300	Yes	
	Rawlplug South Africa	MS			M5 – M12	Yes	
	Tel-Screw Products	MS			M8 – M76		Yes
	WLS Fastener Manufacturing Co. cc	MS/HT			M8 – M76	Yes	
Channel Bolts	Bascol (Pty) Ltd	MS			M8 – M10	Yes	
	Bolt & Eng Distributors	MS			M8 – M10	Yes	
	Global Bolt & Tool	MS			M6 – M8	Yes	
	Tel-Screw Products	MS			M8 – M76	Yes	
	WLS Fastener Manufacturing Co. cc	MS/HT			M8 – M76	Yes	
J-Bolts	Bascol (Pty) Ltd	MS			M8 – M36	Yes	
	Bolt & Eng Distributors	MS	NO SPEC		M8 – M24	Yes	
	Global Bolt & Tool	MS			M6 – M8	Yes	
	Rawlplug South Africa	MS			M5 – M12	Yes	
	Tel-Screw Products	MS			M8 – M76	Yes	
	WLS Fastener Manufacturing Co. cc	MS/HT			M8 – M76	Yes	
Eye-Bolts	Bascol (Pty) Ltd	MS			M8 – M16	Yes	
	Bolt & Eng Distributors	MS	NO SPEC		M8 – M76	Yes	
	Global Bolt & Tool	MS/HT			M8 – M36	Yes	
	Rawlplug South Africa	MS			M5 – M12	Yes	
	Tel-Screw Products	MS/HT			M8 – M76	Yes	Yes
	WLS Fastener Manufacturing Co. cc	MS			M6 – M76	Yes	
Straining Eye-Bolts	Bascol (Pty) Ltd	MS			M8 – M16	Yes	
	Global Bolt & Tool	MS			M10 x 200 – M16 x 300	Yes	
	Tel-Screw Products	MS/HT			M76	Yes	Yes
	WLS Fastener Manufacturing Co. cc	MS			M8 – M24	Yes	
Linked Eye Nuts	Rawlplug South Africa				M6 – M16	Yes	
Linked Eye Rods	Tel-Screw Products	MS			M8 – M76	Yes	

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TYPE OF FASTENER	COMPANY	STEEL GRADE	SPECIFICATION	SPECIFICATION	AVAILABLE SIZES	HOT DIP GALVANIZED TO ORDER	HOT DIP GALVANIZED EX STOCK
SPECIAL FASTENERS continued							
Forged Eyebolts	Global Bolt & Tool	Lifting: HT / Scaffolding: MS			M16 – M20	Yes	
	Rawlplug South Africa				M6 – M16	Yes	
	Tel-Screw Products				M8 – M30	Yes	
Welded Eyebolts	Rawlplug South Africa	MS			M8 – M16	Yes	
Scaffold Rings	Rawlplug South Africa	MS			M8 – M16	Yes	
Threaded Studs	Bascol (Pty) Ltd	MS/EN8			M8 – M64	Yes	
	Bolt & Eng Distributors	MS	NO SPEC		M8 – M76	Yes	
	Global Bolt & Tool	MS/HT			M6 – M36	Yes	
	Rawlplug South Africa	MS/HT			M5 – M30	Yes	
	Tel-Screw Products	MS/HT			M8 – M76	Yes	
	WLS Fastener Manufacturing Co. cc	MS/HT			M8 – M76	Yes	Yes
Tie Rods	Bascol (Pty) Ltd	MS/EN8			M8 – M64	Yes	
	Bolt & Eng Distributors	MS	NO SPEC		M8 – M76	Yes	
	Global Bolt & Tool	MS			M8 – M30	Yes	
	Tel-Screw Products	MS/HT			M8 – M76	Yes	
	WLS Fastener Manufacturing Co. cc	MS/HT			M8 – M76	Yes	
Other specials	Bascol (Pty) Ltd	MS/EN8	Threading & bending to customers specification				
	Bolt & Eng Distributors	Specials manufactured to order					
	Rawlplug South Africa	Special application chemical and/or mechanical anchor bolts as required					
	Tel-Screw Products	Specials manufactured to order			M8 – M76	Yes	
	WLS Fastener Manufacturing Co. cc	MS/HT			M8 - M76	Yes	
Domed Head or Cap Nuts	Global Bolt & Tool	MS	DIN 1587		M6 – M20	Yes	
	Tel-Screw Products					Yes	
	WLS Fastener Manufacturing Co. cc	MS/HT			M8 - M36	Yes	
Hex Coach Screws	Global Bolt & Tool	MS	DIN 571		M6 – M12	Yes	
	Rawlplug South Africa		DIN 7976		M5 – M12	Yes	
	Tel-Screw Products	MS	DIN 7976		M6 – M12	Yes	Yes

OS – Over Sized / MS – Mild Steel / HT – High Tensile

THE ABOVE MATRIX IS NOT NECESSARILY COMPREHENSIVE AND TOTALLY REPRESENTATIVE OF THE INDUSTRY BUT INCLUDES PARTICIPATING FASTENER MANUFACTURERS AND STOCKISTS.

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

"Weigh Less" for galvanizers – Conrad's Rule

With the cost of hot dip galvanizing increasing by 100% over the last year, the need for accurate costing has become so much more important. Loss of product at galvanizers will take place because of the process, however, how does one calculate this mass loss, when the process of galvanizing itself has a mass gain. What is the bench mark to know when your galvanizer's systems are not operating correctly, resulting in an unreasonable shrink.

So Conrad Alexander from CBC Fastener's quality department, coming from a very strict quality control back ground, set out to find the truth.

Because any two fasteners from different batches potentially can have mass differences due to setting and tooling wear, it was not just a case of taking product off the shelf and weighing it. Test samples of product were weighed and sent out to galvanizers under strict control. The exact samples sent were weighed on return. Varying lengths, tending toward the shorter popular lengths, were sent to establish length variations.

So as a bench mark, what was the result? Starting from the average of all the product tested, a gain of 1.8% was measured after the hot dip galvanizing process. Overall the gain for bolts is 1.5% and for nuts, 3.5%. For those who are again a bit more fanatical (accountants dare we say), here is the broken down detail.

	Bolts	**Nuts**	
12mm	2.6%	4.5%	
16mm	1.5%	3.8%	
20mm	1.3%	2.6%	
24mm	1.0%	2.2%	
Average	1.5%	3.5%	Total 1.8%

Note: *Nut mass gain is calculated before the tapping of the thread*

Having got this far, what is the shrink taking place at the galvanizers. Detailed statistics of our total hot dip galvanized tonnage were taken out

from CBC Fastener's records for a three month period. The average weight gain was 1.4% instead of 1.8%. So on average, assuming the market demand of the above products, the shrink in weight is 0.4%.

Don't think that "well, that is minimal" and can be discounted. Remember it is the full cost of the finished product that needs to be accounted for and not just the slight increase in the actual galvanizing costs

Example
(using nice round numbers for easy maths!)

Cost to manufacture		
1 tonne of product	R	10 000
Galvanizing per tonne	R	3 500
Total product cost	R	13 500
Actual loss of 0.4% (R13 500 x .004 not R3500 x .004)		54
Therefore galvanizing must be costed @	R	3 554

Other points of interest which should be noted.

- Mass gain for smaller diameters not frequently hot dip galvanized
  6mm = 6.5%
  8mm = 3.8% and
  10mm = 3.1%.
- The mass gain for longer lengths is progressively less than average and visa versa for shorter lengths.

CBC Fasteners is a leader in the field of fastener supply and has been at the forefront of off-the-shelf supply of hot dip galvanized products. Testament to CBC's leadership is the fact that they won the Export Category of the Eskom Hot Dip Galvanizer's Awards in 2005. Please feel free to contact us at our helpdesk tech@cbc.co.za with any problems you may have.

Coating 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 Coating 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 will be run from the Hot Dip Galvanizer's Association Offices in St. Andrews, Bedfordview. Bookings are limited (maximum 20 people) and will be treated on a first-come-first-serve basis.

COURSE CONTENT

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

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, on the following dates in 2007: March 6 & 7; May 8 & 9; July 10 & 11; September 4 & 5 and November 6 & 7.

Lunch and refreshments will be provided. Comprehensive course notes can be collected from our offices two weeks before the course.

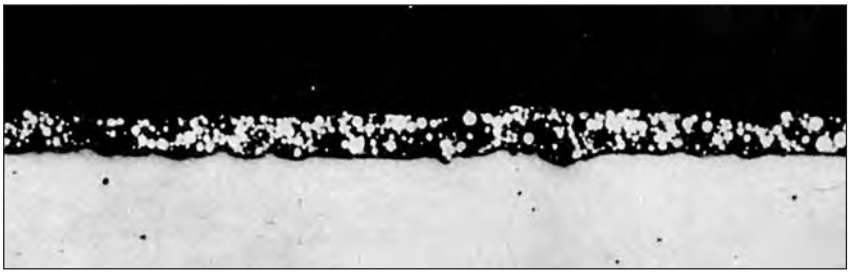
COURSE COST AND PAYMENT TERMS

R2 394.00 per person inclusive of VAT. Should you have 2 or more delegates from the same company, course costs will be R2 166.00 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.

The hot debate considering the effectiveness of cathodic protection provided by either a metallic coating or a zinc rich paint continues...

We refer to the article "How to select zinc silicate primers" presented by International Protective Coatings Akzo Nobel, as submitted by Rob Watson of International Paint (Durban) and wish to respectfully comment as follows:



Typical section through a zinc rich paint layer.

We stated in our original response regarding the Cathodic Protection (CP) benefits using Zinc rich paints that *"Cathodic Protection (CP) is somewhat complex, especially if one is to demonstrate the practicalities of inorganic zinc dust providing CP when applied to a steel surface. Important aspects such as Anode Loading (the amount of current being drawn from the zinc), the circuit resistance between the zinc, steel and moisture via the epoxy paint, the anode capacity (how much current can be delivered for a specific time duration), etc all play a significant role. The matter is further exacerbated by the presence and/or absence of film forming products in the electrolyte (moisture), pH, temperature, etc."*

The very first rule of CP that one needs to understand, is as follows: In order for CP to work, you need an anode (zinc), a cathode (steel surface) and an electrolyte (water). The electrolyte is required in order to permit the flow of current, thereby permitting the transfer of current and allowing the anode to "corrode" in order to protect the cathode (steel).

In accordance with most accepted international specifications, protection is deemed to have been attained, once the instant off (ohmic error has been taken into account) potential is more negative than –850mV Copper Sulphate Electrode (CSE).

We have summarised the most pertinent points regarding the latest claims:

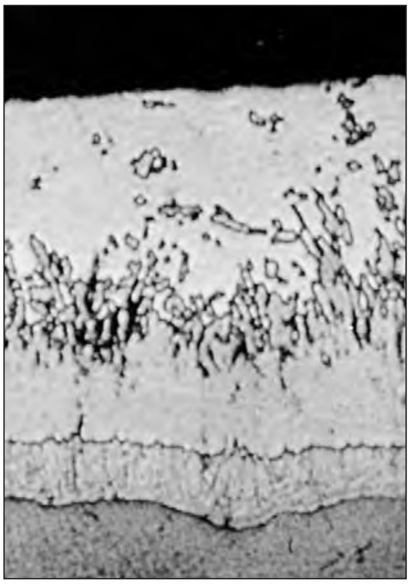
- Complete CP has been stated to occur only for first 80days.
- Partial CP and barrier protection for 60days subsequent to this
- Barrier Protection thereafter

In terms of "Claim 1 – Complete CP for 80 days". There is no data provided as to how the testing was carried out. The most pertinent question one would ask would be:

The protective "criteria" are not stated? What values have they used?

Zinc has a natural potential of around 1100mV (CSE). The mere fact that a potential of –1050mV is indicated in the graph, does not mean that the steel was at a protected potential of –850mV.

continued on page 34...



Typical section through a hot dip galvanized coating on aluminium killed steel.

Zinc Supplies in South Africa

Zincor is a zinc refinery based in Springs and has been in operation since 1967 and has supplied the South African zinc requirements since this time. The raw material used in the production of zinc metal is zinc concentrate (zinc sulphide), which is procured by Zincor from zinc mines in Southern Africa, namely Black Mountain (Northern Cape) and Rosh Pinah (Namibia). Shortfalls in zinc concentrate for the Zincor operation are imported as and when required.

Zincor is a division of Kumba Base Metals, a strategic business units of Kumba Resources, which is a South African mining company listed on the JSE. It is the strategic objective of Zincor to supply the zinc requirements of the South African market in addition to supporting the development of the application of zinc in the local economy.

The major market application for zinc in South Africa is the galvanizing sector, comprising 80% of the zinc usage, with the hot dip galvanizing market forming the largest component.

The sulphuric acid plant forms the front end of the zinc plant with zinc concentrates being roasted to produce So2 gas (sulphuric acid) and calcine (Zn0) which is the feed for the zinc plant.

It is normal practice for Zincor to have an acid plant shut on an annual basis. This is normally a three week shut which does not affect the supply of zinc to the market. It was essential that in 2007 one of the roasters had to be completely rebuilt. This is a three month project that had to be done to ensure that continued uptime of the plant. To ensure continued availability of zinc, Zincor has been importing zinc on a monthly basis from July 2006.

Due to unforeseen problems that occurred during the extensive shut / rebuild there were unfortunately some delays that caused a shortage of zinc in the market. In opening the roasters it was found that there was more extensive work required, which caused additional delays. During this period Zincor has been liaising closely with customers to avoid or minimise any production stoppages.

Currently the roaster rebuild is nearly complete and the plant is scheduled to come on line in the week of 9th October, which will result in the normalisation of zinc production. To assist in the normalisation of zinc stocks levels, Zincor will be importing zinc in October and November 2006.

Zinc metal is the essential component in galvanizing and Zincor wish to ensure that it's hot dip galvanizing customers are adequately supplied with zinc to support the demand for this corrosion protection system in the South African market.

If required, Zincor will import zinc again, if the zinc stock situation should require this to ensure that there is sufficient zinc available in South Africa to support the market requirements.

Owen Tennant – Kumba Base Metals


International
Protective Coatings

...continued from page 32

What was the exposed steel surface area where protection was "measured"?

What solution (electrolyte) was used for the test?

Was the test specimen fully submerged for the test?

The potential dips after 100 days, it "becomes" more negative after this. How do they explain this sudden increase in negative potential and then another sudden positive increase in the potential? Was current added to the circuit to achieve this?

Rain water has a conductivity of 0.0548µ S/cm at 25°C. A small circular defect in the steel of say 75µm in diameter, would possess a resistance of around 1.21 $10^{13}\Omega$.

Based on Ohms Law, one could only deliver 4.932 10^{-14}Amps. However, a defect of this size would require 8.8 10^{-11}Amps in order to protect it. In order to ensure that the required current could be delivered, one would require a larger defect or a larger number of smaller defects (resistance would decrease, as the exposed defects are in a parallel electrical circuit). However, as the number of defects increases to lower the overall resistance, the current required would also increase (more bare area of steel to protect). So would CP ever work under actual/typical conditions?

The report then states that they have "partial cathodic protection" and "partial barrier effect" for the following 60 days.

Claim 2: What does "partial CP" mean? This appears to be a vague term that sounds more "convincing" to the laymen than the technical term "not protected".

The terms "partial" means "not complete". So what does "not complete protection" really mean?

Based upon their data, the amount of zinc per square metre of surface is said to be equal to around 270g/m5. This is typically half that of Hot Dip Galvanizing (HDG), so why does their system not provide CP for 10-30 years (depending upon the environment) i.e. half the life of a HDG steel structure?

The "barrier effect" is an acceptable form of corrosion protection, for which zinc silicates are well suited.

The Association would kindly like to thank Gerald Haynes of Corrosion Technology Consultants (Affiliate Member of this Association) for this valuable contribution.

MISCONCEPTIONS

Miss Conception puts it "straight"

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

The Hot Dip Galvanizing process has a deleterious effect on the mechanical properties of special steels.

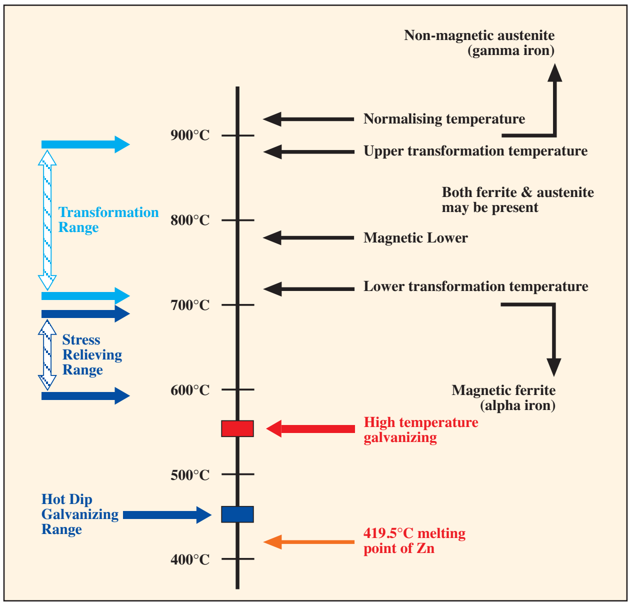
True or false?

Heat treatment as the term implies is designed to alter the properties of steel components in order to render them suitable for the purpose for which they have been manufactured. For example, a spring requires to be tempered after manufacture to provide the required resilient properties.

Plainly heat is an essential requirement in the heat treatment process with the temperature and exposure time varying, depending on specification requirements and the product, which is treated.

The hot dip galvanizing process entails immersion in molten zinc at a temperature of 450°c normally for a period of about 4 minutes. Higher zinc temperatures than this must be avoided, as they will result in severe damage to galvanizing plant and equipment. For the relatively short exposure time to molten zinc at a modest temperature, the galvanizing process is most unlikely to alter steel metallurgical properties to a significant degree.

To illustrate, millions of hot dip galvanizing resilient rail fasteners are in service throughout the world. These fastening devices are manufactured from En 45 spring steel, which is heat-treated to a hardness of about 44 on the Rockwell C scale. Extensive tests carried out before and after hot dip galvanizing indicates that a change in hardness, if any, is neglible to the extent that it can be ignored.



Significantly, one of the major causes of fracture in the case of hardened materials is corrosion. Where surface corrosion occurs, stress raisers and pits develop, which in time may produce cracks, which propagate to the stage where steel fracture occurs.

Many of the special steels, including some in the stainless steel range, are prone to pitting corrosion, particularly in a chloride environment. This insidious form of corrosion frequently progresses at an extremely rapid rate while at the same time because of its localised nature, the small pits often remain undetected until extensive damage has taken place, including what can be a loss of the mechanical integrity of a structure. In contrast, zinc is not prone to pitting corrosion. The corrosion of zinc is uniform with a gradual overall reduction in coating thickness over a period of time.

Evaluation of zinc coated wire mesh

Three welded wire mesh sample items were submitted for evaluation. One of the samples had been welded and then galvanized. The remaining two samples had employed pre-galvanized wire, which had then been welded into the mesh product. It was noted that for the latter post galvanizing welded mesh samples, the extent of the (black) discolouration adjacent to the arc sites differed. Of the pre-galvanized samples, one had a nominal wire diameter of 2.2mm, whilst the second had a nominal wire diameter of 2.5mm.

A section through a welded joint from each mesh was extracted and prepared for metallographic examination. On the post weld galvanized sample, the thickness of the zinc coating was 145-150mm with the zinc filling the gap between the two crossed wires *(figure 5)*. On the galvanized wires that had been welded, the zinc coating thicknesses were similar being 40mm and 42mm for the 2.2mm and 2.5mm diameter wires respectively (satisfying the SANS 935 requirements for Grade 1). The 'burn back' of the zinc from the welding operation was similar for both samples and was between 0.3mm and 0.4mm *(figure 7)*.

Short term salt spray testing (48 hours) resulted in the formation of white rust on the galvanized surfaces of the wires, but no red rust was evident at the welded joints, in particular those of the prior galvanized wires.

Figure 5: Zinc filling at the welded joint (125x).

Figure 7: Burn back of the zinc layer at the welded joint (125x).

Hot dip galvanizing of light weight mesh reinforcing

As part of the Association's effort to educate and improve the frequent ineffective communication between the end client and the galvanizer, often via a number of contracting parties, the specifiers finish expectations and the manufacturer and galvanizer's commitment to the quality of the final product, etc. we include for your reading, this coating report by the Association.

For obvious reasons names of all parties have been withheld but the article might prove invaluable to others in order to avoid similar situations in future.

Report

The Hot Dip Galvanizers Association was asked to comment on the hot dip galvanized coating of certain wire mesh required by a mesh reinforcing company for their client to produce gabion baskets for export. After discussion, two other samples of continuous wire galvanizing mesh used normally for the same purpose, were also submitted for comment. (*See photos and coating report* (*left*) *by Russel Thompson of Physmet – ref no* 06484).

I *report as follows*:

The mesh reinforcing company was under the impression based on previous hot dip galvanizing of wire mesh albeit 4.5mm thick that similar mesh of 2.5mm thick would look the same after hot dip galvanizing. The photos right indicate the difference.

The reason why the appearance is vastly different is the fact that the mesh panels on the left have been hot dip galvanized separately, whereas the thin mesh on the right due to their mass and the price quoted, were hot dip galvanized in bundles and most probably the bundles were hung under one another to increase the mass on the flight bar.

In our opinion the galvanizer should have proactively notified the mesh reinforcing company before hot dip galvanizing, of the manner in which he intended jigging the wire mesh panels and if necessary increased the quoted price to take into account the customers requirements.

Coating thickness and corrosion protection

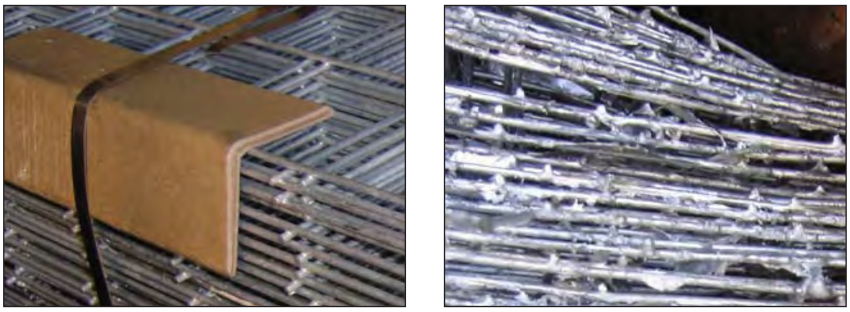
The primary reason for using hot dip galvanizing in most instances is to protect steel for corrosion protection. For this reason two things are most important with a hot dip galvanized coating, and they are coating thickness and coating continuity.

According to the Physmet report the coating thickness achieved on the mesh that has been hot dip galvanized by the general galvanizing process, SANS 121 (ISO 1461) was about 145 - 150µm thick. The coating is well in excess of that required by the specification, which for steel equal to and greater than 1.5mm thick but less than 3mm requires a mean coating thickness of 55µm.

The coating on the continuously hot dip galvanized wire mesh that had been subsequently welded after galvanizing, measured 40 to 42µm. This satisfied the requirements of SANS 935 Grade 1, which requires a coating mass of 275gms/m^2, equating to a coating thickness of 40µm for 2.5mm diameter wire.

Coating continuity

Due to the manner in which the mesh has been hot dip galvanized, (in bundles) there were several areas after galvanizing where because of the close proximity of the mesh, the molten zinc has stuck a number of the mesh panels together. Following delivery, some of the panels have been separated and where contact has occurred it is highly likely that the soft zinc or eta layer has broken away leaving most of the coating in the form of an iron/zinc alloy layer. This alloy layer on its own will provide substantially better corrosion protection to that of the mesh fabricated from Grade 1, continuously hot dip galvanized wire. In fact coating life is proportional to coating thickness.



The mesh panels on the left have been hot dip galvanized separately, the mesh on the right was hot dip galvanized in bundles.

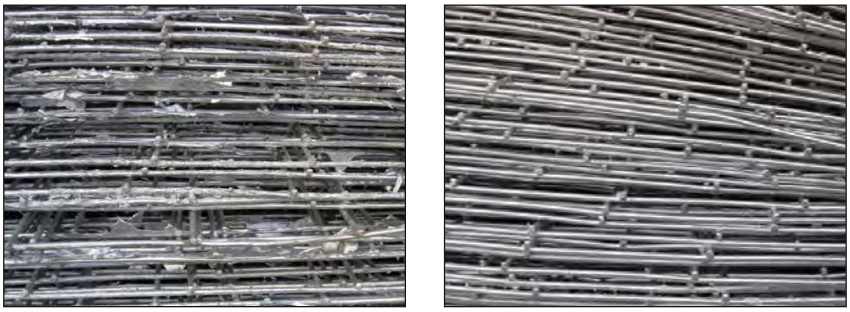


Photo above left shows excessive amount of zinc most probably situated at the lower end of the mesh as they hung on the flight bar, whereas the photo on the right shows the relatively clean and free from excessive zinc which more than likely was at the upper end of the mesh as they hung on the flight bars, when exiting the bath of molten zinc.

Conclusion and recommendation

The hot dip galvanized coating to SANS 121, will provide at least three times the life to that of the Grade 1 coating to SANS 935. Additionally the iron/zinc alloy layer will provide at least 30% better corrosion protection to that of pure zinc coatings.

Apart from some mechanically damaged areas where the mesh has been bent due to mechanical handling, the coating is acceptable in terms of the specification SANS 121.

It is further recommended that when hot dip galvanizing items that are out of the ordinary and due to their low mass cannot be hot dip galvanized normally, i.e. separately, the galvanizer should discuss the manner in which he is likely to jig the items with the client, prior to hot dip galvanizing.

Terry Smith

A bit of mechanical damage has occurred, possibly during loading and transporting. This is very likely to happen if no additional packaging procedures have been agreed to between the client and the galvanizer. The product is exceptionally light in mass and prone to mechanical damage.

Guest Writer

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

Johnny Cash's piece by piece motor car knowledge

Johnny Cash, the well known American Country and Western singer, in a song called '*One Piece at a Time*', recorded in 1979, sings about how he built a big flashy Detroit-type car over a period of twenty years. Bit by bit, from one year to another, he took components from the new car factory where he worked and painstakingly assembled them at home. His reasoning for the crime was that "getting' caught meant getting' fired, but he'd have it all by the time he got retired". Of course, once he started assembling the car he noticed that components changed over the years, some years more chrome, some years different designs, some years bigger, some years smaller. So, as you can imagine, over twenty years the final product was a bit of a mess. For example, the headlights were pretty unusual: "we had two on the left and one on the right, and when we pulled out the switch all three of 'em come on". The '53 transmission was also fitted to a '73 engine.

Today, our very definitive medical science might describe Johnny as having the 'action disorganisation syndrome' where his explicit knowledge of the components (he knew where they fitted) and his 'temporal order' (he knew the sequence of fitting the parts) was not matched by his knowledge of change (he did not know that components changed).

The famous physicist and cosmologist, Steven Hawking, on the other hand, might say that Johnny's final car was 'disordered' as each year there was only one 'ordered' state in which all that years components could be correctly used. Actually, Johnny was on a hiding to nothing as by using individual years' components he could only produce a 'disordered' car. He could have had many other disordered varieties for his final "49, 50, 51…60, 61, 62…68, 69, automobile"!

Unlike Johnny Cash's motor car components, pieces of knowledge that we gather over the years are not subject to disorder – we can use them wherever and whenever we want to and in which ever way they are combined will produce value. While we might perceive knowledge to in fact often be disordered, e.g. attending a meeting where diverse subjects are discussed and conflicting opinions stated, the bits of knowledge gained from the meeting are actually just pieces of information. When combined in, say, Minutes, the seemingly disparate bits of information become a very important, or at least should become, valuable shared and created knowledge that can be subsequently acted upon. We may also be able to use just one little piece of information that we pick up at the meeting to our benefit.

The use of knowledge can, however, be subject to the 'action disorganisation syndrome'. Certainly knowledge can change, in fact it does so all the time, and knowledge can be misapplied. The knowledge you had to use a typewriter is pretty useless now to use a PC or the knowledge of art history will not help you much to build a bridge. Our appreciation of change, in our specific professional fields and in the world around us, and the appropriateness of the relationship between gaining and applying knowledge are critical factors for coping with today's world.

Johnny's car did however have value – it was cheap: "I'd get it one piece at a time and it wouldn't cost me a dime" and very unique: "I'm gonna drive ever' body wild, 'cause I'll have the only one there is around". This is where Johnny's car and knowledge are the same – combining knowledge in an innovative manner to produce something totally unique is the most value-producing thing in the business world today. *Consilience*, the word used by the biologist EO Wilson to describe the philosophy of linking facts and fact-based theories to create a "common basis for explanation" is a very important tool for business success.

Lula Pipe Systems

The use of cast iron fittings in PVC Piping Systems is an established norm with the suppliers and stockists of PVC spigot and socket piping. The excessive cost of producing these fittings locally and the vagaries of the exchange rate in importing the product prompted the need to explore alternatives to cast iron fittings for this purpose.

EPNS Engineering (PTY) LTD, an established supplier of these fittings and related seals, valves, etc., to the PVC Piping manufacturers and stockists, developed a means of pressing welded steel piping into precisely the dimensions necessary to replace the cast iron fittings and a successful alternative was made available.

The potential to then develop this process into an integrated welded steel piping system with all the associated benefits, was mooted and at that stage EPNS Engineering approached Macsteel Tube & Pipe, a manufacturer of welded steel piping, to jointly develop the product. An

When Lula is installed above ground the system cannot be tampered with as there are no couplings to remove.

The coupling was developed by pressing welded steel piping into precise dimensions to accommodate a range of PVC pipe sizes.

agreement was then entered into.

An early decision was taken to ensure that the system be dimensionally correct to suit the outside diameters of the PVC pipe in order for it to be compatible with established PVC systems. To this end Macsteel Tube & Pipe developed unique piping sizes in steel in the PVC size range from 63mm to 200mm OD.

The ease of coupling and the corrosion protection of the steel piping were developed using a Hot Dip Galvanized coating as a base with a tolerance of a further 200 microns should an additional coating such as a duplex coating become a requirement. The system allows the connection of a hot dip galvanized pipe to a duplex coated pipe while offering effective sealing and ease of use.

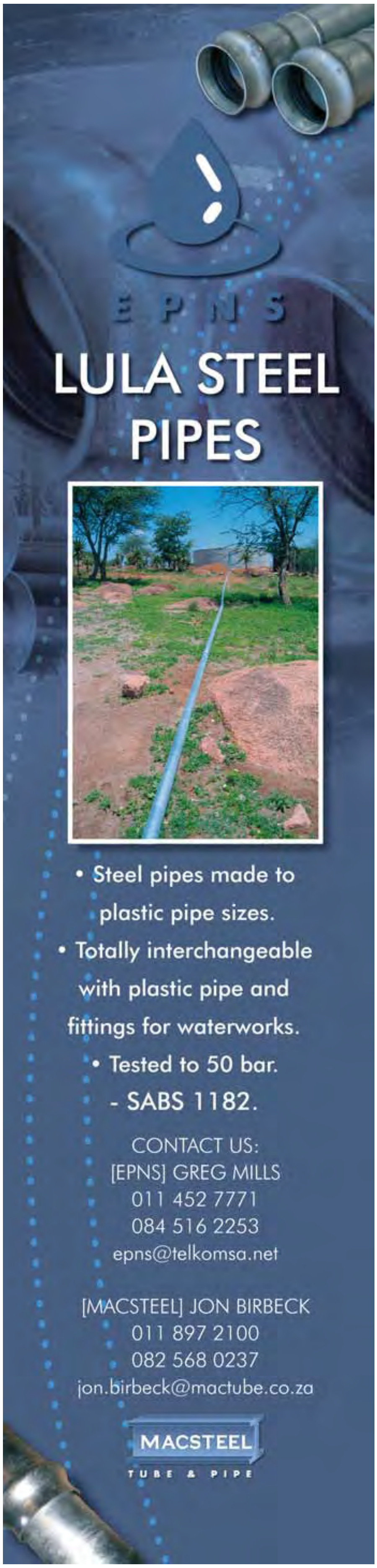
The easiness of use of the system, lead to the naming of the product, "LULA", which is the word for easy in Zulu.

Lula is now installed and in use in numerous locations throughout South Africa and is being specified by the Lepele Water Authority.

Lula is totally interchangeable with PVC pipe, but pressure rated for higher pressures allowing systems to be designed using smaller pipe diameters with resultant saving in valves, fittings and pump costs, has a longer design life, and can be laid above or below ground. The fact that Lula has the mechanical strength to handle traffic when lightly submerged, negates the need to trench and backfill while being compatible with and having the same benefits as PVC of needing no skilled labour or special tools to install. Being light and using the same tried and tested socket system as used in PVC systems while using the same seals (SANS 974) make for a very efficient and user friendly system.

When Lula is installed above ground the system cannot be tampered with as there are no couplings to remove, requires the same thrust blocks and design criteria as PVC, and will not be damaged under water hammer or pressure surge conditions. The integrity and efficiency of the Lula System is not affected by veld fires when installed above ground.

It is with pride that Lula Pipe is offered as a viable Hot Dip Galvanized alternative to existing pipe systems in an environment where the protection, effective use and distribution of our water resources is of paramount importance to our country.



"Marathon Plant Visit"

On 2 August 2006, Phoenix Galvanizing undertook the biggest plant tour in the history of the company, when they hosted first year architecture students and lecturers from UKZN. In total 66 students and lecturers (Derek van Heerden, Adam Knight and Leon Conradie) were treated to a slide show presentation by the HDGASA's Bob Wilmot and toured the Phoenix Galvanizing Plant. Because of the size of the delegation, the group was split into two. The plant tour was planned to coincide with a project the students are currently doing on "lightweight construction". Judging by the enthusiasm and the fascination with the hot dip galvanizing process, the industry can hopefully look forward to hot dip galvanizing specified projects in the future.

A breakthrough in zinc passivation

Traditional use of chrome based passivators for the prevention of white rust is being outlawed around the world due to the toxic nature of the product.

Chemplus R & D have anticipated the change in environmental laws and have in conjunction with Robor Galvanizers perfected a passivator which complies with all environmental needs as well as aesthetics needed in the industry.

To explain the benefits of the new Chemplus Galvogard EF passivation system, first an overview of the existing Chrome and heavy metal based passivator systems used.

1. *Hexavalent Chrome*

Carcinogenic substance capable of damage to living species in very small amounts, Ingested chromium damages the digestive and air tract in living organisms. Additionally direct contact allows this carcigen to be absorbed through the skin.

2. *Trivalent Chrome*

Also present in passivator baths and is slightly less toxic than hexavalent chrome.

3. *Nickel*

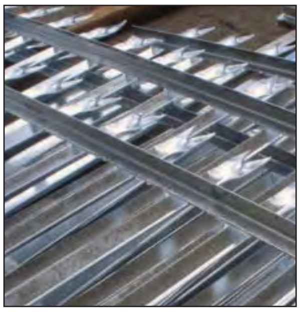
Some other passivator systems use the above which is also environmentally toxic..

As the industry is aware, costs of disposal and management of the above products are becoming onerous and expensive.

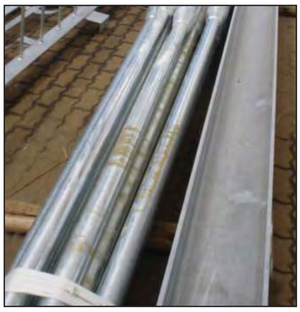
Benefits of Chemplus Environmentally Friendly Passivator Galvogard EF

- Total absence of all Chromium compounds.
- Total absence of all heavy metals.
- Environmentally friendly.
- Product can be disposed to municipal waste.
- Greater corrosion protection than that offered by Chrome based products.
- A non staining, highly reflective surface finish.
- Galvogard EF can be used at boiling temp as opposed to chrome based product which loses efficiency at 55°C.
- No sludge formation.

As always, Chemplus passivator Galvogard EF used in conjunction with Chemplus flux Fluxor S1 Exp ensures optimal efficiency and finish.



Galvogard EF.



Sodium di-chromate.

Walter's Corner

The introduction and history of hot dip galvanizing in the mining industry

Corrosion of steel structures installed underground in mines is invariably severe. If not anticipated and suitable control measures taken, maintenance and replacement costs throughout the life of the mine can impact severely on performance and profitability. Apart from reduced performance, there is the all important aspect of the safety of mining personnel. Many of the accidents that have been experienced in mines in the past can be attributed to the degradation of equipment and structures as a result of corrosion.

Severe corrosion in deep level mines can be attributed to elevated temperatures, high humidity levels, fumes from explosives and corrosive fissure water which seeps into the mine from the surrounding rock.

Until the early nineteen seventies, virtually no hot dip galvanized material was used in mines other than perhaps some large bore high pressure piping, while all structural steel components were painted only. One reason for this was that specifiers were inclined to judge all hot dip galvanizing by the durability of the thin coating as applied to continuously hot dip galvanized sheet with a nominal zinc thickness of 19 micrometers, compared to four and even five times that thickness normally obtained by the general galvanizing process.

It was during a business flight to Richards Bay that Michael Brett, the well known corrosion consultant, expressed the opinion that hot dip galvanizing and duplex systems should be considered to a greater extent for corrosion control in the mining industry. This led to extensive discussions between Michael Brett, his team of consultants as well as galvanizing experts and mining engineers. The result was keen interest displayed by, among others, Union Corporation (now Gencor), with Dennis Clair, the Chief Consulting Engineer, and his team adopting a positive approach to the concept of hot dip galvanizing.

At the time, the sinking and equipping of the 2000m deep Kinross No2 shaft in what is now Mpumalanga, was in progress. The decision was reached to hot dip galvanize all the shaft steel work, with a duplex paint coating applied in the severely corrosive areas encountered at a depth of 500m and more below the surface. This project was an outstanding example of what can be achieved by full cooperation and team work by all parties; in this case the mining engineers, the corrosion consultants and the hot dip galvanizer.

On completion of the project, a technical paper, titled "Developments in the Use of Hot Dip Galvanizing & Duplex Systems in the South African Gold Mining Industry" was presented at an International Corrosion conference in 1976 by Messrs MA Brett and the writer. The interest created by this paper was such that it qualified for the Corrosion Institute's best paper award during that year. This was followed 10 years later by a paper describing the favourable condition of the shaft steel work after 10 years in service.

Much was learnt through this initial galvanizing project which has led to design improvements and measures to reduce even further the propensity for corrosion. A typical example is the introduction of an abrasion resistant urethane elastomeric coating onto the leading surface of buntons, to avoid abrasive attack by falling debris on the applied coatings.

The Kinross no 2 shaft project was soon followed by similar hot dip galvanizing projects at mines such as Unisel, Elands Rand, St Helena, Vaal Reef and even Western Deep Levels (South Deep). More recent projects in the Mining industry include Moab Khotsong as well as several platinum mining projects and even some collieries.

Improvements in specifications are ongoing, with for example, the paint system currently used for duplex protection, providing improved adhesion and durability compared with those applied in the early days.

It is difficult, if not impossible to calculate the volume of steel protected from corrosion in the Mining Industry by hot dip galvanizing and duplex coatings during the past 30 years, but this would amount to several hundred thousand tonnes with even components such as shaft guides now hot dip galvanized on a regular basis.

The successful development of the use of hot dip galvanizing throughout the mining industry is an excellent example of what can be achieved by team work and full cooperation between end users, specifiers and those required to undertake the work.

Typical steel being hot dip galvanized for the mining industry.

HOT DIP GALVANIZING MEMBERS

GALVANIZER	LOCATION	TEL. NO	SPIN	NO. OF LINES	BATH SIZES (L x W x D) (m)
GAUTENG					
Armco Galvanizers	Isando	011 974-8511		1	13.2 m x 1.5m x 2.0m
Armco Galvanizers – Dunswart	Dunswart	011 914-3512	●	3	5.2m x 1.2m x 2.0m 3.0m x 1.0m x 1.5m 2.0m x 1.0m x 1.5m
Babcock Nthuthuko Powerlines (Pty) Ltd	Nigel	011 739-8200		1	12.0m x 1.4m x 1.8m
Cape Gate (Pty) Ltd	Vanderbijlpark	016 980-2270		#	Wire galvanizer
DB Thermal SA (Pty) Ltd	Nigel	011 814-6460		#	In-line galvanizer
Galvadip (Pty) Ltd	Waltloo	012 803-5168		1	7.2m x 1.5m x 1.8m
Galvrite Galvanising (Pty) Ltd	Randfontein	011 693-5825		1	6.5m x 1.3m x 2.0m
GEA Air Cooled Systems	Germiston	011 861-1571		#	In-line galvanizer
Lianru Galvanisers cc	Nigel	011 814-8658		2	7.2m x 1.3m x 1.6m 1.95m x 0.83m x 1.2m
Macsteel Tube & Pipe	Boksburg	011 897-2194		In-line	13.5m x 1.6m x 2.4m
Mittal Steel SA	Vereeniging	016 889-8816		#	Sheet galvanizer
Pro-Tech Galvanizers (Pty) Ltd	Nigel	011-814-4292	●	2	3.0m x 1.1m x 1.2m 3.2m x 1.1m x 1.5m
Robor Galvanizers	Germiston	011 876-2900		2 Tube	14m x 1.35m x 2.5m 10.0m x 2.0m x 4.0m Dia 42mm to 114mm max tube length 6.7m
Robor Tube	Elandsfontein	011 971-1600		1	Pipe plant
Supergalv	Alrode	011-908-3411		1	6.0m x 1.2m x 1.8m
MPUMALANGA					
Chevron Engineering (Pty) Ltd	Barberton	013 712-3131		1	Dia 0.7 x 1.2d
NORTH WEST					
Andrag Agrico	Lichtenburg	018 632-7260		#	In-line galvanizer
WESTERN CAPE					
Advanced Galvanising Corp.	Bellville	021 951-6242		1	8.0m x 1.5m x 3.0m
Cape Galvanising (Pty) Ltd	Parowvalley	021 931-7224		1	14.0m x 1.6m x 2.6m
Galvatech (Pty) Ltd	Bellville	021 951-1211		1	7.5m x 1.5m x 2.6m
Helderberg Galvanizing	Strand	021 845-4500		1	5.5m x 0.8m x 2.4m
South Cape Galvanizing (Pty) Ltd	George Industria	044 884-0882		1	5.5m x 1.0m x 2.6m
Zincgrip Galvanizers & Coatings	Stikland	021 949-7630		1	4.5m x 1.0m x 2.5m
EASTERN CAPE					
Butterworth Metal Industries	Butterworth	047 401-3600		1	1.2m x 0.6m x 0.8m
Galvanising Techniques cc	Port Elizabeth	041 486-1432		1	12.4m x 1.4m x 2.6m
Galvaspin (Pty) Ltd	Port Elizabeth	041 451-1947	●	1	1.8m x 1.2m x 1.4m
Morhot (Pty) Ltd	East London	043 763-1143		1	6.0m x 1.2m x 2.5m
KWAZULU/NATAL					
A&A Galvanisers	Pietermaritzburg	033 387-5783	●	1	3.3m x 0.95m x 1.9m
Bay Galvanisers	Richards Bay	035 751-1942		1	5.0m x 1.2m x 2.5m
Phoenix Galvanizing (Pty) Ltd	Phoenix	031 500-1607	●	3	14.0m x 1.4m x 2.5m 7.0m x 1.2m x 3m 2.5m x 0.9m x 1.2m
Voigt & Willecke (Pty) Ltd	Durban	031 902-2248		1	9.0m x 1.2m x 2.5m
ZIMBABWE					
Tube & Pipe Industries Ltd	Harare	092634-611721		1	7.0m x 1.2m x 1.2m

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

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

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