ADVISORY NOTE

NAN 013

Durability of screws

Introduction

The durability of steel frames can be influenced by the durability of the fasteners used for fabrication and erection.

This Advisory Note discusses some of the issues involved in the correct selection of screw coatings for steel framing and makes recommendations on minimum coating performance to achieve reliable durability in steel framing connections.

NS 200 NASH Standard – Residential and Low-rise Steel Framing, Part 2: Design Solutions references AS 3566.2 for the durability performance of screws. Standards Australia has published a 2025 edition of this Standard which covers only screws used to fix roof and wall cladding.

There are several reasons to now separate fasteners used in framing from those used in cladding:

- The structural integration and lack of accessibility during the life of the building places increased requirements for longevity on fasteners used for framing applications compared to more accessible installations, such as cladding.
- The environmental and micro-climatic influences associated with framing applications vary considerably to exposed applications, even within the same structure.

There is a vast range of fasteners available in Australia to accommodate a wide variety of building materials and construction methods, while the coatings vary significantly to exposed applications, even within the same structure.

Current requirements and guidance

NS 100 NASH Standard – Residential and Low-rise Steel Framing, Part 1: Design Criteria - Clause 1.3.3 Durability, gives the following criteria for durability of all members and components.

> *'The design criteria have been developed on the assumptions that materials used and their installation and maintenance ensure that the components will fulfill their intended structural function for the intended life of the structure.'*

NH 100 NASH Handbook – Design of Residential and Low-rise Steel Framing based on the Australian Building Codes Board (ABCB) Guidelines for Durability in Buildings, recommends an intended minimum design life of 50 years for components which are not accessible or economical to repair and replace.

NS 200 NASH Standard Part 2: Design Solutions - Clause F1.2 specifies that screws must be Class 3 in accordance with AS 3566.2 or better. Table B.5 recommends a Class 4 coating for atmospheric corrosion category C4.

Corrosivity

The corrosivity influence on components used in house construction will be determined substantially by:

- Distance from coastline and heavy industry; and type of coast (the macro-environment)
- The micro-environment, usually influenced by:
  - Local wind direction
  - Topography
  - Whether the component is enclosed, sheltered or fully exposed

The corrosivity zone in which the building is located can be determined using AS 4312. The corrosion designations are summarised in Table 1 below. NASH does not give any recommendations for Atmospheric corrosivity category C5 or CX as the solutions are very site specific and usually involves a systems-based approach.

Table 1 Corrosivity zones

Atmospheric corrosivity category	Description
C1	Indoor dry air-conditioned (not ventilated externally)
C2	Most areas of Australia beyond 50 km from the sea but can be as close as 1 km from relatively sheltered waters
C3	In costal areas with significant surf, this area extends from 1 km to 50 km, varying significantly with winds, topography and vegetation. Around sheltered bays it extends from around 50 m to 1 km from the shoreline
C4	Occurs mainly on the coast in areas with rough seas and surf, extending from around 300 m to 1 km inland. Around sheltered bays it extends up to 50 m from the shoreline
C5	Severe industrial and marine, typically 50 m to 500 m from surf or very rough seas
CX	Extreme marine, typically within 50 m of surf or very rough seas

Note: Refer to AS 4312 and ISO 9223.

Different coating systems

The following metallic protective coating systems are commonly available:

- Zn or Zn/Sn alloy applied by galvanizing or mechanically plated
- Zn or Zn/Sn alloy with additional polymer top coat
- Zn or Zn/Ni alloy applied by electroplating with additional polymer E-coat
- Zn/Sn alloy applied by low temperature galvanizing

Driving of screws

When driving self-drilling or self-tapping metal coated screws, very little of the protective coating is lost as the screw coating tends to be “moved around” rather than lost. However, top coatings are generally stripped at the extremities by the self-drilling or self-reaming action of installation, losing some of the benefit they offer to the metallic coat. It is for this reason that screws with only a polymer (paint) top coat are not recommended for framing applications.

Accelerated testing

NASH recommendations are based on a design life of 50 years. *(reference NH 100).* As it is not practical to build a structure and then field test over a 50 year timeframe to determine how the fasteners perform, the following accelerated testing procedures have been developed to help predict the performance of screw coatings:

- Outdoor exposure test
- Salt spray test
- Fog test
- Cyclic test

There are many considerations in interpreting the results from these tests and great care needs to be taken when comparing different coating systems. It is critical that driven screws are always used in testing, so that the influence of the stripping of paint and metallic coating from both heads and shanks during the driving process is accounted for.

Metallic coated steels that are commonly used in construction applications often contain coating alloys that provide sacrificial protection to steel and can corrode to protect fasteners that are experiencing corrosive failure. This is often referred to as halo corrosion or haloing.

The failure criteria for corrosion outlined in AS 3566.2 is for corrosion of the head of the screw only and the performance of the thread is not considered. In steel framing applications, corrosion of the threads is just as important and hence is one of the failure criteria. The screw should be tested in an assembly with the metal coated steel (Z, AZ or AM) and haloing of the steel’s metal coating observed as another potential failure criterion.

Interim recommendation

The following table contains suggested minimum requirements for coatings of fasteners:

Coating type	Minimum metallic coating thickness[1] (µm)
Hot dipped galvanized	30
Mechanically plated Zn (zinc)	40
Mechanically plated Zn/Sn (zinc-tin) (20% Sn)	25
Zn/Sn alloy (low temperature galvanizing)	12
Electroplated Zn + polymer top coat	18+ top coat
Mechanically plated Zn + polymer top coat	25 + top coat
Mechanically plated Zn/Sn + polymer top coat	18 + top coat
Electroplated Zn and electrically applied polymer (E-coat)	10 + top coat
Electroplated ZnNi (12-15% nickel) and electrically applied polymer (E-coat)	10 + top coat

Notes:
1. *Thickness to be measured on flat portion of screw head*
2. *Metallic coatings should be in accordance with AS 3566.2*
3. *Typical polymer top coats are epoxy or zinc rich paints with a dry film thickness of 10 microns*
4. *Mechanical plating to AS 5056 with a density of 8*
5. *Not all these coatings may be commercially available.*

A polymer top coat without a metallic layer is unacceptable for framing applications.
Wall membranes provide additional protection to the screws and are generally recommended particularly close to the coastline.

This is an interim recommendation and is subject to revision as more information becomes available.

References

NS 100 NASH Standard – Residential and Low-rise Steel Framing, Part 1: Design Criteria

NS 200 NASH Standard – Residential and Low-rise Steel Framing, Part 2: Design Solutions

NH 100 NASH Handbook – Residential and Low-rise Steel Framing: Design Criteria

AS/NZS 1214 Hot-dip galvanized coatings on threaded components

AS 1397 Continuous hot-dip metallic coated steel sheet and strip - Coatings of zinc and zinc alloyed with aluminium and magnesium

AS 1897 Fasteners – Electroplated coatings

AS 3566.2-2002 Self-drilling screws for the building and construction industries - Corrosion resistance requirements

AS 3566.2-2025 Self-drilling screws for the building and construction industries, Part 2: Requirements for corrosion resistance of self-drilling screws and specifications for associated sealing washers for roofing and cladding

AS 4312 Atmospheric corrosivity zones in Australia

AS 5056 Metallic coatings – Powder metal (and composites) applied by mechanical means at ambient temperature

ISO 14993 Corrosion of metals and alloys – Accelerated testing involving cyclic exposure to salt mist, dry and wet conditions

ISO 15110 Paints and varnishes – Artificial weather including acidic deposition

ISO 13573 Corrosion of metals and alloys – Test method for thermal-cycling exposure testing under high-temperature corrosion conditions for metallic materials

ABCB Guideline Document – Durability in Buildings