

Data sheet: C 1.1

Availability and properties

Galvanised Material

Hot-dip galvanised cold rolled and hot rolled steel substrate

General description

Hot-dip galvanised sheet is produced on continuous zinc coating lines from either cold rolled (thickness range 0.27 to ≤ 2.0 mm) or hot rolled (thickness range 2.01 to 3.0mm) steel substrate, in coil form. It is produced to the requirements of EN 10346, EN 10143, ASTM A653M, ASTM A924, SABS 3575 or SABS 4998 as well as ArcelorMittal South Africa's ISQ standards.

The galvanising process yields homogeneously zinc-coated sheet with a bright, smooth metallic finish. The zinc coating can be supplied with a normal or flattened minimised spangle finish.

Zinc coatings of different thickness may be ordered to suit specific end-use requirements. The thickness and type of steel substrate are selected on the grounds of mechanical and structural considerations. For tolerances on galvanised sheet refer to the data sheet: Galvanised Material Tolerances (File reference C1.2).

Mechanical properties

Refer to Table 1: Mechanical properties specifications of substrate.

Coating mass

The prefix Z in the coating designation indicates a pure zinc coating and the number denotes the total mass of the coating on both sides of the sheet (g/m^2). The coating mass (Refer to ISO 1460) is given in Table 2.

Table 2 Coating mass

Coating designation	Minimum Requirement Triple Spot Test (g/m^2) Total Both Sides	Minimum Requirement Single Spot Test (g/m^2) Total of both sides	Nominal thickness of zinc coating per side (μm)
Z100 ¹	100	85	7
Z150 ²	150	128	10
Z200	200	170	14
Z275	275	235	19
Z450 ^{3,4}	450	385	32
Z600 ^{3,4}	600	510	43

Notes:

1. Only available on 0.27 and 0.30mm ISQ 550 material.
2. ISQ specification only.
3. Not recommended for forming grades.
4. Not available on full hard material.

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Bend Test

Bend tests to evaluate the adhesion of the zinc coating are carried out in accordance with the relevant specifications. In addition to this, impact adherence cupping tests are performed on all products, irrespective of specification, to ensure good adhesion of the zinc coating.

The coating bend test specimens are suitable for bending through 180 ° in any direction without showing any signs of flaking. An area of 6mm from each edge of the specimens is disregarded in order to exclude the effect of the cut edge. The inside diameter of the coating bend test is prescribed in Table 3.

Table 3 Minimum inside bend diameter ¹

Coating Designation	Commercial & Forming Steels ISQ 230, LFQ (Lock-Forming Quality) and DQ (Drawing Quality)		Structural Steel ISQ 300
	$0.4 \leq t \leq 2.0$	$t > 2.0$	$0.4 \leq t \leq 1.2$
Z150 / Z200 / Z275	0t	2t	2t
Z450 / Z600	2t	2t	2t

Notes:

1. Given as a multiple of *t* (Coated material thickness)
2. ISQ 550 does not have specified requirements for this property.

Dimensions

Table 4a Available dimensions (Regular spangle)

Thickness ¹ (mm)	Width (mm) ^{3, 4}
0.27 ²	762, 914
0.3 ²	
0.4	925 ≤ w ≤ 1 219
0.47	925 ≤ w ≤ 1 320
0.5	
0.53	
0.58	925 ≤ w ≤ 1 524
0.8	
1.0	
1.2	
1.4	
1.6	
1.9	925 ≤ w ≤ 1 225
2.4	
3.0	

Note:

1. Coated thickness, i.e. including the thickness of the zinc coating.
2. Available as ISQ 550 coils only.
3. The following standard widths are available (Depending upon thickness): 762, 914, 925, 940, 1000, 1175, 1219, 1225, 1250 and 1320mm.
4. Structural grades that require medium to high strength mechanical properties are subject to thickness and width limitations (Limitations available on enquiry).
5. Maximum width for Full Hard (ISQ 550 3T) material is 1225mm.

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Table 4b: Available Dimensions (Flattened Minimised Spangle)

Thickness (mm) ²	Un-Passivated Width(mm)	Passivated Width(mm) Excluding LFQ material
0.40 - 0.41	925 ≤ w ≤ 1219	925 ≤ w ≤ 1050
0.42 - 0.44	925 ≤ w ≤ 1225	925 ≤ w ≤ 1075
0.45 - 0.49	925 ≤ w ≤ 1265	925 ≤ w ≤ 1115
0.50 - 0.59	925 ≤ w ≤ 1320	925 ≤ w ≤ 1175
0.60 - 1.20	N/A	925 ≤ w ≤ 1225

Hot rolled substrate

Due to the nature of the hot rolling process, surface blemishes such as surface scratches and coil breaks which may be highlighted by the zinc coating, can occur on material with a thickness of greater than 2.01mm. Neither of these defects will affect the functionality of the material however they may not be aesthetically acceptable. The end-user should take cognisance of this, as no claims for aesthetic reasons can be entertained.

Zinc coating surface finish

The following surface finishes may be ordered to suit specific end-use requirements:

1. Normal or regular spangle

This finish is obtained during normal solidification of a hot-dip zinc coating on steel sheet, and results in the formation of a coating which exhibits either no spangle or zinc crystals of different sizes and brightness depending on the galvanising process and conditions.

If the end user requires a heavier coating (Z450 or Z600), there is a distinct tendency for the coating to develop very visible sag lines and ripples that results in a rough surface. However, the solidified zinc appearance has no effect on either the quality or corrosion resistance of the coating.

Normal or Regular spangle is supplied for a wide range of applications where over-painting for maintenance purposes may be undertaken at a later stage.

2. Flattened minimised spangle

This zinc coating finish is obtained by restricting the normal zinc crystal growth followed by the application of a skin pass process. The zinc coating thus obtained has improved formability and the zinc surface serves as an excellent base for pre-painting, post-painting and powder coating applications.

This finish is recommended for applications where a high gloss paint finish is required. It is available for zinc coatings of mass up to Z275, and a maximum material thickness of 1.20 mm if passivation is required, or a maximum thickness of 1.60 mm if passivation is not required

Strain ageing

Galvanised steel sheet tends to strain age and this may lead to the following:

1. Surface markings from stretcher strain (Lüder's lines) or fluting when the sheet is formed.
2. Deterioration in ductility.

It is recommended that the period between final processing at the mill and fabrication be kept as short as possible, preferably not exceeding six weeks.

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Fretting

Fretting, also known as either friction marks or friction stain can occur superficially on hot dip galvanised coils.

It is caused by the interaction of two surfaces in contact with one another, which are simultaneously subjected to either high or low frequency vibration. For this reason, fretting, if encountered, may be present when material is transported in trucks over relatively long distances.

The fretting is observed as black patches which are a superficial phenomenon only, and that they are confined to usually only a few microns on the material surface. The life expectancy of the material is thus not compromised by the presence of fretting. It may be of aesthetic concern to some end-users, but from a functional point of view the material may be applied accordingly.

Zinc surface treatment

The following surface treatments are used by ArcelorMittal South Africa to reduce the possibility of wet storage stain (sometimes referred to as 'white rust') during transport and storage:

1. *Passivation*

Passivation by chromic acid (ideally even coatings of 20 to 40 mg/m² total on both sides) is normally applied to all galvanised material. In cases where this treatment may interfere with subsequent processing such as phosphating, the galvanised steel may be ordered without passivation, in which case oiling is recommended. Although every endeavour is undertaken to ensure that the passivation coatings are evenly applied, occasionally local colour variations are encountered. However, these colour differences will not impair the quality of the zinc coating and with time they will gradually disappear.

2. *Oiling*

The corrosion preventive oil is used to coat galvanised sheet as an additional protection against wet storage staining during handling and storage. Oil is only applied if requested.

3. *Unoiled and unpassivated*

If unoiled and unpassivated galvanised steel sheet is ordered, the danger of wet storage stain is increased and therefore no rust complaints will be entertained. Proper protective packing should be specified to protect the material against the ingress of moisture during transport and storage, although this would not guarantee wet storage stain free material. Various packaging options are available (see 'Packaging Specification').

Wet storage corrosion

When galvanised sheet in coil or cut lengths is stored under wet conditions, the galvanised surface may be damaged by wet storage corrosion.

Unless the galvanised material is stored in a warehouse under a controlled atmosphere, no "white rust" complaints will be entertained. Packs of galvanised material must not be stacked directly on floors.

Rainwater or water vapour can easily be drawn in between tightly stacked profiled or flat sheets, or between laps of coils by capillary action. Due to the absence of freely circulating air, this moisture cannot evaporate, causing unfavourable conditions that may result in wet storage corrosion of galvanised sheeting.

Normally light white staining on galvanised sheet is not reason for concern. The wet storage corrosion process will stop when the affected areas are dried and exposed to the atmosphere. The discoloration will disappear within a few months during the normal weathering of the material. Where affected surfaces will form part of unexposed overlaps or other concealed areas that may be subject to extended periods of dampness, such areas should be cleaned and additionally protected.

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Corrosion protection

Under normal exposed conditions the zinc coating is gradually consumed through atmospheric corrosion and therefore, the heavier the coating, the longer the period of protection.

It is recommended that galvanised sheeting be over-painted preferably before the first appearance of red corrosion products.

Expected Corrosion - Free life (in years)

Coating Weight (g/m ²)	Rural (yrs)	Industrial (yrs)	Marine 1 (yrs)	Marine 2 (yrs)
Z 100	7 - 10	3 - 5	0.5 - 1.5	1 - 3.5
Z 150	10 - 15	5 - 9	0.5 - 2	1.5 - 5
Z 200	13 - 20	7 - 10	1 - 2	2 - 7
Z 275	15 - 25	10 - 20	1 - 3	3 - 10
Z 450	25 - 40	16 - 28	2 - 5	5 - 16
Z 600	40 - 60	21 - 30	3 - 7	7 - 20

Marine 1 Refers to a distance between 0,5 and 3,0 km from the sea.

Marine 2 Refers to a distance between 3,0 and 20,0 km from the sea.

These values are only indicative because the exposure period until the first signs of Red Rust corrosion can vary considerably depending upon the conditions of the site.

Cut edge corrosion resistance

The zinc coating protects cut edges of sheet against corrosion by cathodic action, as the adjacent zinc coating will oxidise protecting the uncoated edge. Material with a gauge less than 2.5 mm is adequately protected along the cut edge by a Z275 zinc coating.

Welding

Zinc coated steels may be welded satisfactorily by most commonly practised welding techniques. However, closer control of welding parameters is necessary in order to reduce the formation of toxic fumes that are not encountered when welding uncoated steel.

Painting

Chemical conversion coatings and primers have been developed to provide good adhesion of subsequent paint films on zinc-coated surfaces. To obtain optimum results it is essential to adhere to the instructions of the paint manufacturers.

Warranty

ArcelorMittal South Africa guarantees the prime quality of the product, but cannot accept liability for scratches or other damage to the material sustained during and after profiling, transport to or storage at the building site, and during erection.

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Quality assurance

A quality assurance system that complies with SANS 9001 is in operation throughout the manufacturing process, and ArcelorMittal South Africa's products conform to the requirements of both SABS ISO 3575 and SABS ISO 4998.

Supply conditions

Hot-dip galvanised sheet is supplied in terms of Price List 140 and ArcelorMittal South Africa's General Conditions of Sale.

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Table1. Mechanical properties specifications of the steel substrate

C1.1

		Commercial Steels					Forming Steels ²	Drawing Steels ²	Structural Steels ^{3,4}				
		Roofing/ Structural	General Purpose	Full hard ⁷ (HRB ≥ 85)	SAE/AISI ¹				ASTM A653 Structural Steel (SS) 2001				
Application		Moderate bending and roll forming	Moderate bending, forming and roll forming	Moderate roll forming and bending with ample bend radius	Moderate forming and roll forming	Higher average strength for moderate forming and bending	Severe bending, lock-forming and roll forming	Moderate drawing, severe bending, lock-forming and roll forming	Mechanical or structural properties of the base metal are specified or required				
Specification		ISQ 300	ISQ 230 ASTM A653M-'01 Commercial Steel (CS) TYPE A	ISQ 550	SAE/AISI 1006 (1995)	SAE/AISI 1012 (1995)	LFQ ASTM A653M-'01 Forming Steel (FS) Type A	DQ					
Mechanical properties ⁵	YS (MPa)min	t≤0.60 275	t≥0.61 300		550				230	255	275	340	550
	UTS(MPa)min				570				310	360	380	450	570
	El (%)min	16	16						20	18	16	12	
Similar specifications ⁶			JIS G3302 SGCC SABS ISO 3575:1996 01Commercial				EN 10346 DX51D (2009) SANS 3575:1996 02 Lock-forming	EN 10346 DX52D (2009) JIS G3302 SGCD1 SANS 3575:1996 03 Drawing	EN 10346 S220GD (2009) SANS 4998:1996 GR220	EN 10346 S250GD (2009) SANS 4998:1996 GR250	EN 10346 S280GD (2009) SANS 4998:1996 GR280	EN 10346 S350GD (2009) SANS 4998:1996 GR350	EN 10346 S550GD (2009) SANS 4998:1996 GR550

Notes:

1. Chemical analysis only
2. Thickness range 0.40 to 2.00mm with a maximum zinc coating mass of Z275.
3. Thicknesses greater than 2.00 mm are available on enquiry only.
4. Restricted to certain width to thickness ratios.
5. YS = Yield strength; TS = Tensile strength; El = Elongation
6. For details refer to relevant specification.
7. A tensile test is required only if the hardness is below 85 Rockwell B

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