

ATMOSPHERIC CORROSIVITY CATEGORIES

INTRODUCTION

Atmospheric corrosivity categories are a standardised rating of the corrosivity of the atmosphere in relation to the corrosion rate of certain metals. They group environments which share a finite range of corrosion rates. The categories are obtained from empirical measurements and predictive modelling and are of assistance in the following:

- Selection of protective coatings for metal products.
- Maintenance of coating systems.
- Selection of suitable metals and metallic-coated products.
- Component design.

See TECHnote DES 045 for corrosion protection of building services.

ATMOSPHERIC CORROSIVITY CATEGORIES IN NATSPEC

Corrosivity requirements within NATSPEC align with the categories defined in AS 4312 and ISO 9223, except where the information specifically deals with corrosion of structural steel, in which case NATSPEC cites the AS/NZS 2312 series. These atmospheric corrosivity categories are based on corrosion rates, measured in micrometres (microns) per year.

AS 4312 complements the AS/NZS 2312 series and provides guidance on determining the appropriate corrosivity category considering location in the Australian environment and other environmental factors. It deals with both macro-environments (i.e. those generated by normal weather patterns in a specific area) and micro-environments (i.e. those restricted in scale and generated by local features or the complexity or orientation of a structure).

AS 4312 atmospheric corrosivity categories	AS/NZS 2312 categories	AS/NZS 2728 atmospheric classifications	Mild steel corrosion rate (µm/year)	Zinc corrosion rate (µm/year)	Copper corrosion rate (µm/year)
C1 (Very low)	C1 (Very low)	A (Very low)	< 1.3	< 0.1	< 0.1
C2 (Low)	C2 (Low)	B (Low)	1.3 – 25	0.1 – 0.7	0.1 – 0.6
C3 (Medium)	C3 (Medium)	C (Medium)	25 – 50	0.7 – 2.1	0.6 – 1.3
C4 (High)	C4 (High)	D (High)	50 – 80	2.1 – 4.2	1.3 – 2.8
C5 (Very high)	C5 (Very high) (C5-I: Industrial C5-M: Marine)	E (Very high) (E-I: Industrial E-M: Marine)	80 – 200	4.2 – 8.4	2.8 – 5.6
CX (Extreme)	CX (Extreme)	-	200 – 700	8.4 – 25	5.6 – 10
-	T (Inland Tropical) *	F (Inland tropical)*	-	-	-

* Categories F and T (Inland Tropical) referenced in the AS/NZS 2312 series and AS 2728 are generally not very high in corrosivity but the aggressivity of the environment to organic coatings means special protection is required.

The categories C5 in the AS/NZS 2312 series and E in AS/NZS 2728 are divided into Industrial and Marine subcategories.

NATSPEC's 0171 *General requirements* worksection makes provision for the nomination of an external and internal project *atmospheric corrosivity category* applicable to all metal materials requiring corrosion protection. Worksections that cover materials requiring corrosion protection must be completed to match the corrosivity categories documented.

The *ABCB Housing Provisions*, cited by NCC Volume 2, refer to metal coating for protection of metal sheet roofing in four environment categories (Low to Very High) aligning with AS 4312.

To assist the specifier, NATSPEC *Templates* nominate default protective systems or products, sometimes in the form of a **Corrosion resistance and durability table**. However, categories C5 (Very high) and CX (Extreme) are not addressed as they relate to very aggressive atmospheres usually requiring specialist attention.

STANDARDS

Consult AS 4312 when determining the external and internal project *atmospheric corrosivity category* and the appropriate design solution.

Consult the AS/NZS 2312 series for selection of protective coating systems for structural steel.

Relevant standards

AS 2312.1 *Guide to the protection of structural steel against atmospheric corrosion by the use of protective coatings - Paint coatings* classifies environments based on the corrosion rates of mild steel, plus one tropical category which is not determined by the corrosion rate.

AS/NZS 2312.2 *Guide to the protection of structural steel against atmospheric corrosion by the use of protective coatings - Hot dip galvanizing* classifies environments based on the corrosion rates of zinc.

AS 2699 (series) *Built-in components for masonry construction*.

AS/NZS 2728 *Prefinished/prepainted sheet metal products for interior/exterior building applications - Performance requirements* notes the environment may have different effects on the durability of the base metal and the protective coating.

AS 3700 *Masonry structures* discusses the minimum durability for built-in components.

AS 3715 *Metal finishing - Thermoset powder coatings for architectural applications of aluminium and aluminium alloys*.

AS 4145 (series) *Locksets and hardware for doors and windows*.

AS 4312 *Atmospheric corrosivity zones in Australia*, provides guidance in determining the appropriate corrosivity category taking into account location in the Australian environment and other environmental factors.

AS 4506 *Metal finishing - Thermoset powder coatings*.

AS 4773.1 *Masonry in small buildings - Design*.



This lintel was revealed during building work on a structure 200 m from salt water and within 2 km of breaking surf.



ATMOSPHERIC CORROSIVITY CATEGORIES

AS/NZS 2728, cited in NATSPEC, references atmospheric classifications A to F to correlate with the categories defined in the AS 2312 series and AS 4312, as indicated in the table above.

AS 3700, cited in NATSPEC, defines various durability classes for built-in components based on defined exposure environments of mild arid to severe marine. An additional exposure environment, *Special*, is defined for particularly aggressive environments.

SPECIFYING ATMOSPHERIC CORROSION PROTECTION IN NATSPEC

NATSPEC recommends the following steps in specifying atmospheric corrosion protection systems or products:

1. SELECT THE ATMOSPHERIC CORROSIVITY CATEGORY

Select an external and internal *atmospheric corrosivity category* to AS 4312 for the project and specify it in 0171 *General requirements* under **Corrosion resistance** in the **PERFORMANCE** clause. An internal situation is where the building fabric is protected from salt and moisture by vapour barriers, sarking, sheathing or building wraps. External situations include the external leaf and air spaces behind external leaf brickwork or blockwork walls. Consider the following in determining the appropriate *atmospheric corrosivity category*:

- **Macro-climatic factors:** Refer to AS 4312 and The Corrosion Mapping System (CMS) for assistance in determining the corrosivity zone for the site. Refer to AS 4312 (2019) Table 4.1 for assistance in determining the macro environment in relation to distance from shoreline.
- **Future atmospheric conditions:** These may result from future activities carried out in or around the structure. AS 2312.1 (2014) Table 2.1 and AS/NZS 2312.2 (2014) Table 6.1 provide examples of different internal environments, such as offices, warehouses and swimming pools and their associated atmospheric corrosivity categories.
- **Evidence of site-specific conditions:** Carry out inspections and/or review records of corrosive actions on adjacent structures.
- **Micro-climatic factors:** AS 4312 also discusses other factors affecting the atmospheric corrosivity such as industrial pollutants and chemical attacks, shelter from rain and regular washing, screening from salt and pollution deposition, prolonged surface wetness, abrasion and erosion.

0344 *Steel – hot-dip galvanized coatings* and 0345 *Steel – protective paint coatings* allow for the nomination of an *atmospheric corrosivity category* for individual structural steel components.

0455 *Door hardware* also provides schedules for corrosion resistance categories for locksets and hardware (C1 – C10) and padlocks (C1 – C5). These categories conform to the AS 4145 series and do not correlate to the *atmospheric corrosivity categories* specified in 0171 *General requirements*.

0673 *Powder coatings* allows for the nomination of the service condition category for metals other than aluminium to AS 4506 and for aluminium substrates to AS 3715, AAMA 2603, AAMA 2604 or AAMA 2605 as appropriate.

2. CHECK THE TEMPLATE DEFAULT VALUES

Review the **Corrosion resistance and durability table** in the individual worksection. Consider the following:

- **NCC requirements:** BCA Volume 2 defines acceptable corrosion protection requirements for structural steel members, steel framing, lintels, wall ties and metal sheet roofing.
- **Situation:** The tables in NATSPEC include default values for a particular *atmospheric corrosivity category*. Consider corrosion protection requirements in detail and check that the default values provided are appropriate.
- **Standards:** Refer to the relevant standards listed in this TECHnote.
- **Manufacturer's technical literature:** For example, BlueScope Technical Bulletin TB 01A – *Steel roofing products - selection guide*.

3. EDIT THE TEMPLATE

Edit the tables where the default values are not appropriate to the project edit the tables to delete the atmospheric categories that do not apply.

The Corrosion Mapping

System (CMS), a joint venture between Industrial Galvanizers and the CSIRO, provides corrosion data, based on CSIRO environmental modelling, for any location in Australia. It provides information on the corrosion rates of copper, steel and zinc (galvanized) coatings with a range of coating masses based on both geographic location and the element's location on the structure being evaluated. The CMS can be accessed by registering with Industrial Galvanizers at corrosion.ingal.com.au

Relevant worksections

0171 *General requirements*
 0181 *Adhesives, sealants and fasteners*
 0183 *Metals and prefinishes.*
 0241 *Landscape - walling and edging*
 0310 *Concrete - combined*
 0311 *Concrete formwork*
 0313 *Concrete post-tensioned*
 0321 *Precast concrete*
 0322 *Tilt-up concrete*
 0331 *Brick and block construction*
 0332 *Stone masonry*
 0334 *Block construction*
 0335 *Brick construction*
 0341 *Structural steelwork*
 0342 *Light steel framing*
 0343 *Tensioned membrane structures*
 0344 *Steel - hot-dip galvanized coatings*
 0345 *Steel - protective paint coatings*
 0361 *Monolithic stabilised rammed earth walls*
 0362 *Mud brick and pressed earth block walls*
 0420 *Roofing - combined*
 0423 *Roofing - profiled sheet metal*
 0424 *Roofing - seamed sheet metal*
 0430 *Cladding - combined*
 0432 *Curtain walls*
 0433 *Stone cladding*
 0436 *Cladding - profiled and seamed sheet metal*
 0453 *Doors and access panels*
 0455 *Door hardware*
 0456 *Louvre windows*
 0511 *Lining*
 0523 *Partitions - brick and block*
 0611 *Rendering and plastering*
 0673 *Powder coatings*