

Australian Standard[®]

**Durability of galvanized and
electrogalvanized zinc coatings for the
protection of steel in structural
applications—Atmospheric**



This Australian Standard® was prepared by Committee MT-014, Corrosion of Metals. It was approved on behalf of the Council of Standards Australia on 7 April 2008. This Standard was published on 19 May 2008.

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- Australasian Corrosion Association
 - Australian Chamber of Commerce and Industry
 - Australian Electrolysis Committee
 - Australian Paint Approval Scheme
 - Australian Pipeline Industry Association
 - AUSTROADS
 - Blast Cleaning and Coating Association of Australia
 - Bureau of Steel Manufacturers of Australia
 - Corrosion Prevention Centre
 - CSIRO Manufacturing and Materials Technology
 - Galvanizers Association of Australia
 - Materials Australia
 - Plumbing Products Industry Group
 - Water Services Association of Australia
 - Water Utility Interests
-

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PREFACE

This Standard has been prepared by the Australian members of the Joint Standards Australia/Standards New Zealand Committee MT-014, Corrosion of Metals. After consultation with stakeholders in both countries, Standards Australia and Standards New Zealand decided to develop this Standard as an Australian Standard rather than an Australian/New Zealand Standard.

The objective of this Standard is to specify a classification for the durability of metallic zinc based coatings on structural steels and to provide a broader understanding of the application of the product.

Currently there is no appropriate International Standard for classification of metallic coatings.

The term ‘informative’ has been used in this Standard to define the application of the appendix to which it applies. An ‘informative’ appendix is only for information and guidance.

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STANDARDS AUSTRALIA

Australian Standard

Durability of galvanized and electrogalvanized zinc coatings for the protection of steel in structural applications—Atmospheric**1 SCOPE**

This Standard provides classification guidelines for the durability of galvanized and electrogalvanized coatings for structural steel applications in various atmospheric environments.

NOTES:

- 1 Non-atmospheric corrosion environments are not considered in this part of the Standard.
- 2 This Standard does not cover durability of galvanized and electrogalvanized coatings on steel fasteners in detail.
- 3 This Standard excludes other protective systems applied over galvanized or electrogalvanized coatings.
- 4 For guidance on demonstrating compliance with this Standard, refer to Appendix B.

This Standard also discusses pre-galvanized steel, surface conditions and preparation, environmental zones and types of structure and associated components.

2 REFERENCED DOCUMENTS

The following documents are referred to in this Standard:

AS

1199	Sampling procedures for inspection by attributes
1199.0	Part 0: Introduction to the ISO 2859 attribute sampling system
1199.1	Part 1: Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection
1214	Hot-dip galvanized coatings on threaded fasteners (ISO metric coarse pitch)
1627	Metal finishing—Preparation and pretreatment of surfaces
1627.1	Part 1: Removal of oil, grease and related contamination
1627.2	Part 2: Power tool cleaning
1627.4	Part 4: Abrasive blast cleaning of steel
1897	Electroplated coatings on threaded components (metric coarse pitch)
2400	Packaging
2400.5	Part 5: Temporary corrosion protection
3566	Self-drilling screws for the building and construction industries
3566.2	Part 2: Corrosion resistance requirements
4312	Atmospheric corrosivity zones in Australia
5056	Metallic coatings—Powder metal (and composites) applied by mechanical means at ambient temperature

AS/NZS

2312 Guide to the protection of structural steel against atmospheric corrosion by the use of protective coatings

4680 Hot-dip galvanized (zinc) coatings on fabricated ferrous articles

AS/NZS ISO

9001 Quality management systems—Requirements

9004 Quality management systems—Guidelines for performance improvements

HB 18.28 Conformity assessment—Guidance on a third-party certification system for products

ISO

9223 Corrosion of metals and alloys—Corrosivity of atmospheres—Classification

3 DEFINITIONS

For the purpose of this Standard, the definitions below apply.

3.1 Atmospheric corrosivity

The corrosion rate of a material on exposure to atmospheric conditions such as found in industrial, urban, marine and rural environments.

3.2 Atmospheric environment

The environmental conditions delivered to a material from the surrounding atmosphere.

3.3 Climate

The general prevailing weather conditions recorded over a number of years.

3.4 Climate—Regional

The general prevailing weather conditions of a region, where a region measures several square kilometres, refer to Figure 1.

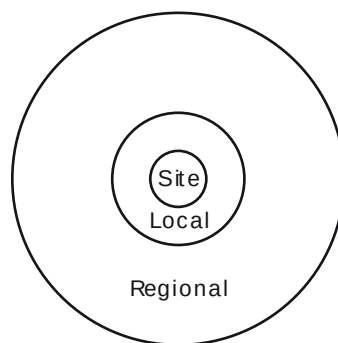


FIGURE 1 DIAGRAM OF SITING GUIDELINES

3.5 Climate—Local (macro-climate)

The general prevailing weather conditions within a local area, where local area is larger than a micro-climate. This macro-climate may be very different to the regional conditions due to local effects such as vegetation, topography, and meteorological conditions.

3.6 Climate—Site (micro-climate)

The general prevailing weather conditions of a site within a location, where a site typically measures a few square metres. The micro-climate may be very different to the macro conditions due to the level of exposure or sheltering of surfaces.

3.7 Continuous (in-line) galvanizing

A process where uniform steel sections (wire, sheet and hollow and open sections) are galvanized as an integral part of their manufacturing process.

NOTE: This produces a smooth and ductile coating with a mass of 50 to 300 g/m² except on cut edges. The product provides ductility for forming and pressing but, due to a lower zinc thickness, may require supplementary coating in outdoor exposure.

3.8 Corrosion—Atmospheric

Generally the result of the joint action of oxygen, airborne gases and particulates, and moisture on a metal surface to form a new compound by reacting with the base metal. This is a long term, discontinuous and irreversible process resulting in a loss of metal from the corroded surface.

3.9 Corrosivity classification—Industrial atmosphere

An area of high atmospheric corrosivity typified by an atmosphere rich in airborne contaminants such as sulfur dioxide, oxides of nitrogen or other corrosive gases, particulates and salts.

3.10 Corrosivity classification—Marine atmosphere

An area of high atmospheric corrosivity from conditions which are typified by an atmosphere rich in airborne marine salts.

3.11 Corrosivity classification—Rural atmosphere

An area of low atmospheric corrosivity.

3.12 Corrosivity classification—Urban atmospheres

An area of low to moderate atmospheric corrosivity.

3.13 Corrosivity categories

Regions which share a common finite range of corrosion rates for a given material. The categories are obtained from empirical measurements and predictive modelling.

3.14 Durability rating (zinc coatings)

A classification based on currently available commercial zinc coatings and the well established proportional relationship between coating durability and coating thickness.

3.15 Exposure—Open washed

Any surface which has direct exposure to all atmospheric conditions and atmospheric contaminants, and is not sheltered from rain.

3.16 Exposure—Sheltered unwashed

The exposure to atmospheric contaminants in under-cover or partly enclosed spaces, not subject to rain.

3.17 Service life

The time (in years) from initial coating to the point where maintenance of the coating is first required.

NOTE: Beyond this point, the effort required to satisfactorily clean the surface for reinstatement becomes increasingly impractical, and less economically viable.

3.18 Sheltered—Enclosed

Any surface which is protected from the prevailing atmosphere, climatic conditions and airborne contaminants, such as indoor or in enclosed spaces.

3.19 Time of wetness (TOW)

The period during which a metallic surface is covered by moisture.

4 SERVICE LIFE AND DURABILITY

4.1 General

Long service life for steel is normally a design assumption of its use. This is based on the adoption of corrosion management principles in terms of assessment of corrosivity of the exposure environment, the design of the structure and the use of coatings or other methods to minimize exposure of the steel to the environment.

4.2 Design considerations

The service life of a galvanized or electrogalvanized coating is dependent on a range of factors, particularly coating thickness and the severity of the environment to which the coating is exposed.

Table 1 provides guidance on the durability of commonly available coatings in a range of exposure conditions.

The durability of the coating is defined as the time elapsed after initial coating before deterioration reaches the point that maintenance is necessary to restore protection to the base material. It may be possible to specify a coating which will protect the structure from corrosion for its entire design life, or alternatively maintenance may be required to deliver the required service life. In either case, the durability required must be clearly defined, in order to allow selection of the appropriate coating.

Structural steel will commonly incorporate elements of fabrication such as welding or connections with fasteners after galvanizing, which will impact upon the durability of the zinc coatings, and ultimately the structure. Where steel components are welded to a galvanized structure, it is important that the weld be treated in such a way that similar durability is achieved in this area. This may require the use of zinc rich paint or other recognized repair to ensure corrosion resistance at the weld. Similarly, fasteners should be chosen such that either the durability of the fastener matches or exceeds that of the adjoining zinc coated steel or alternatively that inspection, maintenance or replacement of fasteners is programmed.

Any areas damaged during transport, storage or fabrication must be repaired, in order to achieve the maximum performance from the coating system. Guidance on repairs is provided in Appendix F.

4.3 Coating thickness

The durability of a galvanized product is a function of its coating thickness. Table 1 lists the range of commercially available galvanized coatings and the associated nominal thicknesses. When the corrosion rate for a given environment is known, an accurate assessment of durability can readily be made, taking account of any micro-environments.

The continuous galvanizing process produces film thicknesses of 7 to 40 μm . The post-fabrication hot dip galvanizing process nominally produces film thicknesses of 50 to 150 μm .

4.4 Exposure environment

4.4.1 General

The durability of a coating system is dependent upon the exposure of the coating to the environment. The primary concerns relate to the deposition of airborne contaminants such as sea salt (marine environments) and carbon particulates (industrial environments), and the exposure to corrosive gases (sulfur dioxide, oxides of nitrogen, and others) which are commonly found in urban and industrial environments. Typically Australian corrosivity is dominated by marine conditions, with much of the infrastructure located close to the coast, with sources of corrosive gases mostly in small and isolated locations. Structures located close to the coast require special consideration in the design phase, and this and other issues are discussed in greater detail in AS/NZS 2312.

Consideration for the design of the component or system to reduce the likelihood of retaining moisture from rain, ice, snow, or condensation is important. In addition, surfaces which are exposed to the prevailing weather but are not readily washed by the rain will usually corrode at a higher rate.

4.4.2 Classification of environments

This Clause addresses environments in Australia which affect the corrosion rate of steel and galvanized coatings. When selecting an appropriate galvanized product, the overall environment where the structure is located should be the starting point of research. Of prime importance is the effect the environment has on the corrosion rate of the galvanized coating.

Corrosion of steel in pH neutral environments generally requires the presence of moisture and oxygen. Steel corrosion rates are usually very low in dry environments, higher in damp environments and very high in the presence of moisture and salt or other contaminants. The effect of the environment on galvanized coatings can be different to its effect on steel.

4.4.3 Atmospheric corrosivity categories

Atmospheric environments taken from AS/NZS 2312 are classified into the following five atmospheric corrosivity categories based on the corrosion rates of mild steel given in ISO 9223, plus one tropical category. For further guidance on atmospheric corrosivity, refer to AS 4312.

Category A: Very low. Environments in this category are most commonly found inside heated or air conditioned buildings with clean atmospheres, such as most commercial buildings. They may also be found in semi-sheltered locations remote from marine or industrial influence and in unheated or non-air conditioned buildings. The only external environments in this category in Australia or New Zealand are some alpine regions although, generally these environments will extend into Category B.

Category B: Low. Environments in this category include dry, rural areas as well as other regions remote from the coast or sources of pollution. Most areas of Australia and New Zealand beyond at least 50 kilometres from the sea are in this category, which can however, extend as close as 1 kilometre from seas that are relatively sheltered and quiet. Typical areas occur in arid and rural inland regions, most inland cities and towns such as Canberra, Ballarat, Toowoomba, Alice Springs and Hamilton, NZ and suburbs of cities on sheltered bays, such as Melbourne, Hobart, Brisbane and Adelaide (except areas within 3 to 6 kilometres of the coast near Adelaide). Unheated or non-airconditioned buildings where some condensation may occur, such as warehouses and sports halls, can be in this category. Proximity to the coast is an important factor.