2012 Volume 9 Issue 1

HOT DIP GALVANIZING TODAY

HOT DIP GALVANIZERS ASSOCIATION Southern Africa

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Featuring:

- The Annual Fastener Feature including the Availability Matrix
- Hot dip galvanized railway sleepers from Brazil
- What is CP and what it isn't? • New zinc metal spray gun
- Duplex - The importance of substrate preparation • Intergalva 2012 Paris
- National Environment Management Workshop in Cape Town
- Regulars - Education and Training, Bob's BANTER, On The Couch & Members News

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

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Front Cover: *A kaleidoscope of projects where the specifying of hot dip galvanized bolts are an essential requirement for long term project durability and corrosion control, surrounding a new centrifuge plant (see Members News) and some hot dip galvanized Crosby Clamps (article in next HDGT).*

Hot Dip Galvanizing – Adding value to Steel

Executive Director's Comment

When our industry was notified of the intended closure of Zincor Ltd, alternative plans were put into place in order to ensure a continued, reliable supply of zinc into the country. The importation of zinc is not a new phenomenon and as such, the industry was capable of sourcing alternative supplies of zinc in order to continue to meet the demand of our customers. Furthermore, there are alternative suppliers of zinc who are already operating and ably assisting the industry. Therefore, the hot dip galvanizing industry is well placed in order to continue supplying this valuable service to its customers.

It appears that some innuendo is being leveled in that zinc is harmful to humans. During the first half of the 20th century, researchers discovered that zinc is essential for the normal growth and survival of plants and animals. All living organisms need zinc and for this reason, zinc is termed an essential element. Adequate daily intake is vital for the proper functioning of many of our natural processes. Zinc deficiency is now recognised as one of the most important health risks to human health.

Hot dip galvanizing consists of a coating of zinc alloyed to the surface of the steel. Zinc melts at about 420ºC (galvanizing temperature) and boils at 907ºC. When zinc boils the vapour reacts quickly with the air to form zinc oxide, which is the dense white fume easily visible. Although zinc oxide is an important component of some medicines and creams one should avoid breathing zinc oxide; or any other fume for that matter.

If one does breathe in zinc fumes, the zinc will be absorbed into the bloodstream, with excess zinc excreted quickly through the kidneys and then in the urine. One may have an acute case of "zinc fever", displaying flu-like symptoms for 24 hours. As far as the International Zinc Association (IZA) is aware, "zinc fever" is almost unknown in modern industrial countries which observe basic health and safety precautions.

Bob Wilmot

Note from the Editor

When I joined Walter Barnett at the HDGASA in February 1996, the Journal was a mere 8 page document that was fully funded by the Association. Advertising was not in Walter's agenda but when we launched our first buyer's guide, included in the journal in 2002, Walter conceded to once off advertising. The booklet proved to be such a success from all participating parties' perspective that we decided to include advertising for all subsequent copies of the magazine. While a bumper issue of 68 pages was produced in May 2005, the free quarterly magazine which is posted to all that specify, use or are interested in our industry is usually capped at 44 pages.

Together with Sandra Addinall the magazine designer since inception, Anne van Vliet who joined us in 2004 and is responsible for advertising sales and acts as the sub-editor, and I, we are proud to have been associated with the magazine's growth as we have now reached the magic half century – Magazine No. 50!

Thank you to all that have contributed to its success and participated by way of articles or advertising over the past years, it is highly appreciated!

Duplex coating includes "Protecting your Steel Investment" which discusses appropriate substrate preparation. In the next HDGT, there will be an article on BS EN 15773 and EN 13438. The former standard stands proud in encouraging active communication between all parties that have a vested interest in the project.

Table 1 – Standards for powder organic coatings and hot dip galvanized steel, recommends under the "Galvanizing" column, "Good communications in place and agreements made between galvanizer and client regarding general quality requirements in relation to zinc coating". *Table 2*, discusses the supply phase and the essential communication links that should exist through each of these phases.

The standard also addresses the definition of "Surface Smoothing – Reduction, usually by means of mechanical finishing of roughness associated with the galvanized surface such that when the galvanized surface is pre-treated and coated with the powder organic coating system, no protrusions penetrate through the organic coating".

I encourage all specifiers of duplex coating systems to refer to these standards and when only hot dip galvanizing at least Annex A from SANS121:2011 as discussed in my note of Magazine No. 49.

Lastly, my experience tells me that the galvanizer is generally a sub-contractor to the main contractor and therefore does not actively participate in the initial project meetings, whereas if he was frequently included, his input would be valuable to the final outcome of the hot dip galvanized or duplex coated finish.

The main feature for this edition is our annual Fastener Feature, which includes the fastener availability matrix and several interesting articles on fasteners including, "Placing hydrogen embrittlement in perspective" by Prof Waldo Stumph of the University of Pretoria, "Let's torque tightening" by Russell Thompson of Physmet and Rob Pietersma of CBC discusses "The changing landscape of structural fastening".

Other articles include "What is CP and what it isn't?" by Gerald Haynes, "Beware of hot dip galvanizing Structural Steel with extremely high levels of Phosphorous!" and "Steel Railway Sleepers" from Brazil.

Regulars include Duplex Coating Systems, Education and Training, Bob's BANTER, Zinc Metal Spraying, Members News and On the Couch where we interview Linda Ness of Ness and Associates.

Enjoy the "magazinc".

Terry Smith

Fastener availability matrix and participating fastener suppliers

From experience it has been shown that on many occasions at building sites, alternatives to hot dip galvanized such as zinc electroplated fasteners are mistakingly used. In order to provide a similar service life to that of the hot dip galvanized structure, it is important to specify and use hot dip galvanized fasteners to SANS121:2011 (ISO1461:2009). To this end we provide the following "Fastener Availability Matrix", indicating the feasibility and availability of a range of hot dip galvanized fasteners, etc. Should a particular fastener that you require not be listed, kindly contact one of the participating fastener suppliers at the end of this matrix or the Association.

TYPE OF FASTENER	COMPANY	STEEL GRADE	SPECIFICATION	SPECIFICATION	AVAILABLE SIZES	HOT DIP GALVANIZED TO ORDER	HOT DIP GALVANIZED EX STOCK
LOCKING NUTS							
Hard Lock Nuts	Avlock International	Gr: 8/Gr: 5			M8 – M30	Yes	
	Bolt Fast	MS/Gr: 8			M8 – M30	Yes	
	Impala Bolt & Nut	MS/HT			M8 – M30	Yes	Yes
	Mr. Bolt & Nut	Gr: 4.8/Gr: 8			M8 – M48	Yes	
	SA Bolt Manufacturers	Gr: 4.8/Gr: 8			M8 – M64	Yes	
	Tel-Screw Products	MS/HT			M8 – M48	Yes	Yes
	WLS Fastener Manufacturing Co. cc	MS/HT			M8 – M36	Yes	Yes
Castle Nuts	Bolt Fast	MS/Gr: 8			M8 – M30	Yes	
	Mr. Bolt & Nut	Gr: 8			M8 – M30	Yes	
	Tel-Screw Products	MS/Gr: 8			M8 – M100	Yes	
Steel Hex Lock Nuts	Bolt Fast	MS			M8 – M100	Yes	
	Mr. Bolt & Nut	MS/Gr: 8			M8 – M100	Yes	
	SA Bolt Manufacturers	MS			M8 – M64	Yes	
	Tel-Screw Products	MS/HT			M8 – M100	Yes	
	WLS Fastener Manufacturing Co. cc	MS			M8 – M48	Yes	
Crimped Nuts	Bolt Fast	MS			M8 – M48	Yes	
	Impala Bolt & Nut	MS			M8 – M48	Yes	
	Mr. Bolt & Nut	MS			M8 – M48	Yes	
	Tel-Screw Products	MS			M8 – M48	Yes	
Locking Washers	Bolt Fast	MS			M8 – M52	Yes	Yes
	Mr. Bolt & Nut	MS			M8 – M52	Yes	
	WLS Fastener Manufacturing Co. cc	MS			M8 – M52	Yes	
Nyloc Nuts Most smaller size nyloc nuts are only available in electroplated form	Bolt Fast	Gr: 8			M6 – M48		
	CBC Fasteners	Gr: 8			M6 – M48		
	Impala Bolt & Nut	Gr: 8			M6 – M48		
	Mr. Bolt & Nut	Gr: 8			M6 – M48		
Cleeve Lock Nuts	Bolt Fast	Gr: 8			M8 – M30	Yes	
	Mr. Bolt & Nut	Gr: 8			M8 – M30	Yes	Yes
Prevailing Torque Hex Lock Nuts	Bolt Fast	Gr: 8 & 10			M8 – M30	Yes	
	Tel-Screw Products	Gr: 8 & 10	DIN 980V		Selected sizes	Yes	
NORMAL NUTS							
Hex OS Nuts	Bolt Fast	MS/Gr: 8 & 10			M8 – M64	Yes	Yes
	CBC Fasteners	Gr: 8	DIN 934	ISO 4032	M8 – M30	Yes	Yes
	Impala Bolt & Nut	Gr: 8	DIN 934		M8 – M30	Yes	Yes
	Mr. Bolt & Nut	MS Gr: 8 Gr:10			M8 – M30	Yes	
	SA Bolt Manufacturers	MS/Gr: 8 & 10	DIN 934	ISO 4032	M8 – M64	Yes	Yes
	Tel-Screw Products	Gr: 8; 10 & 12	DIN 934		M16 – M36	Yes	
	WLS Fastener Manufacturing Co. cc	MS/HT			M8 – M64	Yes	Yes
Hex Long OS Nuts	Bolt Fast	MS			M8 – M20	Yes	
	Mr. Bolt & Nut	MS/HT			M8 – M16	Yes	
	Rawlplug South Africa	MS			M8 – M16	Yes	
	Tel-Screw Products	MS/HT	TSP		M8 – M48	Yes	
	WLS Fastener Manufacturing Co. cc	MS			M8 – M36	Yes	Yes
Shear Nuts or Anti-vandal Nuts	Bolt Fast	MS			M8 – M20	Yes	Yes
	Impala Bolt & Nut	MS			M8 – M16		Yes
	Mr. Bolt & Nut	MS			M8 – M20	Yes	
	Rawlplug South Africa	MS			M8 – M16	Yes	Yes
	SA Bolt Manufacturers	MS/HT			M12 – M24	Yes	Yes
	Tel-Screw Products	MS/HT			M8 – M48	Yes	Yes
	WLS Fastener Manufacturing Co. cc	MS			M8 – M24	Yes	
Flanged Nuts	Bolt Fast	MS			M8 – M10	Yes	
	Mr. Bolt & Nut	MS			M8 – M10	Yes	Yes
	SA Bolt Manufacturers	MS HT			M8 – M36	Yes	Yes
	Tel-Screw Products	MS/HT			M8 – M36	Yes	
	WLS Fastener Manufacturing Co. cc	MS			M8 – M16		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
WASHERS							
Thru Hardened Washers	Bolt Fast	Gr: 8			M6 – M48	Yes	
	Impala Bolt & Nut	MS	DIN 6916		M10 – M30	Yes	
	Mr. Bolt & Nut	G:10			M6 – M48	Yes	Yes
	SA Bolt Manufacturers	Gr: 8			M8 – M64	Yes	
	Tel-Screw Products	MS	DIN 6916		M10 – M64	Yes	
	WLS Fastener Manufacturing Co. cc	MS			M8 – M36		Yes
Flat Washers	Bolt Fast	MS			M6 – M64		Yes
	Impala Bolt & Nut	MS	DIN 120/125		M8 – M30		Yes
	Mr. Bolt & Nut	MS			M6 – M64	Yes	Yes
	SA Bolt Manufacturers	MS	DIN 120/125		M8 – M64	Yes	
	Tel-Screw Products	MS	DIN 120/125		M8 – M76	Yes	Yes
	WLS Fastener Manufacturing Co. cc	MS			M8 – M76		Yes
Square Flat Washers	Bolt Fast	MS			M12	Yes	
	Mr. Bolt & Nut	MS Taper			M10 – M24	Yes	Yes
	SA Bolt Manufacturers	MS			M8 – M30	Yes	
	Tel-Screw Products	Specially manufactured to order			M6 – M76	Yes	Yes
	WLS Fastener Manufacturing Co. cc	MS			M8 – M30		Yes
Square Curved Washers	Bolt Fast	MS			M16 – M30	Yes	
	Mr. Bolt & Nut				M8 – M76	Yes	Yes
	SA Bolt Manufacturers	Specially manufactured to order			M16 – M30	Yes	
	Tel-Screw Products	Specially manufactured to order			M6 – M76	Yes	Yes
Spring Washers	Bolt Fast	MS			M6 – M52		Yes
	Impala Bolt & Nut		DIN 127		M8 – M30		Yes
	Mr. Bolt & Nut				M8 – M36	Yes	Yes
	SA Bolt Manufacturers		DIN 127		M8 – M48	Yes	
	Tel-Screw Products		DIN 127		M8 – M64		Yes
	WLS Fastener Manufacturing Co. cc				M8 – M36		Yes
BOLTS AND SCREWS							
Hex Head Screws	Bolt Fast	MS/Gr: 8 & 10			M8 – M42		Yes
	CBC Fasteners	MS	DIN 558	ISO 4018	M18 – M30	Yes	Yes
	CBC Fasteners	Gr: 8.8 & 10.9	DIN 933	ISO 4017	M8 – M30	Yes	Yes
	Impala Bolt & Nut	MS	DIN 658		M8 – M24		Yes
	Impala Bolt & Nut	Gr: 8.8	DIN 933		M8 – M30		Yes
	Mr. Bolt & Nut	MS/Gr: 8 & 10			M8 – M64	Yes	
	Rawlplug South Africa	MS	DIN 933		M8 – M12	Yes	
	SA Bolt Manufacturers	MS/Gr 8.8; 10.9; 12.9	DIN 933		M48 – M72	Yes	Yes
	Tel-Screw Products	MS/Gr: 8.8			M8 – M39	Yes	Yes
	WLS Fastener Manufacturing Co. cc	MS/HT			M8 – M36	Yes	Yes
Hex Head Bolts and OS Nuts	Bolt Fast	MS			M8 – M36		Yes
	CBC Fasteners	MS	DIN 601	SABS 135	M8 – M30	Yes	Yes
	Impala Bolt & Nut	MS	DIN 931		M8 – M30	Yes	Yes
	Mr. Bolt & Nut	MS			M8 – M36	Yes	
	SA Bolt Manufacturers	MS	DIN 601		M10 – M64	Yes	Yes
	Tel-Screw Products	MS/HT	DIN 601	Lay – 520	M8 – M39	Yes	Yes
	WLS Fastener Manufacturing Co. cc	MS			M8 – M36		Yes
Hex Head Bolts and OS Nuts (High tensile)	Bolt Fast	MS/Gr: 8 & 10			M8 – M52		Yes
	CBC Fasteners	Gr: 8.8 & 10.9	DIN 931	ISO 4014	M8 – M30	Yes	Yes
	Impala Bolt & Nut	Gr: 8.8 & 10.9	DIN 931		M8 – M30	Yes	Yes
	Mr. Bolt & Nut	Gr 8.8 & 10.9			M8 – M52	Yes	
	SA Bolt Manufacturers	Gr 8.8; 10.9; 12.9	DIN 931		M10 – M64	Yes	Yes
	WLS Fastener Manufacturing Co. cc	HT			M8 – M36		Yes
Large Dia Bolts and OS Nuts	Bolt Fast	Gr: 8			M30 – M76	Yes	
	Mr. Bolt & Nut	MS/Gr 8.8			M27 – M64	Yes	
	SA Bolt Manufacturers	Gr: 8.8 & 10.9			M27 – M64	Yes	
	Tel-Screw Products	MS/Gr: 8.8			M36 – M76	Yes	
	WLS Fastener Manufacturing Co. cc	MS HT			M39 – M76	Yes	
Cup Head Square Neck Bolts and OS Nuts	Avlock	MS	DIN603		M8 – M16	Yes	Certain sizes
	Bolt Fast	MS			M8 – M30	Yes	
	CBC Fasteners	MS	SABS 1143		M8 – M20	Yes	Selected
	Impala Bolt & Nut	MS	DIN 603		M8 – M16	Yes	Certain sizes
	Mr. Bolt & Nut	MS			M8 – M30	Yes	
	Rawlplug South Africa	MS	DIN 603		M8 – M12	Yes	
Cup Head Square Neck Bolts and OS Nuts (continued)	SA Bolt Manufacturers	MS	DIN 603		M8 – M24	Yes	
	Tel-Screw Products	MS	SABS1143/DIN 603		M8 – M30	Yes	Yes
	WLS Fastener Manufacturing Co. cc	MS			M8 – M20	Yes	

TYPE OF FASTENER	COMPANY	STEEL GRADE	SPECIFICATION	SPECIFICATION	AVAILABLE SIZES	HOT DIP GALVANIZED TO ORDER	HOT DIP GALVANIZED EX STOCK
BOLTS AND SCREWS (continued)							
C/Sunk Square Neck Bolts and OS Nuts	Avlock	MS/HT	SABS 1143		M8 – M30	Yes	Yes
	Bolt Fast	MS			M10 – M24	Yes	
	CBC Fasteners	MS	SABS 1143		M10 – M20	Yes	
	Impala Bolt & Nut	MS	DIN 605		M10 – M16	Yes	
	Mr. Bolt & Nut	MS			M8 – M24	Yes	
	SA Bolt Manufacturers	MS	DIN 605		M8 – M33	Yes	
	Tel-Screw Products	MS/HT	SABS 1143		M8 – M30	Yes	Yes
	WLS Fastener Manufacturing Co. cc	MS			M10 – M20	Yes	
C/Sunk Nib Bolts and OS Nuts	Bolt Fast	MS			M10 – M24	Yes	
	CBC Fasteners	MS	SABS 1143		M12 – M24	Yes	
	Impala Bolt & Nut	MS	DIN 604		M10 – M20	Yes	
	Mr. Bolt & Nut	MS			M12 – M30	Yes	
	SA Bolt Manufacturers	MS	DIN 604		M12 – M36	Yes	
	Tel-Screw Products	MS	SABS 1143		M8 – M24	Yes	
	WLS Fastener Manufacturing Co. cc	MS			M12 – M24	Yes	
Friction Grip Bolts and Nuts	CBC Fasteners	Gr: 8.8S & 10.9		EN 14399	M16 – M30	Yes	
	CBC Fasteners	Gr: 8.8S & 10.9S	SABS 1282	ISO 7411	M12 – M30	Yes	
	Impala Bolt & Nut	Gr: 8.8S & 10.9S			M12 – M30		Yes
	Mr. Bolt & Nut	Gr: 10.9			M12 – M30	Yes	
	SA Bolt Manufacturers	Gr: 8.8 & 10.9S			M12 – M30	Yes	
Hex Socket C/Sunk Head Screws	Bolt Fast	MS			M8 – M39	Yes	
	Mr. Bolt & Nut	Gr: 10.9 & 12.9			M12 – M24	Yes	
	SA Bolt Manufacturers	Gr: 10.9 & 12.9			M8 – M48	Yes	
	Tel-Screw Products	HT			M8 – M24		
	WLS Fastener Manufacturing Co. cc	HT			M8 – M24	Yes	
Lockbolts	Avlock	8.8 Pins/6.8 collars			1/2" – 7/8" (imperial)	Yes	
	Impala Bolt & Nut Pins & Collars 1/2" - 7/8"	8.8 Pins/6.8 collars			1/2" – 7/8" (imperial)	Yes	
	Mr. Bolt & Nut	8.8 Pins/6.8 collars			1/2" – 7/8" (imperial)	Yes	
	SA Bolt Manufacturers	8.8 Pins/6.8 collars			1/2" – 7/8" (imperial)		

continued on page 6...

TYPE OF FASTENER	COMPANY	STEEL GRADE	SPECIFICATION	SPECIFICATION	AVAILABLE SIZES	HOT DIP GALVANIZED TO ORDER	HOT DIP GALVANIZED EX STOCK
BOLTS AND SCREWS (continued)							
Pigtails – 1 & 1 1/2 Turn	Bolt Fast					Yes	
	Mr. Bolt & Nut	MS			M8 – M12	Yes	
	Tel-Screw Products				M8 – M76	Yes	Yes
	WLS Fastener Manufacturing Co. cc	MS			M8 – M24	Yes	
3m – Threaded Rod	Bolt Fast	MS/Gr: 8			M8 – M30		Yes
	CBC Fasteners	MS	DIN 975				
	Impala Bolt & Nut	MS/HT	DIN 975		M8 – M24	Yes	
	Mr. Bolt & Nut	MS/Gr: 8.8			M10 – M30	Yes	
	SA Bolt Manufacturers	MS/HT	DIN 975		M8 – M36	Yes	
	Tel-Screw Products	MS/HT			M8 – M76	Yes	Yes
	WLS Fastener Manufacturing Co. cc	MS			M8 – M36		Yes
1m – Threaded Rod	Bolt Fast	MS/Gr: 8 & 10			M8 – M52		Yes
	CBC Fasteners	MS	DIN 975				
	Impala Bolt & Nut	MS/HT	DIN 975		M8 – M24	Yes	Selected
	Mr. Bolt & Nut	MS/HT			M8 – M52	Yes	
	Rawlplug South Africa	HT			M8 – M30	Yes	
	SA Bolt Manufacturers	MS/HT	DIN 975		M8 – M36	Yes	
	Tel-Screw Products	MS/HT			M8 – M36	Yes	Yes
	WLS Fastener Manufacturing Co. cc	MS			M8 – M36		Yes
HD Bolts (Foundation Bolts) and OS Nuts	Bolt Fast	MS/EN8			M8 – M72		Yes
	Impala Bolt & Nut	MS/350WA			M8 – M72	Yes	
	Mr. Bolt & Nut	MS/EN8			M8 – M72	Yes	
	Rawlplug South Africa	MS/HT			M8 – M36	Yes	
	SA Bolt Manufacturers	MS/HT			M12 – M72	Yes	Selected sizes
	Tel-Screw Products	MS/HT			M8 – M72	Yes	Yes
	WLS Fastener Manufacturing Co. cc	MS			M8 – M72	Yes	
CONCRETE ANCHOR BOLTS							
Rawlbolts	Rawlplug South Africa	5.8	www.rawl.co.za	International	M8 – M24	Yes	
	Mr. Bolt & Nut				M8 – M24	Yes	
SPT Throughbolts	Rawlplug South Africa		www.rawl.co.za	EU	M8 – M20	Yes	Yes
Through Bolts	Rawlplug South Africa		www.rawl.co.za		M8 – M24	Yes	Yes
	Mr. Bolt & Nut				M8 – M24	Yes	
R-Cas Chemical Spin-in Anchors	Rawlplug South Africa	5.8 HT	www.rawl.co.za	BBA	M8 – M30	Yes	Yes
R-Hac Chemical Hammer-in Anchors	Rawlplug South Africa	5.8/HT	www.rawl.co.za	BBA	M8 – M30	Yes	Yes
R-Kem Chemical Cartridge System	Rawlplug South Africa	5.8 HT	www.rawl.co.za	BBA	M8 – M30	Yes	Yes
R-Ker Chemical Cartridge System	Rawlplug South Africa	5.8/HT	www.rawl.co.za	EU	M8 – M30	Yes	Yes
R-KeX Chemical Slow Cure Cartridge System	Rawlplug South Africa	5.8/HT	www.rawl.co.za	BBA	M8 – M30	Yes	Yes
Express Anchors	Rawlplug South Africa	5.8/HT	www.rawl.co.za	EU	M8 – M20	Yes	Yes
Rawl Kemfix Chemical Anchor Studs – for use with all chemical anchoring (capsule and/or cartridge systems)	Rawlplug South Africa	5.8/HT	www.rawl.co.za	BBA	M8 – M30	Yes	Yes
Chemical Anchors with Studs	Bolt Fast	MS/EN8			Various		
	Mr. Bolt & Nut	MS/EN8			M8 – M64	Yes	
	Rawlplug South Africa	5.8/HT	www.rawl.co.za	BBA	M8 – M30	Yes	Yes
	SA Bolt Manufacturers	EN8			M8 – M30	Yes	
	Tel-Screw Products	MS/HT			M8 – M36	Yes	Yes
	WLS Fastener Manufacturing Co. cc	EN8			M8 – M30	Yes	Yes
Concrete Anchor Bolts	Bolt Fast	MS			M8 – M24	Yes	
	Mr. Bolt & Nut	MS		BBA	M8 - M24	Yes	
Concrete Expansion Bolts	Bolt Fast	MS			M8 – M24	Yes	
	Bolt Fast - single collar wedge type anchor				M8 – M30	Yes	
	Bolt Fast - nail plug hammer in anchors				M8		Yes
	Bolt Fast - mortar cartridge system				300, 345 & 380mm		Yes
	Bolt Fast - double collar anchors				M8 – M30		Yes
MISCELLANEOUS							
Type 17 Self Drilling Screws	Avlock	1022			#8 – #14	Yes	
	Mr. Bolt & Nut				#8 – # 14	Yes	
Gutter or Veranda Bolts	Avlock	1006			M8 x 12 x 75mm	Yes	
	Mr. Bolt & Nut	MS			M8 x 22 – 75mm		Yes

TYPE OF FASTENER	COMPANY	STEEL GRADE	SPECIFICATION	SPECIFICATION	AVAILABLE SIZES	HOT DIP GALVANIZED TO ORDER	HOT DIP GALVANIZED EX STOCK
MISCELLANEOUS (continued)							
Self Drilling Screws SDS can be successfully hot dip galvanized but due to a slight thread softening, a smaller diameter pilot hole must first be drilled	Avlock	MS			Various	Yes	
	Mr.Bolt & Nut	MS			Various	Yes	
	Bolt Fast	MS			Various	Yes	
	Rawlplug South Africa		www.rawl.co.za		Various	Yes	
	WLS Fastener Manufacturing Co. cc					Yes	
Cast-In Lifting Sockets	Rawlplug South Africa	5.8/HT	www.rawl.co.za	BBA	M10 – M24	Yes	
Insulation Fixings	Rawlplug South Africa		www.rawl.co.za	BBA	Various	Yes	
SPECIAL FASTENERS							
Countersunk Machine Screws	Bolt Fast	MS			M8 – M24	Yes	
	Mr. Bolt & Nut	MS/HT				Yes	
	Tel-Screw Products	MS/HT	DIN 963 & 965		M8 – M36	Yes	Yes
	WLS Fastener Manufacturing Co. cc	MS/HT			M8 – M36	Yes	
Round U-Bolts	Bolt Fast	MS			M8 – M72	Yes	
	Mr. Bolt & Nut	MS			M8 – M76	Yes	
	Rawlplug South Africa	MS/HT	DIN 963 & 965		M8 – M36	Yes	
	SA Bolt Manufacturers	MS/HT			M8 – M72	Yes	
	Tel-Screw Products	MS/HT			M8 – M76	Yes	Yes
	Tel-Screw Products	HT			M8 – M76	Yes	
Square U-Bolts	Bolt Fast	MS			M8 – M76	Yes	
	Mr. Bolt & Nut	MS			M8 – M76	Yes	
	Rawlplug South Africa	MS/HT	DIN 963 & 965		M8 – M36	Yes	
	SA Bolt Manufacturers	MS/HT			M8 – M76	Yes	
	Tel-Screw Products	MS/HT			M8 – M76	Yes	
	WLS Fastener Manufacturing Co. cc	MS/HT			M8 – M36	Yes	
TV U- Bolts	Bolt Fast	MS			M8 – M76	Yes	
	Mr. Bolt & Nut	MS			M8 – M76	Yes	
	Tel-Screw Products	MS/HT			M8 – M76	Yes	Yes

continued on page 8...

TYPE OF FASTENER	COMPANY	STEEL GRADE	SPECIFICATION	SPECIFICATION	AVAILABLE SIZES	HOT DIP GALVANIZED TO ORDER	HOT DIP GALVANIZED EX STOCK
SPECIAL FASTENERS (continued)							
Hook Bolts	Avlock	MS			M8 – M10	Yes	
	Bolt Fast	MS			M8 – M76	Yes	
	Mr. Bolt & Nut	MS			M8 – M76	Yes	
	Rawlplug South Africa	MS			M8 – M12	Yes	
	SA Bolt Manufacturers	MS/HT			M8 – M76	Yes	
	Tel-Screw Products	MS/HT			M8 – M76	Yes	Yes
	WLS Fastener Manufacturing Co. cc	MS/HT			M8 – M76	Yes	
Channel Bolts	Bolt Fast	MS			M8 – M76	Yes	
	Mr. Bolt & Nut	MS			M8 – M76	Yes	
	Tel-Screw Products	MS/HT			M8 – M76	Yes	
	WLS Fastener Manufacturing Co. cc	MS/HT			M8 – M76	Yes	
J-Bolts	Bolt Fast	MS			M8 – M76	Yes	
	Mr. Bolt & Nut	MS			M8 - M76	Yes	
	Rawlplug South Africa	MS	www.rawl.co.za		M8 – M12	Yes	
	Rawlplug South Africa	MS			M8 – M36	Yes	
	SA Bolt Manufacturers	MS/HT			M8 – M76	Yes	
	Tel-Screw Products	MS/HT			M8 – M76	Yes	
	WLS Fastener Manufacturing Co. cc	MS/HT			M8 – M76	Yes	
Eye-Bolts	Bolt Fast	MS			M8 – M42	Yes	
	Mr. Bolt & Nut	MS			M8 – M76	Yes	
	Rawlplug South Africa	MS	www.rawl.co.za		M8 – M36	Yes	
	SA Bolt Manufacturers	MS			M8 – M76	Yes	
	Tel-Screw Products	MS/HT			M8 – M76	Yes	Yes
	WLS Fastener Manufacturing Co. cc	MS			M8 – M76	Yes	
Straining Eye-Bolts	Bolt Fast	MS			M8 – M76	Yes	
	Mr. Bolt & Nut	MS			M8 – M76	Yes	
	Tel-Screw Products	MS/HT			M8 – M76	Yes	Yes
	WLS Fastener Manufacturing Co. cc	MS			M8 – M24	Yes	

TYPE OF FASTENER	COMPANY	STEEL GRADE	SPECIFICATION	SPECIFICATION	AVAILABLE SIZES	HOT DIP GALVANIZED TO ORDER	HOT DIP GALVANIZED EX STOCK
SPECIAL FASTENERS (continued)							
Linked Eye-Bolts	Bolt Fast	MS/HT			M8 – M76	Yes	
	Mr. Bolt & Nut	MS/HT			M8 – M76	Yes	
Linked Eye Nuts	Bolt Fast	MS/HT			M8 – M76	Yes	
	Mr. Bolt & Nut	MS/HT			M8 – M76	Yes	
	Rawlplug South Africa		www.rawl.co.za		M8 – M16	Yes	
Linked Eye Rods	Bolt Fast	MS/HT			M8 – M76	Yes	
	Mr. Bolt & Nut	MS/HT			M8 – M76	Yes	
	Tel-Screw Products	MS/HT			M8 – M76	Yes	
Forged Eye-Bolts	Bolt Fast	MS/HT			M8 – M30	Yes	
	Mr. Bolt & Nut	MS/HT			M8 – M30	Yes	
	Rawlplug South Africa		www.rawl.co.za		M8 – M16	Yes	
	SA Bolt Manufacturers	MS/HT			M8 – M30	Yes	
	Tel-Screw Products	MS/HT			M8 – M30	Yes	
Welded Eye-Bolts	Bolt Fast	MS			M8 – M16	Yes	
	Mr. Bolt & Nut	MS			M8 – M16	Yes	
	Rawlplug South Africa	MS	www.rawl.co.za		M8 – M16	Yes	
Scaffold Rings	Bolt Fast	MS			M8 – M16	Yes	
	Mr. Bolt & Nut	MS			M8 – M16	Yes	
	Rawlplug South Africa	MS	www.rawl.co.za		M8 – M16	Yes	
Threaded Studs	Bolt Fast	MS/EN8			M8 – M76	Yes	
	Mr. Bolt & Nut	MS EN8 B7			M8 – M76	Yes	
	Rawlplug South Africa	MS/HT	www.rawl.co.za		M8 – M30	Yes	
	SA Bolt Manufacturers	MS/HT			M8 – M76	Yes	
	Tel-Screw Products	MS/HT			M8 – M76	Yes	
	WLS Fastener Manufacturing Co. cc	MS/HT			M8 – M76	Yes	Yes
Tie Rods	Bolt Fast	MS/EN8			M8 – M76	Yes	
	Mr. Bolt & Nut	MS			M8 – M76	Yes	
	Tel-Screw Products	MS/HT			M8 – M76	Yes	
	WLS Fastener Manufacturing Co. cc	MS/HT			M8 – M76	Yes	
Other specials	Avlock	Any special manufacturing				Yes	
	Bolt Fast	Any special manufacturing					
	Impala Bolt & Nut	All specials relating to fasteners			M8 – M72	Yes	
	Mr. Bolt & Nut	Any special manufactured to specification				Yes	
	Rawlplug South Africa	Special application chemical and/or mechanical anchor bolts as required					
	SA Bolt Manufacturers	Any special manufactured fasteners				Yes	
	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	Mr. Bolt & Nut	MS			M8 – M20	Yes	
	Tel-Screw Products	MS/HT	DIN 1587		M8 – M76	Yes	
	WLS Fastener Manufacturing Co. cc	MS/HT			M8 – M36	Yes	
Hex Coach Screws	Bolt Fast	MS			M8 – M20	Yes	
	Mr. Bolt & Nut	MS/HT			M8 – M20	Yes	
	Rawlplug South Africa		DIN 7976	www.rawl.co.za	M8 – M12	Yes	
	SA Bolt Manufacturers	MS			M8 – M20	Yes	
	Tel-Screw Products	MS	DIN 7976		M8 – M12	Yes	Yes

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

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

THE ASSOCIATION ASSUMES THAT ALL PARTICIPATING COMPANIES IN THE MATRIX, DO IN FACT STOCK OR ORDER HOT DIP GALVANIZED FASTENERS WHEN REQUESTED TO DO SO. THE ASSOCIATION THEREFORE, EXCLUDES ITSELF FROM THE RESPONSIBILITY OF ENSURING THAT ALL FASTENERS OFFERED WILL IN FACT BE HOT DIP GALVANIZED, BY THESE COMPANIES.

SHOULD ANYONE USING THIS MATRIX FIND INACCURACIES OR ERRORS OR HAVE ADDITIONAL SUGGESTIONS, KINDLY CONTACT THE EDITOR.

PARTICIPATING FASTENER SUPPLIERS CONTACT DETAILS			
COMPANY	**TELEPHONE**	**EMAIL**	**WEBSITE**
Avlock International	011 917 2110	query@avlock.co.za	www.avlock.co.za
Bolt Fast	021 505 1000	ShaunD@boltfast.co.za	www.boltfast.co.za
CBC Fasteners	011 767 0000	tech@cbc.co.za	www.cbc.co.za
Impala Bolt & Nut	011 824 3925	adiamond@impalasa.co.za	www.impalabolt.co.za
Mr. Bolt & Nut	021 511 9805	mark@mrboltandnut.co.za	–
Rawlplug	011 894 7147	rmuller@infodoor.co.za	www.rawlplug.co.za
SA Bolt Manufacturers	011 814 2240	info@sabolt.co.za	www.sabolt.co.za
Tel-Screw Products (Pty) Ltd	011 898 3200	info@telscrew.co.za	www.telscrew.co.za
WLS Fasteners	011 882 1150	wlsandrew@telkomsa.net	www.kalm.de

Placing hydrogen embrittlement (HE) of fasteners into perspective

Some general comments on HE

What is problematic in identifying the presence of HE?

Failures from possible hydrogen embrittlement in steel are notoriously difficult to prove post failure for the following reasons[1]:

1. Measuring the total *hydrogen concentration* in the steel to prove the presence of HE is often meaningless as hydrogen trapping occurs at carbides, grain boundaries etc, and it is really the so-called *diffusible hydrogen* that needs to be measured, i.e. that hydrogen that can move to a crack tip and enhance its propagation;
2. Even if the diffusible hydrogen content is measured, the "danger level" of such hydrogen is not a fixed value as its effect varies with the strength of the steel. For a high strength steel, levels as low as 1 or 2 ppm may already be effective in initiating HE while for a low strength steel many tens of ppms may still be acceptable;
3. Once hydrogen atoms have "done their damage" they can even move out of the steel, yet the damage remains there (as "flaking" or "fish eyes") and may later culminate as a long delayed failure;
4. A SEM fractograph of the original fracture face is also not necessarily conclusive as a seemingly ductile dimple fracture is often present after HE. The observations from fractographs of a HE steel that often (but not always) show intergranular fracture are also not necessarily characteristic of HE as a number of other metallurgical mechanisms also lead to intergranular fractures.

The currently accepted model for understanding HE of steels

The current most accepted mechanism of HE failures is the so-called HELP model[1], i.e. Hydrogen Enhanced Local Plasticity, in which the hydrogen atoms diffuse towards the high stress concentration area at the tip of a crack where they actually enhance the plasticity during crack advancement but thereby quickly exhaust the ductility of the steel in that area, forcing the crack to move a step forwards to "fresh" material where the process repeats itself. This brings about that the stop-start of the crack tip leaves so-called "tear ridges" on the cleavage planes on a slow fractured surface in contrast to clear cleavage planes for the same steel but fractured in a fast impact where the crack tip "runs away" from the diffusing hydrogen atoms.

The delay of failure by HE

Delayed failures in HE steel components often occur sometime after processing the component although the delay times are usually measured in hours or days and seldom are longer as diffusion of hydrogen (the smallest of all atoms) in ferritic steel is relatively fast and movement of the hydrogen atoms to the crack tip is relatively fast, even at room temperature.

Source of hydrogen for HE

If HE is suspected one needs to consider from where the hydrogen may have come? If there is no credible source of hydrogen then HE is not likely to be present. Hydrogen may arise from moisture on scrap steel or master alloys fed during melting of the steel or during electroplating or pickling of a final product. It is for this very reason that vacuum degassing is generally employed in the melting and casting of High Strength Low Alloy (HSLA) steels and electroplating and pickling of the same steels is avoided for critical components.

Loss of hydrogen during heat treatment

Ferritic steel actually has a very low solubility for hydrogen and any hydrogen contained within the steel will tend to diffuse out of the component if allowed to. This forms the basis for the so-called *diffusion anneal* of steel components that are suspected to be embrittled by hydrogen.

The design of such a diffusion anneal is a standard calculation[1] which takes into account the distance L from

Bolt size	Solution treatment: 880°C for 1 hour		Tempering treatment: 425°C for 45 min		Overall Hydrogen retention factor: % from the original
	$D_{\gamma/H}$ cm²/s	Retention factor %	$D_{\alpha/H}$ cm²/s	Retention factor %	
M30	$1.3x10^{-5}$	90	$1x10^{-4}$	35	32
M24	$1.3x10^{-5}$	73	$1x10^{-4}$	28	20
M20	$1.3x10^{-5}$	47	$1x10^{-4}$	13	6

Table 1: Calculated retention factors of any initial Hydrogen in the steel during a typical solution anneal, quenching and tempering cycle.

the centre to the surface of the component where the hydrogen will escape, the time t at temperature T and the diffusion rate D for hydrogen at the temperature of the anneal. The latter parameter needs to take into account that "trapping" of hydrogen atoms takes place at carbides, grain boundaries, dislocations etc. that results in a "lower than usual" diffusion rate and use is, therefore, made of experimentally determined "effective" diffusion rates.

Fasteners seldom suffer HE from an initial hydrogen introduced in the melting and casting process as the typical solution anneal, quenching and tempering for high strength bolts effectively act as a "diffusion anneal". Calculations for M30, M24 and M20 bolts during the solution treatment (the steel is austenitic then) and the subsequent tempering process (the steel is ferritic then) have shown the following *(see Table 1)* typical hydrogen retention percentages.

The overall hydrogen retention factor means, for M20 bolts as an example, that if the hydrogen content in the steel was say 2 ppm before the heat treatment, that only 0.06 x 2 ppm will remain after the heat treatment, i.e. only 0.12 ppm will remain. For M24 and M30 bolts the retention factors are naturally somewhat higher from the longer diffusion paths from the centre of the bolt to the surface.

It is for the above reason that short term pickling of fasteners is even allowed in some standards provided that the pickling time is less than the galvanizing time at temperature where some hydrogen pickup from the pickling is removed again during galvanizing.

Where high strength fasteners, however, appear to show effects of HE, the source of hydrogen generally is not from the original melting and casting process but most likely arises from the environment in which the fastener operates or from surface treatment processes of the fasteners such as pickling and/or electroplating. In such a case, HE-induced fracture will, therefore, not be initiated from the centre or core of the fastener but rather at its outer surface, most likely within the stress concentrated area of the threads.

Testing for HE

A number of standards exist to test for HE in steel[2 to 7] with slow bending or slow strain rate testing and stepped loading tests relatively common. Both of these classes of tests rely on the principle that hydrogen atoms, given enough time, will preferentially move to the high stress concentration at the tip of an advancing crack and thereby affect the ductility of the steel in that area, allowing the crack to advance one more step. These tests, however, also have some limitations:

Step loading

In the step loaded test a critical stress/ crack combination will be reached at some point during the regular increase

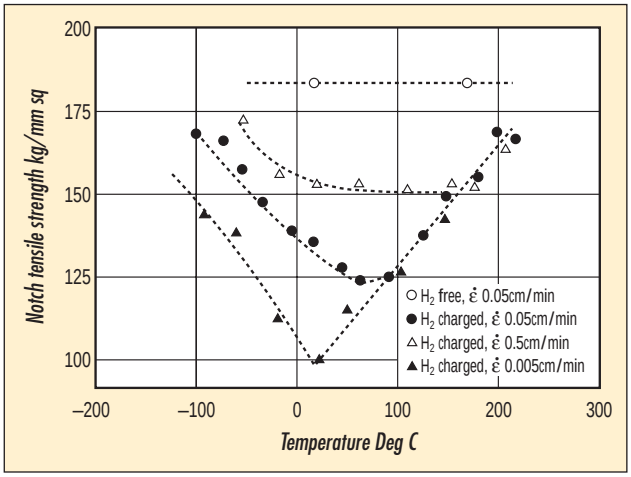

Figure 1.6.2.1: The notched tensile strength of steel AISI 4340 as a function of test temperature for three strain rates of testing[8].

in the stress level (typically on a daily basis), leading to HE-induced fast fracture. The weakness with this type of test is that it cannot distinguish between a pre-existing crack that will also become critical at a certain critical stress in the absence of hydrogen according to classical Fracture Mechanics and a crack induced by HE. This type of test is, therefore, well suited to indicate the presence of HE in those cases where no pre-existing cracks can be

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guaranteed but will fall short if any pre-existing cracks were present.

Slow strain rate tests

The SSR test for HE is based on the widely accepted HELP mechanism, i.e. strain a tensile test specimen in which HE is suspected, at a very slow strain rate (typically 10^{-5} to 1^{-6} s^{-1}) until fracture. The very slow crack propagation rate allows the hydrogen atoms to diffuse to the crack tip where they enhance the local plasticity but also quickly exhaust the local ductility, thereby extending the crack tip to a new area to which the hydrogen atoms will diffuse once more, thereby repeating the process. This brings about that the stop-start of the crack tip leaves so-called "tear ridges" on the cleavage planes on a slow fractured surface in contrast to clear cleavage planes for the same steel but fractured in a fast impact.

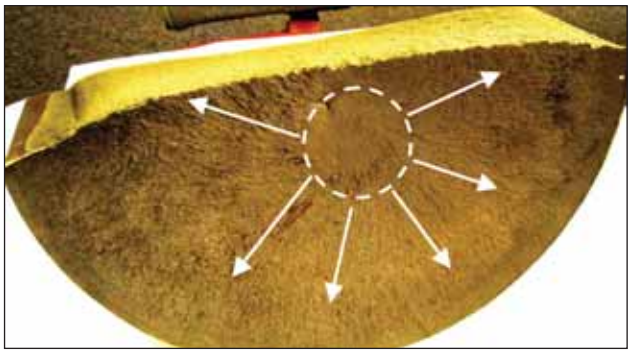


Figure 1.6.3.1: Macro-photographs of the failure by HE initiated at a "fish eye" of a 360 mm shaft manufactured from a low alloy Cr-Ni-Mo-V quenched and tempered steel[9].

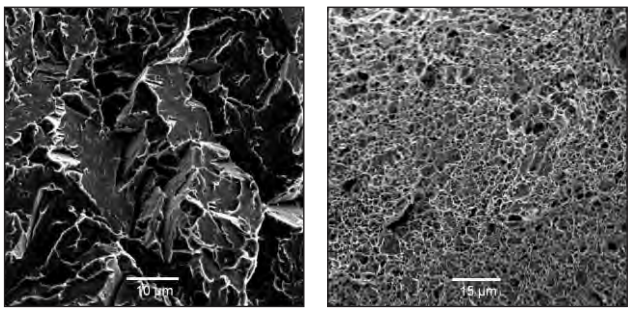


Figure 1.6.3.2: SEM fractographs of both cleavage and dimple fracture areas from the same freshly impact broken sample of a quenched and tempered low alloy Cr-Ni-Mo-V steel that was known to contain Hydrogen in excessive quantities.The white arrows show a few of the large number of secondary microcracks[9].

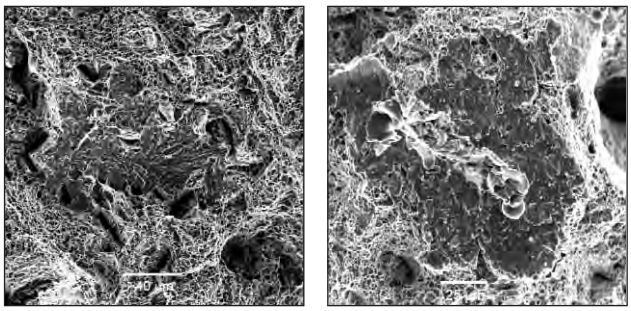


Figure 1.6.3.3: Slow SSR tested fractographs of the same 360mm shaft as in Figure 1.6.3.2 above. Note the "patches" of cleavage fracture areas amidst dimple fractured areas in the center of both figures with both of them showing clear "tear ridges"[10] seen as the fine lines on the cleavage planes[8].

Temperature also plays an important role in the H-embrittlement of steels with embrittlement most severe near room temperature and less severe at lower and higher temperatures. This temperature effect is shown in the *Figure 1.6.2.1* for an AISI 4340 steel (Fe – 0.4%C – 0.8%Cr – 1.8%Ni – 0.25%Mo). It is for this reason that the SSR test is also conveniently done at room temperature.

Note the significantly lowered notch tensile strength for the quenched and tempered low alloy steel AISI 4340 if tested at a cross head speed of only 0.005cm/min compared to less severely affected notch tensile strengths at higher strain rates, both with hydrogen charged specimens.

Signatures for a HE fracture

A number of indirect signatures exist for identifying fractures from HE present in the steel:

1. The fracture usually starts at a so-called "fish eye" which is mostly deep within or even near to the centre of the component where the hydrogen concentration will be the highest after any heat treatment. Fracture is, therefore, unlikely to start at or near to the surface where little or no hydrogen will be present after heat treatment.
2. HE may show either dimple or cleavage fractographs but very often shows secondary cracks leading from the primary fracture face inwards.
3. The fractographs from a Slow Strain Rate (SSR) test compared to a fast fractured one, show two signatures, i.e. a mixture of dimple and cleavage fractures and "tear ridges" on the cleavage planes.

   Compare the "clean" cleavage planes in *Figure 1.6.3.2* of a fast fractured specimen with the cleavage planes full of "tear ridges" of a SSR tested one in *Figure 1.6.3.3*, both from the same 360mm Cr – Ni – Mo – V shaft.
4. Finally, SSR testing will also reveal a low Z (Reduction in Area) if compared to a normal tensile tested sample, as shown in *Figure 1.6.3.5* taken from the Standard for slow strain rate testing for HE susceptibility: ASTM G129[2].

Summary

From all of the above background, it is evident that care should be taken not to arrive at any firm conclusion on the possible presence of HE based on only one or even

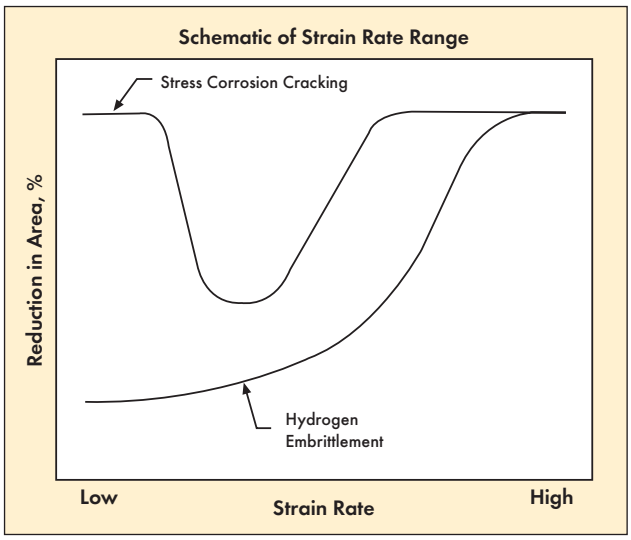


Figure 1.6.3.5: ASTM G129: Effect of SSR testing on the Reduction in Area for a HE specimen[2].

two observations "that fit the picture" while ignoring the rest but that a "global" perspective needs to be taken, typically by a decision tree as proposed below for hydrogen present in the steel from its melting and casting:

1. *Is there an identified possible source of hydrogen for contaminating the steel?* If yes, then consider HE;
2. *Was there a "fish eye" present in the fracture face where the original fracture in the "field" was initiated and did the fracture start near to the centre of the component?* (This is particularly so for delayed failures running into months and not necessarily so for typical delay times of only a few hours) If yes. Then suspect HE;
3. *Is there a marked reduction in the SSR's Z-value (Reduction in Area)?* If yes, HE is suspected;
4. *Does the SSR tested fracture face contain a mixture of dimple and cleavage fracture?* If yes, then strongly suspect HE;
5. *Do the cleavage planes of the SSR tested specimen contain evidence of so-called "tear ridges" whereas the fast fractured ones have "clean" cleavage planes?* If yes, HE is proven.

For the case where the source of hydrogen is from the operating environment or from surface processing (pickling and/or electroplating) and not from the melting and casting of the steel, the above decision tree is still applicable with the exception of Step 2 while steps 4 and 5 should be ideally located at or near to the surface of the fastener where the hydrogen may be present.

References

1. *"Hydrogen Embrittlement", WE Stumpf, Chapter 17 of the advanced post graduate course NHB 700 on the Heat Treatment of Steels, University of Pretoria.*
2. *Standard ASTM G129 (2006): "Standard Practice for Slow Strain Rate Testing to Evaluate the Susceptibility of Metallic Materials to Environmentally Assisted Cracking".*
3. *Standard ASTM F519 (2008) " Standard test method for Mechanical Hydrogen Embrittlement: Evaluation of Plating/Coating Processes and Service Environments'.*
4. *Standard ASTM F1624 (2009): "Standard Test method for Measurement of Hydrogen Embrittlement Threshold in Steel by the Incremental Step Loading Technique".*
5. *BS EN 2831 (1993): "Hydrogen Embrittlement of Steels: Test by Slow Bending".*
6. *BS EN 2832 (1993): "Hydrogen Embrittlement of Steels: Notched Specimen Test".*
7. *ISO 15530 (1999): "Fasteners: Pre-loading test for the detection of hydrogen embrittlement by the parallel bearing method".*
8. *BA Graville, RG Baker and F Watkinson, British Welding Journal: 14(1967)p337.*
9. *Case Study: WE Stumpf, (2008).*
10. *Metals Handbook, Vol 12 Publ ASM (US), p293-307*

Prof Waldo Stumpf, Department Materials Science and Metallurgical Engineering, University of Pretoria.

Roof fixings in aggressive environments

Hi Terry

It was interesting reading the article on the corrosion of the aluminium roof sheeting and washers on the building in East London.

I'd like to make some comments on this case study (published in magazine No. 46 page 7):

If a stainless steel washer had been used there would have been no reaction between the Topspeed and the washer. We often find that contractors use aluminium washers rather than stainless steel washers as the aluminium washers are cheaper.

If the rubber on the bonded washer had a high carbon content (all local EPDM and EVA washers have a high carbon content) it would have promoted pit corrosion around the head of the fastener, with the carbon acting as a conductor. Only low carbon EPDM bonded washers and seals should have been used.

On the aluminium smelters in Richards Bay and Maputo, a washer assembly was used which consisted of the following:

- *a plastic sleeve with a flange at the top which is placed over the Topspeed under the head*
- *a 19mm EPDM/stainless steel bonded washer under the head of the Topspeed and the flange of the sleeve*
- *the 19mm bonded washer goes on top of an aluminium saddle washer profiled to fit over the aluminium sheeting.*
- *a loose rubber washer was installed under the aluminium saddle washer.*

A stepped drill was used to drill an oversized hole through the sheeting (to accommodate the sleeve) and a smaller pilot hole was drilled through the hot rolled purlins.

Although (in my opinion) this was a bit of overkill, in a highly corrosive environment this might be the way to go. The washer assembly is known as a "Hillside washer assembly" named after one of the smelters in Richards Bay.

I thought that this might be of interest to you.

Regards
Reitze Hylkema
Managing Director, Kare Industrial Suppliers (Pty) Ltd.

The changing landscape for fastener manufacturers

The fastening landscape in South Africa has changed significantly over the last four years. This has been brought about by two factors; the resurgence of power station builds in South Africa where designs principally emanate overseas and the new standard EN 14399, High Strength Structural Bolting for Pre-loading. This standard was issued in March 2005 and has had significant influence on South African structural steel engineering as power station builds commenced in 2009.

EN 14399 has placed responsibilities on fastener manufacturers. The first is to conduct a suitability test in respect of a bolt, nut and washer assembly lot. In essence this test demonstrates the performance of the assembly to normal pre load and thereafter assures that it will perform within minimum requirements to ultimate destruction. Another manufacturer requirement is to ensure that the lubrication treatment qualities of the assembly (nut) are within tolerance and that the assembly will also perform to the requirements of the relevant structural standard in attaining the required preload at an equivalent torque value. The coefficient of friction of the nut assembly must also be specified by the fastener manufacturer.

Why has lubricant been given so much focus? The purpose is to reduce error in as a result of inconsistent coefficient of friction due to over and/or under lubrication; this has always been an onsite problem where one erector's light coating is another's over lubrication. Fastener manufacturers now have to supply the nut pre lubricated where the coating is baked on. This is a molybdenum disulphide or equivalent treatment. The coating is on the threads (where 40% of the torque is absorbed when tensioning) as well as on the surface in contact with the washer face (where 50% of the torque is absorbed in tensioning). Only 10% of the torque tensions the bolt. Erectors are cautioned that once the nut is threaded onto the bolt, if it is removed, it should then be discarded as the co efficient of friction will have changed.

It is also noted that the old standard DIN 18800:7:2002, the standard that dealt with the Execution of steel

structures, has been replaced by the 2008 version. Light oiling as an accepted lubrication has now been removed in the new standard because of the inconsistent outcome and poor lubrication quality. For example, to attain the same pre load of 220kN for a M24 grade 10.9 bolt, a torque of 800Nm is required when lubricated with molybdenum disulphide, whereas with oil, 1100Nm torque is required.

Lack of lubrication would be a problem particularly in hot dipped galvanized applications. It has been demonstrated that whereas the coefficient of friction starts at 0.19 at the commencement of tightening, once preload is being achieved, this has increased to 0.27 as a result of the galling of the soft galvanized surface. Therefore the required tension in the bolt will not be achieved, that is the bolt will effectively not be holding plates in a spring pre load condition. Under this un-lubricated condition, it has also been found that the torsional stress can result in the failure of the bolt at around the required pre load, which is only 70% of the yield point before a bolt should start deforming.

We have mentioned torque a few times and this is generally the “talk” on site; what do we torque the bolts to? Torque is a misnomer because it is the pre load or tension in the bolt which is the goal. It has already been demonstrated above that under different coefficient conditions, different torque is required. It is interesting that EN 1090-2:2008, the European equivalent for DIN 18800-7, goes further by not specifying the torque values at all. These values have to be established by testing bolt assemblies themselves to ascertain the torque required to obtain the specified preloads. It is also a daily requirement on site for erectors to verify the calibration of the wrenches in use to ensure that their torque values match the pre load required. This is done by testing three bolts for the diameter of bolt to be used on that day.

Finally, a further requirement of fastener manufacturers is to conduct training to erectors explaining some of the above. In addition to topics covered, it is also generally a good idea to address installation best practice. This is preventative training to ensure that reckless installation is not creating a condition that may only manifest many months after initial installation.

R J Pietersma, Chairman, South African Fasteners Manufacturers Association.

Let's torque tightening!

A brief history

The simple screw thread has found application since the time of Archimedes and has been used (and abused) across the ages. It was however, only with the advent of industrialisation in the 19th century that brought about a need for the systematic design of structural components for machines and engines that would enable these complex devices to be assembled, broken down for repair and/or maintenance and then reconstructed on a repetitive basis. So enter the machine screw or bolt in the rough format as we encounter it today. Nearly two hundred years old and we are all still "torquing" about it.

Initially, like the general engineering of the early industrialisation period, bolting was not given over to extensive analysis and was rather a hit-and-miss affair based upon experience, trial and error and opinion. Engineering shops functioned autonomously and in order to suit their own peculiar needs and requirements, it resulted in a plethora of fastening solutions. With the natural growth and development of an industry suited to regularity, standardisation was initially advanced in the form of the Whitworth thread form. The earliest inklings in the understanding of bolted joints were lead by Wöhler, with his investigations into the axle failures of the railway industry, which established that dynamic alternating loading advanced failure at lower loads than under static conditions (we know this phenomenon as fatigue today). This triggered a concerted effort for the understanding of the bolted joint. It was only in 1891 that von Bach issued his charts for allowable stresses that distinguished between dynamic and static loads. It was he too, who identified the multi-axis loading that occurs when a bolt is tightened and this concept was further advanced by von Camerer. The latter, at the onset of the 20th century, distinguished between the working load, the clamping load and the additional load that a fastener experiences and the residual clamping load at the joint interface. He was also able to grasp the influence that the stiffness of the bolt and the clamped components have upon the magnitude of the partial forces. The concept of bolt preload had been nucleated and in the following years, it all came to naught, as the Great War raged and not much further consideration was given over to the screwing of anything until in 1927, when the automobile industry was developing and literally finding its wheels, that the analysis of the bolted joint was driven further by the desire to manufacture smaller, compact engines and machines that developed and absorbed inordinate power and loads (relative to their preceding technologies). It was during this New Second Golden Age of engineering when Rötscher presented the world with the 'joint diagram'. This has been further refined, as our understanding of materials and failure mechanisms have progressively advanced. The methods are structured so that the bolt is sized in accordance with the required preload, which was understood to be an arbitrary and empirical multiple of the external working load. For the utilisation of the bolt by the preload method, the torsional stresses that arise on tightening are recognised in terms of the deformation energy theories (von Mises). In these calculations, the stiffness of the fastener and the clamped members are considered and using the 'joint diagram', the working load was apportioned to that absorbed by the fastener above its

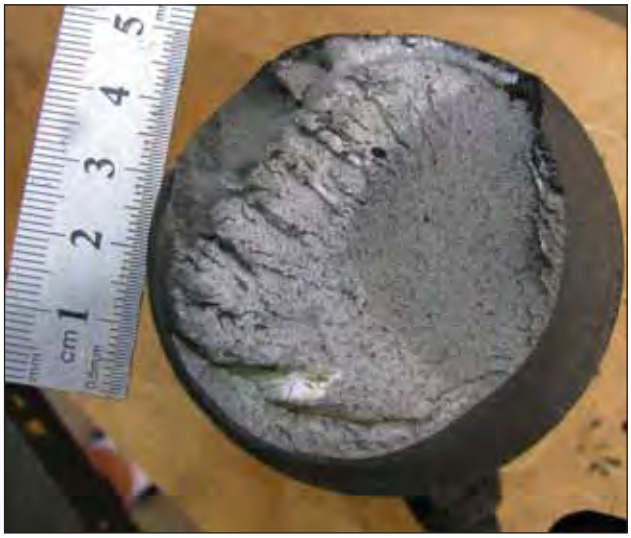


Figure 1: Overload fracture extending from the fatigue cracked zone (dark sickle-shaped region).

Figure 2: Bolt failure morphology ascribed to hydrogen assisted cracking (HAC).

preload, and that given to unloading the interface. By the mid-nineteen sixties, the state of the art analysis was increasingly complex, with the bespectacled brush-cut engineers of the day, manipulating their slide rules to determine whether the loads were above the yield strength (and after the enlightening Comet disasters of the 1950's – above the fatigue strength) and if the interface was fully unloaded, which would naturally lead to a separation failure of the joint.

The unexpected bolt failure

The singular most common form of un-anticipated, premature fastener demise is that associated with a fatigue mechanism of cracking failure,

continued on page 18...

which is followed by the catastrophic overload rupture of the residual uncracked ligament once the insidious sub-critical crack has attained the trigger length for fast fracture. The typical fracture face presented, is illustrated by *Figure 1*, where the imminently recognisable ratchet- and beachmark striations characterise the flat planar fatigue cracked zone.

The fatigue cracking mechanism, as applied to threaded fasteners, immediately invokes the notion that the fastener had been subjected to a varying cyclic loading regimen. Thus what we have, for the past half-century or so, been knowingly trying to avoid by adopting the approach that if we tighten the fastener sufficiently (preload) then it will not experience such in-service loading variations, has occurred.

The peculiar failures of high strength fasteners (notably in strength grades 10.9 and 12.9) are also commonly ascribed to hydrogen-assisted cracking. Notably however, these fasteners have been subjected to a plating operation, after which the baking treatment was delayed or (usually) omitted.

At the other end of the scale, low strength fasteners experience overload failure (hands up anyone who has twisted the head off a brass screw). In ductile materials, this results in a stretched bolt. The failure is somewhat benign. The effort felt through the wrench increases and suddenly there is a seemingly miraculous easing... as the peak tensile strength of the material is exceeded and the stress passes over into the necking region. Such common failures are rare to find, since most are quickly scavenged as trophy pieces and given boastful labels such as " I did this with my left hand...".

So how do I tighten it properly?

The failed bolted joint is by far in the minority. Most of the bolted joints ever made have survived until they

were duly disassembled. It is those bolted joints that failed unexpectedly, that have caused a large degree of associated drama and consternation.

The traditional weapon of the bolted joint designer against the multiple factors that give rise to uncertainty within the bolting application, is over-design. With failure, comes experience. Larger and more numerous bolts are deployed into the joint so that it does not fail even if not all of the bolts are correctly tightened or if the service loads were under-estimated. The route of over-design is often the only recourse when seemingly, the theory evaporates.

Almost all tightening methods invoke relative rotation between the bolt and nut (or threaded hole). The mechanical advantage of the screw thread (what Archimedes identified) enables high clamping loads with only modest torsional moments.

The methods of controlling such tightening efforts are many and from the simple spanner whose length has been estimated to limit the torque that could be reasonably exerted by the human arm, has developed the torque-control method, in which a spring-loaded pin mounted inside a wrench, limits the tightening effort to a predefined level.

Although the accuracy and repeatability of this method has been widely condemned (±27%) it nonetheless enjoys favour with many (including the 'cost effective' mechanic who has just re-assembled your vehicle's engine).

The more reliable method and one that is advanced by the more discerning members of the torquing fraternity, is the 'angle control method' (turn-of-nut). This method rotates the nut through a prescribed angle after it has been given a 'snugging' torque (that is initially chosen to exceed any influences that localised features – such as burrs – might incur).

In the direct measurement method, where both ends of the fastener are accessible, the length of the fastener might be measured and with advances in ultrasonic measurement techniques, this too may be used to determine the extension of the bolt and thus determine through the load extension behaviour, what preload level has been achieved during tightening.

The preload-indicating method that utilises deforming washers beneath the bolt head, has advanced to a

continued on page 20...

degree of formality by its inclusion into the EN14399 family of standards. These compressible-washers have protrusions that are progressively crushed as the bolt is tightened. The use of such direct indicating methods eliminate the need for a prescribed torque, as the deformation of the washer provides a fast and permanent visual record of the compression developed by tightening.

In critical instances, hydraulic or thermal deformation of the fastener is used in conjunction with conventional tightening methods, which enable the subsequent elastic or thermal expansion recovery to develop required preload levels.

One of the principal sources of uncertainty during the tightening of a joint rests with the friction between the threads and the contacting surfaces of the rotating nut (or bolt head). Students of engineering are often familiar with Shigley's simplified form of the relationship between the size of the fastener, the desired preload, friction and the tightening torque that amalgamates these aspects and it is presented below:

Tightening Torque (Nm) = friction coefficient (μ) x preload (N) x fastener diameter (m)

$$T = \mu F_i d$$

The friction coefficient is generally regarded to be 0.20, when considering the engagement of bare steel threads. A smidgen of grease contamination from dirty hands during handling will be sufficient to change the friction coefficient. The use of surface coatings, such as zinc, for protective or other purposes, have a propensity to alter under the intense local pressures experienced on the deforming threads and thus throw the practical attainment of a preload into doubt. The EN14399 family of specifications attempts to limit the range of frictional fluctuation through the manufacturing route by prescribing the lubrication conditions.

In overview, it is crucial that the relationship between tightening torque and preload is recognised and it is the latter aspect which ensures that the bolted joint remains intact. It is desirable to efficiently convert the tightening torque into the maximum level of preload that is tolerable by the strength and size of the fastener being employed, which is the desired objective. When all else fails and the experience level has increased, there is the traditional route to fall back on. It worked for Grandpa in his day, and it will work for you too.

Russell Thompson
PhysMet

Get a grip

In the latter 1880's three Rawlings brothers started a small plumbing company in London's South Kensington. The company prospered and diversified over the next twenty years into electrical, automotive, sanitary and general engineering as well as building.

One of the brothers, John Joseph Rawlings, an engineer and responsible for the building contracting division of the business, was contracted by the British Museum to install extensive electrical fittings on the walls throughout the museum. The mandate was that they should be installed unobtrusively without damage to the masonry.

The recognised method of doing this at the time was to chisel out a square hole in the masonry, then whittling a wooden wedge to fit the hole size and then driving this wedge into the chiselled hole. Apart from being extremely time consuming, the surrounding plaster was very often cracked and damaged in the process, the result was unsightly and the loads achieved were at best inconsistent.

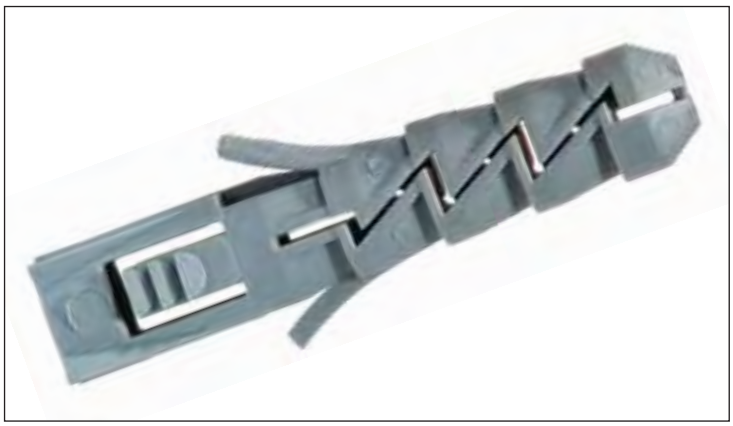
Rawlings experimented with various materials and methods and found that fibre suited the purpose due to its resilience, tenacity and that it expanded readily into the voids of the hole as the screw was turned into its core. The grip in the masonry that it provided was dramatic.

Lengths of jute and string were laid lengthways on a mandrill and bonded with a mixture of bonding agents including heated cattle blood.

These rigid cylindrical forms were made in various diameters in long lengths, then dried before being cut to standard lengths.

Rawlings lodged his first patent application in 1911, the "Rawlplug"

Rawl FIX-N plug.



Rawl FIX-N plug.

And the Rawlplug trade mark was first registered in the following year, 1912.

Effective in all types of masonry, the Rawlplug provided a simple and effective solution for thousands of fixing problems requiring smaller, neater holes with much improved loads. Rawlings was to extend his early hypothesis of 'expansion equals grip' in later years to equally good effect and the impact of his hypothesis on the building, construction and related industries cannot be overemphasised.

So revolutionary was the Rawlplug that it took countless demonstrations and a previously unheard of whole front page advertisement in the UK Daily Mail before the product was recognised for what it was. Demand grew rapidly leading to mass production and the formation of a separate dedicated manufacturing company, The Rawlplug Company Ltd., in 1919.

Rapid expansion over the next 25 years lead to many million Rawlplugs being sold annually all over the world.

In response to the invention of reinforced concrete and the market need for a heavy duty fixing to secure heavy steel to this new high strength concrete, Rawlings responded with the now equally world famous "Rawlbolt" which was first patented in 1934 and proved as revolutionary to the construction industry as the Rawlplug.

The original 4 segment Rawlbolt was refined in the late 1970's and the slimmer 3 segment version of today was released in the early 1980's with enhanced load capacity.

Rawlplug has continued to expand their range of fixings and anchors and today are justifiably proud of their long standing international reputation for excellence and their broad range of highest specification chemical and mechanical anchors and fixings which others can only envy.

100 years after the first Rawlplug, the company launched their newest Rawlplug – the all new Rawl FIX-N plug, pictured above and on the previous page which they state is "The strongest Rawlplug the world has ever seen". They should know.

Their website is: www.rawlplug.co.za

A secure strategy for growth

New faces and a dynamic new vision at Impala Bolt & Nut have catapulted this industry leader onto an exciting new path for success

Founded in 1988, with a clear goal of establishing themselves as an industry leader in customer satisfaction, Impala supplies high quality fasteners and related products to the construction, engineering, automotive, industrial and mining industries. Over the years, Impala has cemented their reputation as a customer-centric, independently-run manufacturer, and are now expanding their sights with a dynamic new vision for the company's future growth.

A fresh perspective and bright new ideas

Director Anthony Diamond set out to advance Impala's growth strategy by welcoming new investments from Global Capital, a private equity specialist, as well as through the appointment of a new director and partner, Derek Cohen, in September 2011.

With over 20 years' experience in engineering and business management, Cohen brings an abundance of invigorating ideas, and a fresh new perspective, to Impala. Having come from a larger company, Cohen is expertly equipped to extend Impala's current offering, and working closely with Diamond will ensure a smooth transition as the company implements new processes and systems. This enables Impala to commit to a stable and sustainable growth strategy in terms of new markets and products - including a renewed focus on the automotive industry.

The injection of capital has allowed Impala to bring in additional machinery and testing equipment, increasing capacity and expanding their extensive range of standard and customised fasteners. In addition, the move has allowed Impala to expand their workforce with an infusion of knowledgeable and industry-experienced staff, bringing fresh ideas and renewed vigour to the table.

One noteworthy new addition to the Impala team is industry veteran Technical/Quality Manager, Dirk Pretorius, whose vast experience will expand Impala's capabilities for sound Technical and Quality Management. Plans are also underway to acquire ISO 9000 accreditation, demonstrating Impala's ever-vigilant commitment to the highest quality standards.

Anthony Diamond and Derek Cohen.

More variety and bigger volumes

Impala's current base of equipment, consisting of over 20 machines (including bolt makers, part formers, headers, nut formers and thread rollers) has also seen a new addition. The part former, weighing around 60 tonnes, can manufacture items up to 200mm long, and has the versatility to manufacture both standardised and specialised products. This exciting new piece of hardware enables Impala to radically expand their current offerings and capacity - and opens up a wealth of new manufacturing opportunities that will both delight and excite their extensive and established client base.

Overall, the company's focused new approach is set to fully maximise on their growth potential. The dynamic plan will, in part, be achieved by taking advantage of the many exciting opportunities available in the industry at present. In addition, by adopting new capabilities, Impala will have the ability to do more in terms of variety and volumes, giving them the flexibility to provide quality at lower costs – while surpassing customer expectations – until they have firmly cemented their position as the leading supplier in the fastener industry.

According to Cohen, "Impala is ready and rearing to go – we have identified gaps in the market that we intend to fill by meeting customer requirements for quality, cost and service."

Diamond confirms, "By leveraging our position as an independently-run company, we have firmly committed ourselves to making decisions and responding to customer demands immediately, ensuring that Impala always offers the kind of service that our clients have come to expect."

YOUR DIRECT SOURCE OF QUALITY BOLTS, NUTS, WASHERS & SPECIALISED FASTENERS

Impala Bolt & Nut manufactures and supplies a vast range of fasteners and related products for a diverse range of applications in the engineering, automotive, industrial and mining industry. The ability to deliver high quality products with industry-leading customer service is part of the complete package that we provide.

Impala offers access to technical know-how and advice with a direct-to-customer approach, giving you peace of mind that you're getting the right product faster and at the right price.

Committed to quality
All products are manufactured according to strictly measured processes and to relevant specifications to consistently ensure a high level of quality from design to delivery.

For more information on how we can help you, visit our new website: www.impalabolt.co.za

Standard Products

Impala manages a vast warehouse of finished products available ex-stock off the shelf.

METRIC HEXAGON HEAD BOLTS, METRIC HEXAGON HEAD SCREWS, METRIC ROUND HEAD BOLTS, METRIC HEXAGON NUTS & WASHERS

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Impala has the flexibility, capacity and expertise to manufacture fully customised fasteners specific to your application.

VIBRATION-PROOF PINS & COLLARS, MINING ROOF BOLT COMPONENTS, RIVETS, PLOUGH BOLTS, GUARD RAIL BOLTS, FOUNDATION BOLTS & MORE

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No matter where you are based, Impala's fleet of trucks is standing by to deliver your order!

Specialist packaging and labelling is a value-added service for convenience to meet your every need.

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Standard bolts, nuts, washers & specialised fasteners for engineering, automotive, industrial & mining

For enquiries call +27 (0)11 824 3925 or email sales@impalasa.co.za

Report on sample bolts from Medupi

On 20 September 2011 five sample bolts and one short threaded rod was received from Profab Engineering c/o Medupi Power Station Lephalale. As per your request our Association was requested to review the quality of the hot dip galvanizing. The samples received were photographed as shown in *photo 1 (right)*.

Photo 1: Sample bolts and a short threaded rod received for a hot dip galvanizing quality review.

After a general visual inspection the steel from which the components were manufactured indicate a reactive material to molten zinc resulting in a "rough" *(photo 2)* surface finish producing a thick coating well in excess of the SANS 121 (ISO 1461:2009) specification requirements of a mean coating thickness 45µm.

Actual measurements taken indicate the following:

No. of readings taken	*10*
Maximum thickness	*195µm*
Mean coating thickness	*123µm*
Minimum thickness	*49µm*

The thicker than normal coating thicknesses are due in part to the rough surface finish. The extra zinc coating thickness is an advantage with regards to longer service life, but could well introduce an assembly problem during the application of the nuts.

Two of the samples are not in accordance with the requirements of the specification as the threads were found to be "clogged" with excess zinc. These two components are illustrated in *photo 3* and are unacceptable.

A previous photograph *(photo 4)* e-mailed to us on 1 September indicates corrosion products on the bolt. We can speculate that the hot dip galvanized thread may well have been retapped in order to accept the nut. Generally this is not accepted practice as the quality of galvanized threads should be able to accept nuts without re-tapping.

Conclusion

In general, the quality of the hot dip galvanized samples received; do not represent normal standard quality. Two reasons are suggested for this:

1. Steel chemistry and the reaction with molten zinc.
2. Poor quality controls during the hot dip galvanizing process.

Should these samples represent the quality of the total consignment there are grounds to reject and to request remedial corrective action.

I trust that this report is a fair representation of the samples received. Should any additional detail or explanation be required, please refer to the undersigned.

R.E. Wilmot

Photo 2: Rough surface finish usually the result of steel chemistry that increases the reactivity when immersed into molten zinc.

Photo 3: Bolt threads not cleaned and as such are not in conformance with the specification Such components are rejectable and should be returned to the responsible galvanizer.

Photo 4: Corrosion products evident on a bolt thread after assembly. Causes could be re-tapping, or poor quality galvanizing both of which are unacceptable.

AUTOMATED CENTRIFUGE PLANT

Galvspin Galvanizers' new automated centrifuge plant provides for quick, high volume turnaround time on centrifugal material.

It delivers a consistent, high quality zinc coating for high tensile items such as fasteners.

The Italian designed plant works on a gas fired system and includes a backup generator that will operate the robotics during times of power cuts.

Surface cleaning is done by an integrated shot blast facility, which is ideal for use on high tensile materials.

The ceramic kettle operates at temperatures of between 440°C and 680°C, while the efficient drying tunnel utilises furnace flue gasses.

The quality management systems and processes are accredited by SANAS with accreditation code SANS 121 (ISO 1461) Product Certification Scheme. ISO 9001 accreditation to follow.

GALVSPIN GALVANIZERS cc

Admin Office: 53A Michelson Street, Westwood, Boksburg Tel: 011 918 6177 Fax: 011 894 4046 **Plant:**20 Hamba Gahle Road, Anderbolt, Boksburg Tel: 011 892 4640 Fax: 011 892 0808

P.O. Box 6525, Dunswart 1508 Email: galvspin@telkomsa.net

Turn your creative staff into skunks to keep them away from predators

In any organisation there are two types of people: those that generate new ideas and those that don't. The creative ones are those that make mistakes and the non-creative those that don't. Regrettably, it is usually the ones that never make mistakes who get promotion. Those that do make mistakes either leave to join companies where mistakes are seen as essential to the creative process or stay on and forced to learn not to make mistakes. The environment within these companies changes creative and potentially creative people into non-creative people and thus the company, to its detriment, is likely to end up with a total complement of non-creative staff.

Non-creative people, let's call them predators, are an important part of this environment. They prey on the mistakes of others. They focus on and devour the mistakes, with little appreciation of the idea itself. They show very little enthusiasm for anything new or different. They do not realise that the innovative process includes making mistakes, and that creative people should be judged on the number of mistakes made, since this indicates the number of new ideas being developed. It's the final result that really counts, and truly creative people will get to a final result, irrespective of the number of failures. In teams, predators are easy to recognise: they are nitpickers, topic-jumpers and blockers. They are usually very negative in outlook, shirk responsibility and have little urgency, purpose or sense of direction. Predators will not take risks. Their growth cycle usually comprises the

elements of non-achievement, boredom, low self confidence, immobilisation and non-achievement. A creative person's development cycle, on the other hand, comprises the achievement of a goal, satisfaction and pride, enhanced self confidence, goal setting and the achievement of a goal. Predators and producers of new ideas do not work well together.

Modern companies need creative people. Tom Peters *(A Passion For Excellence)* has suggested that creative people should be separated from predators, especially if a fast track innovative product is required. Treating creative people as skunks will make a company "smell" of innovation. Skunks do not need a manager, they have no regard for corporate status symbols and will generally work to their own rules. Most skunks see themselves as free agents or as independent contractors. Skunks work well together: they will freely initiate ideas, they will seek and give opinions and will readily clarify, elaborate and summarise ideas among themselves. They will keep communicating with each other and will show encouragement and compromise where necessary. The sense of urgency that skunks have results in quick development/testing/modification of a new idea. Bring predators into the team and these group attributes will fast evaporate. How often have good skunk ideas vaporised when predators have become involved, e.g. when good ideas have been confronted by predator accountants, planners, quality control specialists, time and motion experts and human resource departments? Skunks know that the rapid testing and proving a new idea is the main task at hand. Other requirements can be considered and implemented later. Skunks thrive on failure, for they view every one as a new challenge leading to the attainment of their goal. Their mission in life is to avoid boredom. Edison was a good skunk: he tried 10 000 different materials (9 999 were failures) for the electric light bulb. Skunks have two important attributes, which distinguish them from predators; they have drive and they are fast. Predators should learn not to mess with skunks!

With many companies today going through the processes of business re-engineering, merging, restructuring or unbundling, they would do well to realise that while many other departments or sections may be cut, downsized or reorganised, a good skunkworks should be left alone.

The Association wishes to thank Bob Andrew who is a consulting value engineer and honourary member of the Association for his article. He can be contacted on anneve@iafrica.com or boband@mweb.co.za.

Bob's BANTER: What readers have to say...

Hello Bob,

I wrote to you last year re using your "Cleaner Fish" article in the GALVANIZING magazine. I have spoken to Terry Smith, the editor. He is delighted to hear we read his magazine! He said I may send it on to others. Obviously with your email details.

Coincidentally our sons were friends at school and still maintain contact.

Please send me a copy.

Thanks a lot.

George Savage
Picasso Digital Graphics

Hi Bob

After 15 years' of retirement I find that the pure scientific articles are getting less interesting, or is it understandable. Your Bob's Banter, with its often philosophic slant, is however always great reading. I especially enjoyed your latest one based on Darwin's evolution theory. Thanks. Best wishes for a lovely 2012 and many more to come.

Regards
Wim Skinner

Hi Bob,

Just read your article "Bob's Banter" in HD Galvanizing Today no. 47 – what an inspirational way to start my day.

Hope to see more of your writings in the magazine in the future.

tx

Conrad Hubbe
for STATIC Structural Engineers cc (In association with Geni Consulting Engineers cc)

Motivation and methodology of hot dip galvanizing steel railway sleepers for Vale Do Rio Doce, Brazil

Introduction

Due to thermodynamic laws, steel when left unprotected will in time return to its natural state of iron ore. This means that insufficient corrosion protection, will result in premature corrosion, ultimately reducing the mechanical properties and strength of the steel.

Table 1 shows the corrosion rates of steel and zinc for five environments or corrosivity categories outlined in the Brazilian standard ABNT NBR 14643 *(For ease of reproducibility Table 5, which is similar, taken from ISO 9223, was used below).*

If we compare the maximum corrosion rates on the environment "C5" (exterior: industrial with high humidity or high coastal salinity), which is the environ-ment of Port of Vale in Victoria, the corrosion rate of steel is twenty times higher than the rate of zinc, therefore, 200 microns of steel per year compared to 8.4 microns of zinc per year.

This corrosion rate of steel can be catastrophic and can lead to untold costs.

Hot dip galvanizing is an effective way to protect steel from corrosion. As seen in *Table 1*, zinc has a lower corrosion rate than steel in any environment. The corrosion rates defined in the standard, allows it to extrapolate the life of the metallic coating, an effect that cannot be replicated by other conventional methods of protection.

The corrosion protection criteria of hot dip galvanizing and therefore its service life is based on three pillars: Galvanic Protection, Atomic Diffusion, Full Coverage.

In addition to these three pillars, hot dip galvanizing also provides excellent adhesion of the coating (metallurgical bond), a differentiated hardness (of iron/zinc alloy layers) that helps to resist impact caused by normal handling, transportation and installation. Both these properties

continued on page 28...

1	2	3	4
Corrosion category	Description of environment	Corrosion rate (ave. loss of steel in µm / yr.)	Corrosion rate (ave. loss of steel in µm / yr.)
C1	Interior: dry	≤1.3	≤0.1
C2	Interior: occasional condensation Exterior: exposed rural inland	>1.3 to 25	0.1 to 0.7
C3	Interior: high humidity, some air pollution Exterior: urban inland or mild coastal	>25 to 50	0.7 to 2.1
C4	Interior: swimming pools, chemical plant etc. Exterior: industrial inland or urban coastal	>50 to 80	2.1 to 4.2
C5-I or C5-M	Exterior: industrial with high humidity or high salinity coastal	>80 to 200	4.2 to 8.4

Table 1: Standard ABNT NBR 14643 (Similar to the table above extracted from Table 5 in ISO 9223, (Corrosivity of steel and zinc).

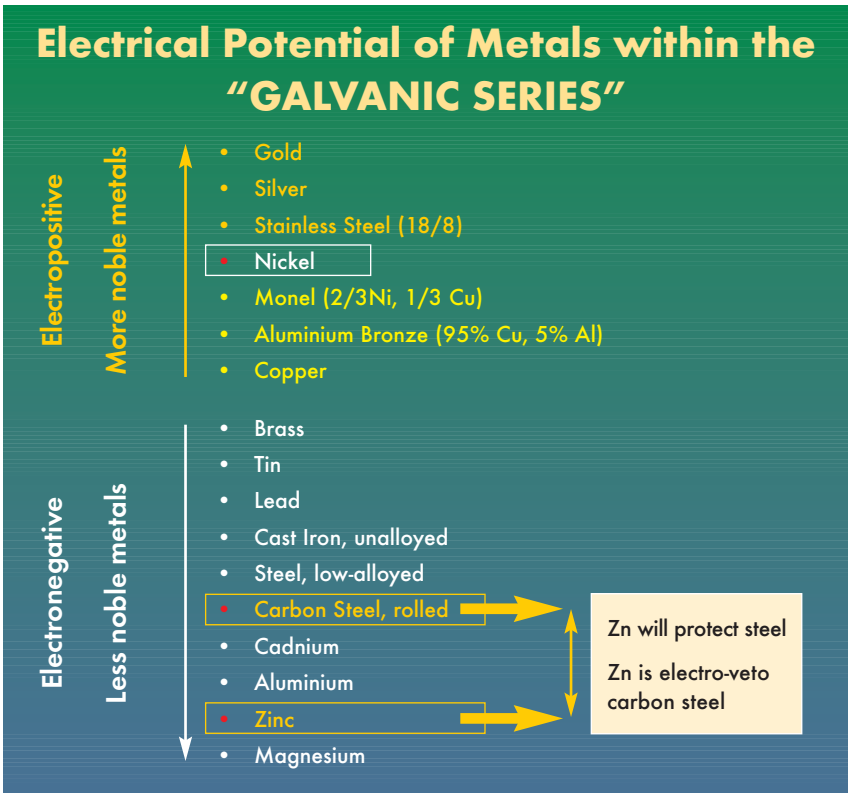

Diagram 2: Galvanic protection.

assist in minimising product / component coating damage during transport, loading, offloading and on site assembly.

a. *Galvanic Protection:* When two metals are in contact with each other and exposed to a corrosive environment, the more anodic metal of the two will corrode in favour of the less anodic or Noble metal, which will remain intact. Corrosion of the noble metal will only start once the anodic metal in the couple no longer exists.

Diagram 2 shows details of the galvanic series of metals.

b) *Atomic Diffusion:* If a the correct temperature, at an exact time, is applied to two different metals that are in contact, their atoms interact to form metallurgical phases.

Diagram 3 shows details of atomic diffusion.

c) *Full Coverage:* Provided appropriate fill, drain and vent holes are added, molten zinc will be able to access all surfaces of a component ensuring complete internal and external protection. In addition, coating thickness of zinc at all edges is maintained or increased slightly, preventing typical edge corrosion. Generally, this is not a feature of other popular methods of protection.

Diagram 4 shows details of full coverage.

Methodology

Assembly: Since an individual steel sleeper has a mass of 75kg, a forklift was used to hang the components on the flight bar *(photo 1)*.

- As no holes were available to hang the sleeper this steel hanging device together with two jigging wires with a collective capacity of up to 100kg were used *(photo 2)*.
- To ensure the correct angle of dip, different lengths of jigging wire were used *(photo 3)*. To limit touch marks and optimise the bath width 7 sleepers were hung in a single position. In order to optimise the length of the bath, 4 rows of 7 were hung on one flight bar.
- Following jigging, the sleepers were fully degreased and visually checked after 10 minutes, if necessary they were left for a further 10 minutes.
- Following degreasing, the sleepers were immersed in pickling acid for 10 minutes and again visually checked for cleanliness and if necessary they were agitated in the pickling solution and left for

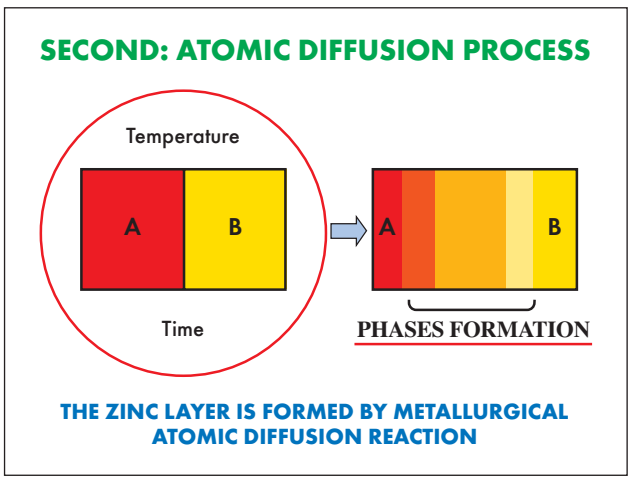

Diagram 3: Atomic diffusion.

Diagram 4 shows details of full coverage.

Photo 1.

Photo 2.

further 10 minutes.

- Following the pickling solution, all sleepers were water rinsed, sequentially in the two rinse baths.
- The sleepers were then immersed into the flux solution for about 5 minutes.

In order to prevent possible weeping at potential weld porosity at overlapping plates, all sleepers were tilted and heated over the bath before dipping in molten zinc. If necessary additional flux salts were applied in areas close to overlapping plates *(photo 4)*.

The sleepers were then immersed in molten zinc for approximately 3 minutes at about 445°C.

All sleepers were then air cooled and finally inspected in accordance with NBR 6323, see coating thickness readings *(photos 5 - 7)*.

Following inspection any uncoated areas were repaired by zinc thermal spraying *(photos 8 - 9)* and the required coating thickness achieved.

continued on page 30...

Photo 3.

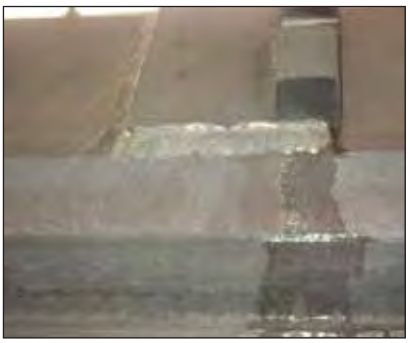

Photo 4.

Photo 5.

Conclusion

The sleepers were hot dip galvanized and in accordance with the Brazilian hot dip galvanizing technical standard ABNT NBR 6323.

The client was extremely happy with the hot dip galvanized products and following the initial test order of 25 MT, the second order of 300 MT (set out in this report). They are now considering an order of 1 000 MT.

The Association wishes to thank and acknowledge:

David Vela – Executive Director, Latin America Zinc Association (LATIZA)

Ricardo Suplicy Goes – General Manager, Non-ferrous Metals Association, Brazil (ICZ)

Eng. Luis Gallegos – General Manager of BBosch Galvanizing, Chile & Brazil.

Juan Antonio Osses M – Commercial Manager, B Bosch Galvanizing

Christian Sánchez Villa – Technical Marketing Manager B Bosch Galvanizing

Photo 6.

Photo 7.

Photo 8.

Photo 9.

Photo 10.

Photo 11.

Photo 12.

With over 25 years' experience in the galvanizing industry, **Transvaal Galvanisers** is capable of meeting almost any requirements when it comes to hot dip galvanizing.

Specialising in dipping, spinning and drag line galvanizing, **Transvaal Galvanisers** accounts for 70% of South Africa's demand for transmission line tower and substation galvanizing.

Transvaal Galvanizers' partnership with IMAB Engineering ensures that

"We strive for excellence, meet our commitments and grow with our client base"

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3 Third Avenue, Vorsterskroon P.O. Box 983, Nigel 1490 Tel: 011 814 1113/4 / 011 814 4710/2 Fax: 011 814 1645

Beware of hot dip galvanizing structural steel with extremely high phosphorous!

It should be reasonably common knowledge that to achieve a good quality hot dip galvanized coating thickness in terms of SANS121of a minimum mean of about 85 microns on structural steel, the silicon content of the steel should be limited to the ideal requirements of the well known Sandelin curve (see figure 1) which basically tells us:

The two chemical constituents in steel that affect coating thickness and aesthetic appearance are silicon and phosphorous. When the silicon falls out of the two desirable ranges on the Sandelin Curve, an extremely thick and easily damaged mottled grey to silver and dark grey coat of zinc is the result. However, when the phosphorous content falls into the out-of-specification range, it affects the successful metallurgical bonding of the coating (i.e. the galvanizing will delaminate in large localised areas).

Ideal steels require a silicon content to fall between 0.02 to 0.04% (the so-called 'aluminium killed steel') and 0.15 to 0.25% ('silicon killed steel').

The maximum phosphorous content should be less than 0.02%. Steel that falls out of these ranges are called 'reactive' steel when it comes to galvanizing.

SANS 121 (ISO 1461) includes an Annex A, which addresses the essential information to be provided by the purchaser to the hot dip galvanizer. Even though the Annex is situated at the back of the Standard, it does not reduce its importance when specifying hot dip galvanizing to ensure the quality product we have come to expect from South African hot dip galvanizers. This includes information about the chemical composition of the steel.

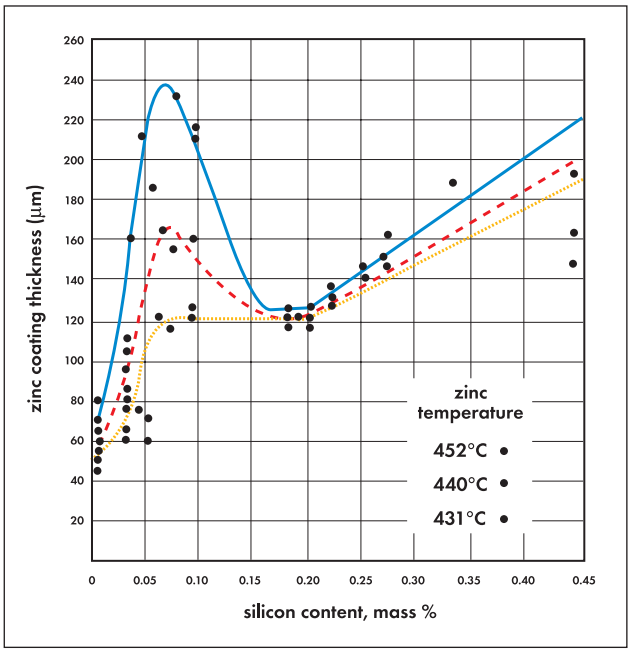


Figure 1: Bath temperature effect on the Traditional Sandelin Curve.

Most general galvanizers will accept steel for hot dip galvanizing as long as the component has been reasonably designed and fabricated taking into account some simple design rules. However they cannot be aware of the potential reactivity of the steel in its black form with respect to molten zinc before hot dip galvanizing unless they have

Cracking of the coating caused by high levels of phosphorous can cause follow on coating delamination.

Out of spec. high levels of phosphorous can cause severe cracking of the coating.

sight of material certificates which spell out the chemical composition of the steel.

For heavy duty coatings on heavy steel sections, usually required for underground mining conditions, a bit of reactivity is a good thing so that a hot dip galvanized coating thickness of in excess of 150 microns can be achieved.

The galvanizer takes responsibility for hot dip galvanizing the steel but the choice of steel grade and chemical composition of the steel is the responsibility of the specifier, his fabricator and the steel supplier, particularly when the latter has been informed that the steel is to be hot dip galvanized!

As a general rule, the fabricator should take responsibility for checking the chemical composition related to its suitability for hot dip galvanizing (as well as its conformance with design requirements) when purchasing the steel. The South African steel rolling mills will take care to supply, as long as it is ordered, steel that is suitable for hot dip galvanizing.

However, when it comes to the so-called commercial quality steels, no chemical composition certificates are available.

If the galvanizer is aware, that for a particular batch of steel, the chemical composition does fall into the 'problem steels' range he then can act accordingly. However, the methods he may use to limit coating build-up are generally insignificant in comparison to the coating buildup effect from extremely reactive steels. Should hot dip galvanizing of the steel be unsuccessful he may be able to offer his client a zinc thermal sprayed metal protective coating as an alternative.

It is also common knowledge that a substantial quantity of steel has been imported into South Africa. We are aware that sometimes the material certificates are not supplied with foreign steel and if they are supplied they are not necessarily accurate.

It has come to our notice of an incident where structural steel was hot dip galvanized where the silicon was in the ideal range but the phosphorous was as high as 0.042%! This resulted in coating cracking and significant subsequent delamination of the coating.

You have been warned to pay attention to the silicon and phosphorus content of steel you intend to hot dip galvanize.

Terry Smith

What is Cathodic Protection (CP) and what it isn't?

In order to understand what Cathodic Protection (CP) is, one must first understand the very basics of the corrosion mechanism. For corrosion to occur, three conditions must be present.

1. Two dissimilar metals
2. An electrolyte (water with any type of salt or salts dissolved in it)
3. A metal (conducting) path between the dissimilar metals

The two dissimilar metals may be completely different alloys, such as steel and zinc, but they are more often microscopic or macroscopic metallurgical differences on the surface of a single piece of steel. If the above conditions are present then at the more active metal surface (in this case we will consider freely corroding steel which is non uniform), the following reaction takes place at the more active sites: (two iron ions plus four free electrons)

$$2Fe \Rightarrow 2Fe^{2+} + 4e^{-}$$

The free electrons travel through the metal path to the less active sites where the following reaction takes place: (oxygen gas converted to oxygen ion – by combining with the four free electrons – which combines with water to form hydroxyl ions)

$$O2 + 4e^{-} + 2H_2O \Rightarrow 4\ OH^{-}$$

The recombination's of these ions at the active surface produces the following reactions, which results in the formation of the iron corrosion product ferrous hydroxide: (iron combining with oxygen and water to form ferrous hydroxide)

$$2Fe + O_2 + 2H_2O \Rightarrow 2Fe\ (OH)_2$$

This reaction is more commonly described as 'current flow through the water from the anode (more active site) to the cathode (less active site)'. Cathodic protection prevents corrosion by converting all of the anodic (active) sites on the metal surface to cathodic (passive) sites by supplying electrical current (or free electrons) from an alternate source.

In the case of hot dip galvanizing (HDG), this occurs as the zinc sacrifices itself as it is more electronegative than the steel. CP may take place, as one has an anode (steel surface), a cathode (zinc surface), a metallic path between the zinc-iron intermetallic layers which formed during the metallurgical reactions between steel and zinc during the galvanizing process, and an electrolyte (sea water, atmospheric water globules on the surface, etc.).

Cathodic Protection (CP) works on submerged (e.g. water tanks) or buried (e.g. pipelines, piles, offshore rigs, etc.) structures, providing that the circuit resistance allows sufficient current to flow from the anode to the cathode through the electrolyte (soil, sea water, etc.).

Does CP work on cars, stadium steel seats? No. It would only work, if one were to submerge the car, stadiums, etc. in water (electrolyte). If CP worked on cars, it would be standard on all BMW, Mercedes, Toyota, Nissan, VW, Audi, etc., etc., but it is not.

Can paints provide CP? No. Please see Hot dip Galvanizing Today Volume 2 Issue 4 2005.

Does CP work in the 'marine splash zone' (MSZ) or any other splash zone? No. As there is an intermittent supply of 'electrolyte' and intermittent flow of current. Due to the highly oxygenated 'water' and wet and dry conditions, extremely high corrosion rates are observed. Carefully designed systems with modified permanent 'electrolytes' do permit CP to take place in a MSZ, please see *http://www.structuraltechnologies.com/LifeJacket* but the 'environment' has been changed to allow CP to occur.

CP is like all other protection systems and has its limitations, so if you are in doubt, then after applying simple logic and the 'reasonable man test' one may need to contact a corrosion specialist.

The Association would like to thank Gerald Haynes of CTC for this article.

The above photo shows the thinly galvanized coating (Z275) (used for security spikes in Kenilworth Cape Town after about 15 years of exposure) being a minimum of 13.5µm to a nominal 20µm per face (when new), both the edges and more so at the tip, the zinc coating providing CP will slowly recede away from the edge or tip revealing a localised rusted area, which as the zinc recedes, will gradually increase in size.

After 26 years of mild marine exposure, this site cut unrepaired hot dip galvanized steel grating still offers cathodic protection at the cut ends.

Protecting your steel investment

Carbon steels are the most commonly used materials for engineering structures as they combine excellent strength with good economy. However, steel has one unfavourable property namely its surface will rust when exposed to the elements and it is our duty to prevent this happening.

Specifiers, engineers, architects and fabricators who have prescribed to their client's good corrosion resistant products over the years can sleep well at night knowing they have provided for a lifelong permanent corrosion free installation. The vision of these people who initially may have over specified is only seen many years later when other systems fail. Over specifying on a project is considerably better than under specifying because when corrosion sets in it is a lot like being the host at a cocktail party that runs out of champagne and snacks when everybody is enjoying themselves. When the failure does occur then the hunt is on to find the scapegoat and fingers are initially always pointed at the applicator as he is the easiest person to blame. However, corrosion failures, which can be spectacular, are normally due to ignorance of the environment and other important factors that create accelerated corrosion. Most failures however occur due to under estimating and subsequently under specifying for the project.

It is normally too late for a structure that is corroding if it is a permanent installation as it will either require dismantling and removal for reprocessing or site work that will require blasting and painting which then becomes very expensive and disruptive.

In recessionary times such as we are experiencing currently, cheaper

Excellent corrosion protection specification.

corrosion protection specifications become more prevalent which are probably due to financial constraints and the danger exists that this will lead to under specifying.

Let us look at a few examples of corrosion specifications.

1) Hot dip galvanizing on any exterior steel structure especially in coastal areas is not negotiable. The best advert for galvanizing is always in their permanent installations such as transmission lines many of which were galvanized in the 1960's and 1970's.

2) Should the installation not be suitable for galvanizing then the steelwork must be abrasive blasted to a minimum of SA2$^{1}/_{2}$ or 3, metal sprayed and painted, or painted with a suitable 2 or 3 coat paint system.

In coastal areas close to the sea, it is necessary to over coat the galvanizing with suitable paint coatings especially in areas that are constantly subjected to strong winds carrying chlorides due to heavy wave action such as that experienced at

Inadequate corrosion specification.

the False Bay coastline. As proximity to the sea decreases the need for painting lessens dramatically from a 3-coat system to only galvanizing. In warm dry rural atmospheres, the stability of zinc is remarkable and the lifetime of galvanized coatings are indefinite.

3) Wire brushing and painting is not a solution as if it is not possible to remove mill scale or rust it is hardly worth the cost of applying the paint to the surface. No protective coating will provide

continued on page 36...

any form of long-term protection without removal of the corrosion product as mill scale eventually cracks and falls off taking the paint film with it, while rust remains damp and retains salts. Tests carried out in the United Kingdom with a wire brush and a 100-micron paint system against blasting to SA3 and the same 100-micron paint system showed the blasted/painted coating will provide a minimum of 3 times the lifetime depending on whether it is in a mild or aggressive environment.

(Ref: Corrosion Protection of Steel Structures – Chandler and Bayliss) A further point to note is that thin paint coatings will not provide long-term protection and it is always safer to over specify the completed DFT thickness of the coating than under specify especially close to the sea.

Similarly when using pre-galvanized roofing sheet always call for the heaviest coating available which is a Z600 (40 microns zinc per side) as this can vary considerably down to a Z100 (minimum of 5 microns per face). In a coastal environment, duplex-coated roof sheets are a necessity and are not negotiable, especially close to the sea. I have a friend whose house is less than 20 metres from the sea, who is about to replace part of his roof for the third time in 30 years. His problem is that he has never specified the coating thickness he requires on the roof sheets even though he has applied paint at a later date. This paint coating must be a heavy duplex coating or even applied in the factory as chlorides are extremely corrosive due to their hygroscopic nature. This is accentuated if the structure does not receive full sunlight and the time of wetness is over extended periods. Some galvanized coatings are also not an item of beauty due to elements in the steel that create dark and ugly coatings. These coatings should be painted for aesthetic reasons where possible.

In developed countries, banks will only finance private capital installations that can provide a 30-year corrosion free lifetime and if the project is hot dip galvanized then the finance is readily available. Makes you think? These overseas bankers are extremely well informed.

The Association would like to thank Iain Dodds of Cape Galvanising for this article.

3 CPD POINTS

3-day Galvanizers Inspectors Course

Hot dip galvanizing is one of the most widely used methods of protecting steel from corrosion. During fabrication and after hot dip galvanizing the coating is inspected for compliance with the relevant specifications.

Following up on comments received from the many participants attending our regular two day inspector courses over the last nine years, we decided to expand and update our 2-Day course into a more comprehensive 3-Day course.

Included are revisions of the course material and the introduction of more practical activities in the form of a full morning at a hot dip galvanizing plant followed by an afternoon of Duplex coatings. The galvanizing plant visit examines materials prior to galvanizing and hands on inspections of finished product. The afternoon is a visit to a paint applicators yard and Duplex coatings systems. Included are demonstrations on chemical cleaning and/or sweep blasting, examination of resulting profiles and followed by the application of paint onto galvanizing. The course will provide delegates with sufficient knowledge to advise on fabrication for successful hot dip galvanizing and also test, inspect and interpret test results after hot dip galvanizing.

COURSE DURATION AND CONTENTS

Day 1	**(08h00 to 16h00)**
Lecture 1	Introduction to the Environment, Steel & Corrosion
Lecture 2	Understanding Zinc Coatings (How does Zn protect)
	ISO 9223 & 12944
Lecture 3	Designs, Fabrication and Inspection before hot dip galvanizing SANS (ISO) 14713:1999
Lecture 4	General Hot Dip Galvanizing Processes
	SANS 121 (ISO 1461:2009) Batch type galvanizing
	SANS 32 (EN 10240: 1997) Automatic T & P
	SANS 10094:2007 HDG of Friction Grip Fasteners
Day 2	**(07h00 to 16h00)**
	Hot Dip Galvanizing Plant Visit and Inspection
Lecture 5	Duplex Coatings and HDG Reinforcement in Concrete
	Duplex Coatings Plant Visit and Applications
Day 3	**(08h00 to Completion of Exam)**
Lecture 6	Inspections after Hot Dip Galvanizing
Lecture 7	Quality Assurances in Coating Applications
	Application of specifications
	Control documentation for a QA System
	Examination on Course Effectiveness

Course schedule may be altered and interesting activities added for the benefit of delegates.

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 HDGSA Galvanizing Inspector. Registration will be confirmed on an annual basis. Successful galvanizing inspectors will become Affiliate Galvanizing Inspector Members of the HDGASA for the year.

VENUE AND NUMBER OF DELEGATES

The courses are usually run in Johannesburg from the Hot Dip Galvanizers Association in St Andrews, Bedfordview and also from a suitable venue in Cape Town. Bookings are limited to 10 people per course on a first come first serve basis.

DATE AND TIME

Courses commence at 08h00 sharp and end at 16h30 (or as otherwise instructed). Lunch and refreshments will be provided. Comprehensive course notes can be collected from our offices two weeks before the course (this is highly recommended).

Johannesburg:
21 to 23 February; 13 to 15 March; 15 to 17 May; 26 to 28 June; 14 to 16 August; 9 to 11 October; 27 to 29 November.

Cape Town:
6 to 8 March; 5 to 7 June; 18 to 20 September.

Special courses can be arranged for a minimum of 6 delegates at appropriate venues in South Africa.

COURSE COST AND PAYMENT TERMS

R4 200.00 per person exclusive of VAT. Should you have two or more delegates from the same company, course costs will be R4 000.00 per person exclusive of VAT. Please note that payment is due on the first day of training. Cheques are to be made out to "Hot Dip Galvanizers Association SA". Members qualify for a discount.

CONTINUOUS PROFESSIONAL DEVELOPMENT (CPD)

By attending the Association's 3 day course Galvanizing Inspectors Course, you will obtain 3 points (accredited by ECSA).

SHOULD YOU BE INTERESTED, KINDLY CONTACT SASKIA SALVATORI OR MARJORIE MONTGOMERIE AT THE ASSOCIATION

Introductory Galvanizers Inspection Course

This one day course has been designed to be more simple and more practical than the 3-day galvanizers inspectors course discussed elsewhere in this magazine.

Topics to be covered and discussed are:

• Brief description about corrosion • How zinc protects • The hot dip galvanizing process • Inspection before and after hot dip galvanizing • Multiple choice question test for course effectiveness.

Should you require some background information on hot dip galvanizing and its acceptance and have a limited formal education, this course is for you!

Contact our offices for more details.

Delegates of the 5-day Corrosion Engineering Course (Corrosion Environments and Metallic and Inorganic Coatings) presented by Terry Smith on behalf of CISA in Cape Town recently.

Delegates of a recent Hot Dip Galvanizing Inspectors Course - held in Cape Town enjoying an inspection at a galvanizer.

INTERGALVA 2012 Paris

Welcome to Intergalva Paris
10 - 15 June 2012

Intergalva is organised by European General Galvanizers Association (EGGA) and hosted by Galvazinc. The conference covers technical, commercial and environmental topics for the general (batch) hot dip galvanizing industry.

It continues the series that began in 1950 and was last held in Madrid in 2009. The 'must-attend' event for the worldwide galvanizing industry.

Features of Intergalva 2012:

- 3-day conference programme with simultaneous translation from and into many international languages
- Visits to galvanizing plants in France
- Extensive trade exhibition
- Exciting social programme
- Sightseeing tours for accompanying persons

Who should attend:

- Owners, operators and managers of galvanizing plants
- Users of galvanized products
- Corrosion specialists
- Everybody who has to specify corrosion protection for steel
- Suppliers of equipment and services to the galvanizing industry
- Suppliers of zinc and zinc alloys to the galvanizing industry

Register now **at www.intergalva.com.**

Register before 10 April for reduced delegate fees. Special fees also apply for association members.

Timeline to Intergalva 2012 – key date

10 April 2012
Reduced fee for early registration fee ends

National Environmental Management Workshop

City of Cape Town, Air Quality Management Unit invites all enterprises involved with hot dip galvanizing activities to attend a workshop to discuss the licensing obligations and requirements in terms of Chapter 4, Section 21 and Chapter 5 of the National Environmental Management: Air Quality Act (Act No.39 of 2004)

We are pleased to invite you to attend this workshop to discuss and familiarise yourself with the licensing obligations and requirements as spelt out in Section 21 on the National Environmental Management: Air Quality Act (NEMAQA) (Act No.39 of 2004) for the metallurgical industry.

This session is organized by the City of Cape Town, Air Quality Management unit who are the appointed Licensing Authority in terms of NEMAQA.

During the workshop the following will be discussed:

1. Overview of NEMAQA
2. Listing of Activities and consequences thereof
3. Pollution prevention plans, atmospheric impact reports and recognition programmes
4. Measures in respect of dust, noise and offensive odours
5. Licensing authorities and procedures for atmospheric emission licences (AEL) applications, EIA's and considerations and decisions of the competent authorities.
6. Issuing of AEL's, contents of Provisional AEL's and AEL's, transfer, review, variation and renewal thereof.
7. Emission control officers and fit and proper persons.
8. Offences and penalties
9. Section 21 List of Activities, definitions, emission measurement, compliance time frames, compliance monitoring, reporting requirements and fugitive emission plans.
10. Category 4: Metallurgical Industry, Subcategory 4.22: Hot dip galvanizing

Participation and input at this workshop will be beneficial to your company and the environment as we move into a new era of air quality management.

While this workshop is being held in Cape Town, we will accommodate delegates from outside the Metro boundaries.

The workshop will take place at *Parow Council Chambers, 1st floor, Parow Municipal Offices, Voortrekker Road, Parow, on Friday 13 April 2012.* Registration 10h00 – 10h30. The workshop will commence at 10h30 – 13h00. It is expected that the workshop will take about 3 hours of your time.

Please RSVP by (Friday 23 March 2012) by emailing Bronwyn.davidson@capetown.gov.za or calling 021 590 1419.

For Executive Director, City Health

PROPOSED FEATURES FOR 2012

May / June (No 51):

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

August / September (No 52):

- Annual Hot Dip Galvanizing Awards
- Cable ladders and trays.
- Artistic / Architectural hot dip galvanizing

November / December (No 53):

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

NOTE: FEATURES MAY BE SUBJECT TO CHANGE

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

New thermal metal spray gun

Weartech have the pleasure of announcing the South African launch of the latest in zinc metal spray technology, namely they Metatherm 17E flame spray gun. This is the latest technology in flame spraying.

Technical director, Adam Wintle explains that the new 17E uses an electric drive motor instead of the traditional air turbine drive system. The older air turbine drive system uses a number of gears and shafts to drive the wire and a braking system to control the speed of the wire feed.

Most of the older turbine air drive guns requires a lot of attention including gear lubrication and servicing of the guns is often expensive.

The new 17E gun utilises the latest German technology with its ceramic bearing electric drive motor eliminating all the gears and shafts inside the main body of the gun. This new motor has been tested for over 3000 hours and is still running flawlessly.

The system comes with a separate electronic drive box for controlling the speed of the wire.

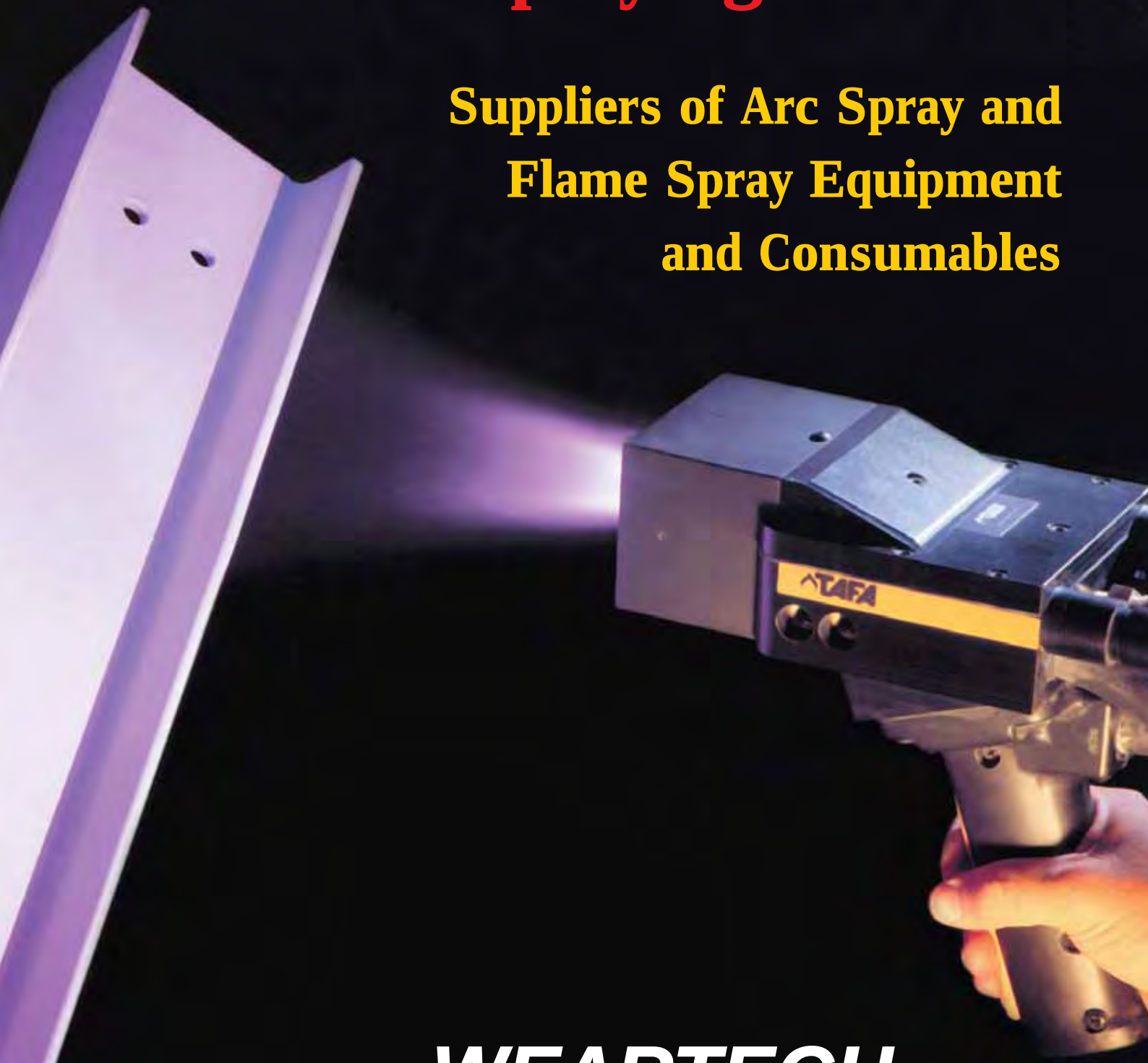
Another new option is the safety release option, which, if the gun is dropped the gas supplies are cut off automatically.

The Metatherm 17E can use a combination of either acetylene and oxygen or propane and oxygen gases.

For more information, please contact Adam Wintle on 011-824-6010 or adam@weartech.co.za

Zinc Metal Spraying?

Suppliers of Arc Spray and Flame Spray Equipment and Consumables



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Website: www.weartech.co.za

Galvspin Galvanizers automated centrifuge plant

Construction of a fully automated centrifuge plant commenced in September 2012 on the premises of Galvspin Galvanizers in Dunswart, Johannesburg.

"The plant will provide for a quick, high volume turnaround time on centrifugal material", said MD Roelf Oosthuizen. "The production, process and system arrangements will cater for the application of a consistent, high quality zinc coating for high tensile items such as fasteners", he further stated. "Immersion times can be geared for specific batches of material capable of being reprogrammed based on 1st off thickness testing results".

The Italian designed plant works on a gas fired system and includes a backup generator that will operate the robotics during times of power cuts. Surface cleaning is done by an integrated shot blast facility, which is ideal for use on high tensile materials. The ceramic kettle operates at temperatures of between 440°C and 680°C, while the efficient drying tunnel utilizes furnace flue gasses.

Pre-treatment solutions are manually operated with provision for timing mechanisms. There are three robotic stations that operate independently from each other, with cycle times capable of being programmed to desired speeds. The centrifuge baskets can be removed and replaced automatically from the galvanizing process without halting the process.

During production received material enters the manually operated pretreatment solution plant, or in the case of

10.9 material is diverted to the shot blast facility. Fluxed material is loaded onto a vibrating conveyor that passes through the drying tunnel. Dried material is discharged onto a "dosing" belt equipped with electronic scaling devices and a predetermined mass of material is charged into 30 kg or 50 kg spinning baskets. The charged basket is rotated and positioned in the "pick up" station after which the first robot collects the basket and positions it in the zinc kettle supported by an "immersion cradle". The cradle is capable of maintaining up to three baskets in the zinc at any one time.

The second robot is an automated centrifuge unit suspended from an independent rolling carriage and it manipulates baskets in the cradle at predetermined intervals.
The cradle constantly rocks and swings to ensure consistent and even immersion times. The robot skims the zinc surface, withdrawing and spinning the baskets within a protective hood after the immersion cycle. The protection hood vibrates allowing excess zinc to fall back into kettle. The centrifuged baskets are then released onto a tilting arm which empties the items into a passivating spoon.

The third robot removes the emptied baskets and replaces them on the rotating charging platform to start the cycle again. The passivating spoon consists of a perforated plate which discharges the quenched material onto a conveyor that passes through a drying tunnel. There is sufficient time and space available on conveyor to perform quality control. The conveyor system discharges the galvanized material onto containers ready for warehousing.

Commissioning of the plant and full production is planned for last week in February 2012. The quality management systems and processes are accredited by SANAS with accreditation code SANS 121 (ISO 1461) Product Certification Scheme. An ISO 9001 listing will follow.

Hi Bob and Terry

Ek hoop alles gaan goed daar by julle. Jammer ek skryf die mail in Afrikaans, maar ek kan myself net beter uitdruk in my taal.

Ek wil julle net komplimenteer met die HDGASA se webblad. Dit is gebruikersvriendelik en indien ek tegniese problem ondervind kan ek net google op die blad. Daar word baie tyd gespaar deur items aan te heg by 'n e-mail en deur te stuur. Vir eenvoudige problem werk "Misconceptions " elke keer en vir die meer tegniese aspekte help die tegniese artikels weer. Dit vergemaklik ons werk baie as daar so 'n goeie webblad beskikbaar is Moet asb nie ophou om Misconceptions te plaas in die tydskrif nie, en hou aan om tegniese artikels te bly plaas op die webblad. Dankie weereens vir 'n doeltreffende en professionele webblad. Dit motiveer 'n mens om aan die HDGASA assosiasie te behoort!

Groete en 'n lekker naweek!

Johann Anderson, Advanced Galvanising Corporation

Robor claims Deloite Best Company to Work For title once again

For the third year running, steel tube and pipe manufacturer, Robor has been named a winner in the Deloitte Best Company to Work for Survey in the Manufacturing Industry category.

Manufacturing companies in South Africa have had a particular difficult year and the Metal Industries strike had a particularly large impact on productivity and staff morale. Despite these challenges, Robor decided to participate in the survey for the fifth year.

"To be a competitive, sustainable global company, we recognise that our employees need to be highly productive, talented and are expected to often deliver more than what we are able to compensate them for" said Gordon Gilmer, CEO of the Robor Group. "As such every employee owns a share of Robor through our Employee Share Trust as well as participation in the 'Gainshare Scheme" continued Gilmer.

The people challenges are not unique to Robor but are felt throughout South Africa. Multi-skilled employees who assist companies to reduce their manpower dependence – especially during industrial action – are the way forward. "With these challenges in mind, Robor's employees are urged to constantly infuse new ideas and provide 'out-of-the-box' solutions to meet our customers requirements" says Sundrie Naidoo, Group HR Executive at Robor.

Leadership development, education and mentoring are at the core of Robor's holistic approach to transformation. Part of this approach is the 'Young Graduates Forum' currently in its fourth year. This forum encourages young graduates many from previously disadvantaged backgrounds to grow into senior management. This forum facilitated by Robor's CEO Gordon Gilmer, exposes employees to the group's strategic plans and insights.

Gordon Gilmer, CEO - Robor.

Sundrie Naidoo, Robor Group HR Executive.

"Recognition is a vital aspect of the Robor culture and employees are constantly encouraged with monthly innovation awards. Communication is maintained through team forums, newsletters, quarterly feedback sessions, Robor DVD's, bi-annual roadshows and CEO breakfasts where employees are recognised for their efforts and their views of the company are canvassed" concluded Naidoo.

On the Couch.....

Linda Ness

By Desere Strydom

On the Couch catches up with Linda Ness, well known Durban Consulting Engineer and disciple of the hot dip galvanized coating in between running her busy practice and making some time for the evening surf ski series race.

Please tell us a little about you background? I grew up in Zimbabwe, and arrived at the University in Durban in the mid 80's and have pretty much been here ever since, give or take a few years here and there working and travelling.

How did you decide on becoming an engineer and who or what inspired this (I daresay unlikely for a female at the time) career choice? There's no interesting answer to this, even though it's probably the question most asked. My father was an incredible man, perhaps my parents saw something that would make them nudge me in that direction, I was always in his garage mucking around with his tools and gadgets. Graphic design was on the cards at one point.

Did you find it difficult initially as a female in a very male dominated industry to gain the respect and trust of your male peers and other industry players? Not to recall generally, I had fantastic colleagues in my formative years, I found them or they found me and hard work did the rest. I've learned over the years to trust my own style, it seems to work .

I've just been listening to a documentary about the Suffragettes and what they did to get the vote for women 100 years ago. I've had it easy I reckon, and I'd have to say I like working in a men mostly environment.

You have been involved with many high profile projects over the past 20 years in a consulting engineer capacity. Which of these stand out and for what reasons? It's the light bulb moments that stand out. The collaborative sketch, the discussion, the astounding piece of workmanship, the moment that elevated a project, and you can think back and say 'that's when this thing happened'. There is a great satisfaction in the product, but it's the people that make it special.

A memorable time was working in a small team of inspiring engineers designing large steel structures. More than once we stood in a piece of desert somewhere saying, how can we believe in a year we need to turn this sand field into a stadium?

You are known in the industry as a staunch supporter of the hot dip galvanized coating, please can you share your thoughts on the coating and its benefits from an engineering point of view? It's a timeless dependable 'brand', it's a corrosion protection method that's over 175 years old. It's a skin, not a coat. In essence, the industry can implement it well, it's predictable, and there's a garage full of backup and advice from your Association.

Please tell us a little about your family? I live with my partner of many years, Glen, and his kids, the dogs, it's a busy home most days.

What are your hobbies and passions? We love hiking, paddling the rivers. We try to do at least one new interesting thing in the world every year. I also dabble in photography.

Complete the sentence... Friday afternoon, 5pm, Linda Ness (for the next few weeks) checks in at Marine Surf Club to do the Friday evening surf ski series race, then off to the pub for a cold beer.

Also see: http://www.nessconsulting.co.za

HOT DIP GALVANIZING MEMBERS

GALVANIZER	LOCATION	TEL. NO	SPIN	NO. OF LINES	BATH SIZES (L x W x D) (m)
GAUTENG					
ArcelorMittal South Africa	Vanderbijlpark	016 889-9111		3	Sheet galvanizer
Armco Galvanizers	Isando	011 974-8511		1	13.2m x 1.5m x 2.2m
Armco Galvanizers – Dunswart	Dunswart	011 914-3512	●	3	5.2m x 1.2m x 2.0m 3.0m x 1.0m x 1.5m 2.0m x 1.0m x 1.5m
Armco Galvanizers – Randfontein	Randfontein	011 693-5825		1	6.5m x 1.3m x 2.0m
Babcock Ntuthuko Powerlines (Pty) Ltd	Nigel	011 739-8200		1	12.0m x 1.4m x 1.8m
DB Thermal SA (Pty) Ltd	Nigel	011 814-6460		In-line	16.0m x 1.0m x 1.0m
Galvadip (Pty) Ltd	Waltloo	012 803-5168		2	7.2m x 1.7m x 2.2m 7.0m x 1.5m x 2.5m
Galvaglow	Factoria	011 955-5200		1	4.0m x 1.5m x 2.5m
Galvspin Galvanizers cc	Boksburg North	011 918-6177	●	2	4.6m x 4.6m x 1.6m 3.0m x 1.0m x 1.5m
GEA Air Cooled Systems	Germiston	011 861-1571		In-line	11.5m x 1.0m x 1.0m
Lianru Galvanisers cc	Nigel	011 814-8658		2	7.2m x 1.3m x 1.6m 4.5m x 1.3m x 1.6m
Macsteel Tube & Pipe	Boksburg	011 897-2194		In-line	13.5m x 1.6m x 2.4m
Pro-Tech Galvanizers (Pty) Ltd	Nigel	011 814-4292	●	2	3.2m x 1.1m x 1.5m 3.0m x 1.1m x 1.2m
Robor Galvanizers (Pty) Ltd	Germiston	011 876-2900		3 Tube	14.0m 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	Tube & pipe galvanizer
Supergalv	Alrode	011 908-3411		1	6.0m x 1.2m x 1.8m
Transvaal Galvanisers In-line & general	Nigel	011 814-1113		3	9.0m x 1.0m x 1.0m 8.0m x 1.2m x 1.5m 6.0m x 1.3m x 1.3m
NORTH WEST					
Andrag Agrico	Lichtenburg	018 632-7260		#	In-line galvanizer
FREE STATE					
Harrismith Galvanizing & Steel Profile (NB: Big line is not in operation)	Harrismith	058 623-2765		2	4.5m x 1.3m x 2.5m (12.0m x 1.2m x 2.5m)
WESTERN CAPE					
Advanced Galvanising (Pty) Ltd	Bellville	021 951-6242		1	8.0m x 1.5m x 3.0m
Cape Galvanising (Pty) Ltd	Parowvalley	021 931-7224		1	14.0m x 1.6m x 2.6m
Galvatech (Pty) Ltd	Bellville	021 951-1211		1	7.5m x 1.5m x 2.6m
Helderberg Galvanizing	Strand	021 845-4500		1	5.5m x 0.8m x 2.4m
Pro-Galv cc	Stikland	021 945-1803		1	7.2m x 1.3m x 2.6m
South Cape Galvanizing (Pty) Ltd (NB: Big line is not in operation)	George Industria	044 884-0882		2	3.7m x 0.94m x 2.3m (5.5m x 1.0m x 2.6m)
EASTERN CAPE					
Border Metal Industries	Butterworth	047 491-5577		1	1.2m x 0.8m x 1.0m
Galvanising Techniques cc	Port Elizabeth	041 486-1432		1	12.0m x 1.3m x 2.3m
Galvaspin (Pty) Ltd	Port Elizabeth	041 451-1947	●	1	3.0m x 1.2m x 1.8m
Morhot (Pty) Ltd	East London	043 763-1143		1	6.0m x 1.2m x 2.5m
KWAZULU/NATAL					
A&A Galvanisers	Pietermaritzburg	033 387-5783	●	1	3.3m x 0.9m x 1.9m
Bay Galvanisers	Richards Bay	035 751-1942		1	5.0m x 1.2m x 2.5m
Phoenix Galvanizing (Pty) Ltd	Phoenix	031 500-1607	●	2	14.0m x 1.4m x 2.5m 3.0m x 1.2m x 1.2m
Pinetown Galvanizing	Pinetown	031 700-5599		1	9.0m x 1.2m x 3.0m
Voigt & Willecke (Pty) Ltd	Durban	031 902-2248		1	14.0m x 1.3m x 2.5m
MOZAMBIQUE					
F&F Services	Beleuane	+258 823021260		1	4.0m x 0.8m x 1.5m

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

Note:

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

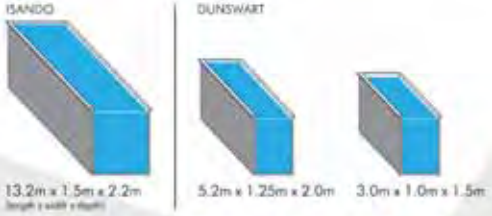
CONSISTENTLY DELIVERING **SUPERIOR QUALITY** GALVANIZED PRODUCTS TO ALL OUR CUSTOMERS

Our **Isando** plant can accommodate heavy steel structures due to our 13,2 meter kettle and improved cranage and loading facilities.
Our **Dunswart** plant specialises in difficult-to-handle items as well as centrifugal work.
Both plants offer an in-house transport facility, a high level of expertise and quick turn around time.

The company has it's own SANS 121 2000 ISO 1461 accredited Hot Dip Galvanizing plants. And is listed under the SABS ISO 9001 scheme.

"ARMCO IS OUR NAME, GALVANIZING IS OUR GAME"

GALVANIZING BATH SIZES



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