Hot Dip Galvanized Information Sheet No.13

Hot Dip Galvanizing - General / Batch Type versus Continuous Sheet

	GENERAL OR BATCH TYPE HOT DIP GALVANIZING			CONTINUOUS SHEET HOT DIP GALVANIZING			
SPECIFICATIONS							
Specifications - local	SANS 121			SANS 3575 SANS 4998			
Specifications - International	ISO 1461:2009			ISO 3575 ISO 4998			
Coating grades				Several coating designations may be specified			
Coating thickness	Steel thickness (mm)	Local coating thickness (µm)	Mean coating thickness (µm)	Coating designation	Average mass of coating gms/m^2	Individual mass of coating gms/m^2	Min coating thickness on one face (µm)
	t > 6	70	85	Z200	200	170	12
	3 > t ≤ 6	55	70	Z275	275	235	17
	1,5 ≥ t ≤ 3	45	55	Z450	450	385	28
	t <1,5	35	45	Z600	600	510	36
Steel thickness	Any steel thickness but preferentially greater than 2mm thick particularly if not shaped or work-hardened.			From 0,28 to 2.9mm thick. Note: The final supplied steel thickness including the applied zinc coating will be marginally thicker.			
Smoothness and acceptance of the coating	Relatively smooth, depending on steel type, complexity of component and dipping exit angle. Free from roughness and sharp points, particularly at “pre-defined” significant surfaces.			Gas Knives (usually high pressure air) wipe off excess molten metal as the continuous sheet exits the zinc bath, leaving behind a closely controlled thickness of coating.			
Ordering, identification and receipt at site.	Steel that has been hot dip galvanized by the general process is relatively easy to identify that it is in fact hot dip galvanized. Silver paint that may have been incorrectly used for repair can easily be scraped off.			The coating grade that has been specified may be difficult to assess in terms of coating grade (and therefore coating thickness) on receipt at site in terms of specification conformity. While taking random coating thickness readings using a calibrated coating thickness instrument are not acceptable in terms of the specification, they will however, provide a reasonable idea of what the coating thickness is and therefore the coating grade that has been delivered.			
PROCESS							
Process	Items that are completely fabricated are dipped in a bath of molten zinc at about 450°C and removed at a relatively steep angle and slow speed.			Continuous sheeting is rapidly (100 to 140m/min) passed through a bath of molten zinc at about 450°C and as it exits the bath the sheeting travels through gas air knives that wipe off the excess coating, resulting in the coating thickness designation that was specified.			
Composition of the coating	The coating comprises a series of iron/zinc (Fe/Zn) alloy layers, normally over coated by a relatively pure zinc layer.			The coating comprises mostly pure zinc with very little iron/zinc alloy layer (about 1 –2 µm), required for ductility.			

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Influences on coating thickness	Silicon and Phosphorus and combinations of these two elements in the steel have a major effect on coating thickness and appearance. Steel thickness and surface roughness also have an effect on coating thickness.	Effectiveness of the air or steam knives.
Zinc melt	98,5% Zn, 1,2%Pb and about 0,007% max. Al.	99,95% Zn, 0,008%Pb and about 0,02% max Al.
Smoothness	Relatively smooth, depending on steel type, surface profile, design shape and angle of exit.	Air or steam wiped and therefore generally smoother than general or batch type hot dip galvanizing.
Passivation	Components are water quenched where the water usually contains a small percentage of sodium dichromate. Although not quite yet fully used by the galvanizers, passivation treatments free of chrome 6 have been developed and are commercially available.	Mill passivation: *A chemical treatment is normally applied to zinc coatings to minimize the hazard of wet storage stain.* Mill phosphating: *This is applied so that subsequent painting after normal cleaning can be relatively easily achieved.* Oiling*: This treatment method further prevents the formation of wet storage stain*.
Testing adhesion	Testing of adhesion is not necessary in accordance with SANS 121.	In order to test the adhesion of a coating, a bend test and impact cupping test is conducted.
DURABILITY		
Corrosion categories C1 to CX (ISO 9223)	The corrosion of a zinc coating or a duplex coating system (hot dip galvanizing and an appropriate paint system) varies depending on the atmosphere the coating is subjected to, see **Information sheet No.13**, compiled from ISO 9223, for a performance comparison between general and continuously hot dip galvanized sheeting.	
Enhanced corrosion protection	Iron/zinc alloy layers which make up between 50 and 85% of the coating provide up to 30% better corrosion protection than pure zinc.	Limited iron/zinc alloy layers due to process speed and requirements for final product ductility.
Cathodic protection at edges	Zinc by its nature because of its position in the galvanic series of metals will sacrifice itself in preference to carbon steel. Cathodic protection is relative to moisture content, coating thickness and the amount of zinc present at the uncoated area.	
Effectiveness of cathodic protection	More effective due to greater coating thickness and an intact coating at all edges.	More effective on thin gauges and thick coatings. Less effective on thick gauge and thin coatings, particularly along cut exposed edges.
Wet storage stain	Wet storage stain is a white voluminous deposit (zinc hydroxide) that is formed on freshly hot dip galvanized surfaces which are in close contact in the presence of moisture. Freshly galvanized coatings react with the environment until such time as the cause is removed and a stable zinc carbonate film is formed on the coating surface. See **Information sheet No.2**	
Effect of wet storage stain	The presence of wet storage staining will rarely have a marked influence on a thick general hot dip galvanized coating.	The presence of wet storage stain, in between closely nestled sheeting, will, if not addressed early enough, lead to premature corrosion of the zinc layer.
Abrasion resistance	Pure zinc is a soft metal, even though it is harder than most organic coating materials. The iron/zinc alloys produced in batch or general hot dip galvanizing are however, very hard. In fact they are harder than ordinary structural steel.	
Superior abrasion resistance	The iron/zinc alloys provide superior abrasion resistance.	Less abrasion resistant than general hot dip galvanizing but better than most organic or paint coatings.

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PRODUCTS		
Appearance	Depending on steel type, coating appearance can vary from a spangle finish to a silvery or matt or even dark matt grey finish.	Different appearances ranging from a spangle coating, minimized spangle coating, iron/zinc alloy coating to a differential coating are offered.
Can appearance be altered?	Yes, the addition of a Zn/Ni/Al alloy can improve coating appearance.	See above.
Ductility	Not ductile, items must be completely fabricated before coating, generally excessive bending will cause cracking of the Fe/Zn alloy layer.	Ductile for subsequent profiling, as Fe/Zn alloy layer almost non-existent.
Component size limitations	Most fabricated steel items can be hot dip galvanized, provided they can fit into the respective galvanizing bath sizes.	Coils of sheeting, up to 1,5m wide, between 0,3 to 3.0mm thick and specified lengths.
Coating repairs	Site alterations and coating damage should be appropriately repaired. If not repaired, the uncoated area will suffer discoloration and eventually localised corrosion but corrosion creep is impossible while zinc is present.	
Are coating repairs allowable in terms of the standard?	Yes, at the galvanizer or at site, provided that an individual repair is no greater than 10cm² and the combined repair area on one component is not be greater than 0,5% of the surface area.	No mention regarding coating repair is made in either specification but if that is required, the same method of coating repair would be applicable.
For enhanced corrosion protection or individual specification requirements including a colour, hot dip galvanizing can be duplex coated by painting with an appropriate paint system.	Combining a hot dip galvanized coating with an appropriate paint coating system, results in a synergistic effect, whereby the sum of the individual coatings can be increased by between 1,3 to 2,7 times the individual coating lives (depending on the specific environment at hand).	
	• Specify the use of the Association's Code of Practice for Preparation, HDGASA 01 Rev 1 2014. • Specification for the Performance Requirements of Coating Systems. HDGASA 02 Rev 1 2014. • Engineering Specification, HDGASA 03 Rev 1 2014. • Discuss with the Association and/or paint supplier. • Preferably use galvanizer with house industrial painting facilities.	• Specify "Chromaprep" – Factory primed coated hot dip galvanized sheeting, ready for top coating. • Specify "Chromadek" or "Chromadek Plus" – Factory painted top coats.