

# Hot Dip Galvanized Information Sheet No.8

## Corrosion of Zinc – Corrosivity of Atmospheres

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**Used by the HDGASA to determine Service Life of Hot Dip Galvanized Steel Exposed to Various Atmospheric Environments**

**Reference Source: ISO 9223:1992**

### **Summary of ISO 9223 Specification**

The ISO 9223 specification considers three key factors in determining the atmospheric corrosion rate of zinc. These factors are:

- 1) Time of wetness, Table 1 – Classification of time of wetness ( $\tau$ ) being the period that the zinc surface is covered by liquid containing the corrosive elements (Electrolyte).
- 2) Airborne pollution containing sulphur dioxide ( $\text{SO}_2$ ), Table 2 – Classification of pollution by sulphur-containing substances represented by ( $\text{SO}_2$ ) and
- 3) Airborne pollution containing salinity, Table 3 – Classification of pollution by airborne salinity represented by chloride usually in the form of chlorides carried in the prevailing winds from the sea.

Two specific methods were employed to determine the classification of atmospheric corrosivity, these were:

- 1) Environmental classification in terms of time of wetness and atmospheric pollution, (ISO 9225) and
- 2) Classification based on corrosion rates measured on exposed standard metal specimens, (ISO 9226).

### **Tables used in the development of the Atmospheric Classifications (Reference source ISO 9223)**

Various tables are published within the ISO 9223 specifications and are listed here for reference purposes. Detailed data pertaining to each of these tables are contained within the ISO 9223 specification.

Table 1	– Classification of time of wetness ( $\tau$ )
Table 2	– Classification of pollution by sulphur-containing substances represented by ( $\text{SO}_2$ )
Table 3	– Classification of pollution by airborne salinity represented by chloride
Table 4	– Categories of Corrosivity of the Atmosphere
Table 5	– Corrosion rates ( $r_{\text{corr}}$ ) for the first year of exposure for the different corrosivity categories
Table 6a & 6b	– Applying table 5 of ISO 9223, estimated service life of hot dip galvanized steel coated according to Table D.1 of ISO 1461:1999, has been extrapolated. Three additional columns have been developed by the HDGASA, that indicate estimates for service life of various hot dip galvanized coatings having “Mean Coating Thicknesses” of 55, 70 and 85 micrometres ( $\mu\text{m}$ ) respectively.

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**Table 6a – Description of Categories of Atmospheric Corrosivity**

Category	Corrosivity	Description of Typical Corrosive Atmosphere
<b>C 1</b>	Very Low	Interior: dry
<b>C 2</b>	Low	Interior: occasional condensation Exterior: exposed rural inland
<b>C 3</b>	Medium	Interior: high humidity, some air pollution Exterior: urban inland or mild coastal
<b>C 4</b>	High	Interior: swimming pools, chemical plant, etc. Exterior: industrial inland or urban coastal
<b>C 5</b>	Very High	Exterior: industrial with high humidity or high salinity coastal

The typical descriptions detailed in Table 6a are intended as a general guide and it is recommended that a review of actual site conditions should be undertaken before finalising the applicable corrosive category. A general review of existing hot dip galvanized structures is an ideal method used to establish the corrosive conditions in the general area of a particular site.

**Table 6b – Estimated Service Life for Hot Dip Galvanized Steel complying with SANS 121 (ISO 1461:1999) and subjected to Atmospheric Environments Classified in terms of ISO 9223:1992**

Corrosivity Category	Corrosion Rates ( $r_{corr}$ ) of Hot Dip Galvanized Coated Steel (Ref ISO 1461:1999)				
	Units	Zinc	55µm for steel ≥ 1.5 mm to < 3mm	70µm for steel ≥ 3 mm to < 6 mm	85µm for steel ≥ 6 mm
<b>C 1</b>	µm/a	$r_{corr} \leq 0.1$	> 100 years	> 100 years	> 100 years
<b>C 2</b>	µm/a	$0.1 < r_{corr} \leq 0.7$	≤ 78.5 years	> 100 years	> 100 years
<b>C 3</b>	µm/a	$0.7 < r_{corr} \leq 2.1$	26 to ≤ 78.5 years	33 to ≤ 100 years	40 to > 100 years
<b>C 4</b>	µm/a	$2.1 < r_{corr} \leq 4.2$	13 to ≤ 26 years	16 to ≤ 33 years	20 to ≤ 40 years
<b>C 5</b>	µm/a	$4.2 < r_{corr} \leq 8.4$	6.5 to ≤ 13 years	8.3 to ≤ 16 years	10 to ≤ 20 years

The figures for service life estimated in Table 6b are intended as a general guide and it is recommended that a more detailed assessment of the actual site environmental conditions should be conducted in order to define longevity expectations for hot dip galvanized coated steel.

It is worthwhile noting that general hot dip galvanizing specifications state the local (minimum) and the mean coating thicknesses. The coating thickness actually achieved in practice, varies with steel composition and this can range from the minimum up to at least 50% greater. As life expectancy predictions in table 6b are based on the minimum coating thickness, they are conservative.

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