

Hot dip galvanized coatings

- General
 - Prior to commencement of design it is recommended that the designer/fabricator refer to Australian Standard 1397 and Australian/New Zealand Standard 4680, in particular Appendix C 'Recommended procedures for design and preparation of materials prior to galvanizing', and to the chapter on Design in the manual 'After Fabrication Hot Dip Galvanizing', produced by Galvanizers Association of Australia
 - The designer is referred to the recommendations contained in Appendix D of AS/NZS 4680 to minimise distortion and reduce the likelihood of other issues occurring
 - High strength low alloy steels, particularly those containing high silicon can, when galvanized, produce brittle coatings which are thicker and different in colour to normal coatings. The high silicon content in weld deposits made by automatic welding processes may result in thicker coatings being formed on these areas. These coating characteristics are usually beyond the control of the galvanizer
 - Where the galvanized coating is to be subsequently painted or treated, the proposed finish specification shall be provided to the galvanizer prior to procurement of materials
 - The following specification is to be read in conjunction with AS/NZS 4680:2006 Hot-dip galvanized (zinc) coatings on fabricated ferrous articles
- Fabrication
 - Care shall be taken to avoid fabrication techniques which could cause distortion or embrittlement of the steel
 - All welding slag and burrs shall be removed prior to delivery to the galvanizer
 - Holes and/or lifting lugs to facilitate handling, venting and draining during the galvanizing process shall be provided at positions as agreed between the designer and the galvanizer
 - Unsuitable marking paints shall be avoided and consultation by the fabricator with the galvanizer about removal of grease, oil, paint and other deleterious materials shall be undertaken prior to fabrication
- Surface Preparation
 - Surface contaminants and coatings, which cannot be removed by the normal chemical-cleaning process in the galvanizing operation, shall be removed by abrasive blast cleaning or some other suitable method
 - Steelwork shall be pre-cleaned in accordance with the requirements of AS 1627.1 followed by acid pickling, in accordance with the requirements of AS 1627.5. Abrasive blast cleaning to Class 2 finish in accordance with the requirements of AS 1627.4 may be used
- Galvanizing
 - All articles to be galvanized shall be handled in such a manner as to avoid any mechanical damage and to minimise distortion (reference should be made to AS/NZS 4680 for guidance)
 - Design features that may lead to difficulties during galvanizing should be pointed out prior to galvanizing
 - Galvanizing parameters such as galvanizing temperature, time of immersion, and withdrawal speed shall be employed to suit the requirements of the article
 - The composition of the zinc in the galvanizing bath shall comply with AS/NZS 4680
- Coating Requirements
 - Thickness

- 5.1.1.The thickness of the galvanized coating shall conform with Table 1 in AS/NZS 4680: -

AS/NZS 4680: Table 1			
Requirements for coating thickness and mass for articles that are not centrifuged			
Steel thickness	Local coating thickness (minimum)	Average coating thickness (minimum)	Average coating mass (minimum)
(mm)	(µm)	(µm)	(g/m ²)
≤ 1.5	35	45	320
< 1.5 ≤ 3	45	55	390
3 ≤ 6	55	70	500
> 6	70	85	600

Note 1: 1 g/m² coating = 0.14 µm coating thickness

- 5.1.2.The thickness of the galvanized coatings on threaded fasteners shall conform with Table 2 in AS 1214: -

AS/NZS 1214: Table 2			
Requirements for coating thickness and mass for articles that are centrifuged			
Thickness of articles (all components including castings)	Local coating thickness (minimum)	Average coating thickness (minimum)	Average coating mass (minimum)
(mm)	(µm)	(µm)	(g/m ²)
< 8	25	35	250
≥ 8	40	55	390

Note 1: For requirements for threaded fasteners refer to AS 1214

Note 2: 1 g/m² coating = 0.14 µm coating thickness

- 5.1.3.The thickness of the galvanized coating shall first be tested by the purchaser/designer at the galvanizer's works, using an approved magnetic measuring device. In the event of any dispute, an independent test shall be carried out in accordance with AS/NZS 4680, Appendix G
- 5.2. Surface Finish
- 5.2.1.The galvanized coating shall be continuous, adherent, as smooth and evenly distributed as possible, and free from any defect that is detrimental to the stated end use of the coated article. On silicon killed steels, the coating may be dull grey, which is acceptable provided the coating is sound and continuous (refer Note 1.3). Any reparation is to be carried out as per Clause 8 of AS/NZS 4680
- 5.2.2.The integrity of the coating shall be determined by visual inspection and coating thickness measurements. Where slip factors are required to enable high strength friction grip bolting, where shown, these shall be obtained after galvanizing by suitable mechanical treatment of the faying surfaces
- 5.2.3.Where a paint finish is to be applied to the galvanized coating, all spikes shall be removed and all edges shall be free from lumps and runs (refer Note 1.4)
- 5.3. Adhesion
- 5.3.1.The galvanized coating shall be sufficiently adherent to withstand normal handling during transport and erection

6. Inspection
- 6.1. Inspection of all galvanized items shall be conducted by either the galvanizer or fabricator to ensure application is consistent and in accordance with requirements of AS/NZS 4680 (refer to: 7.0 Certificate)
7. Certificate
- 7.1. A certificate shall be provided stating that the galvanizing complies with the requirements of AS/NZS 4680
8. Transport and Storage
- 8.1. Galvanized components shall, wherever possible, be transported and stored under dry, well-ventilated conditions to prevent the formation of wet storage staining following the recommendations contained in AS/NZS 4680 Appendix F
- 8.2. A passivation treatment after galvanizing may be used to minimise the wet storage staining which may occur on articles unable to be stored in dry, well-ventilated conditions
- 8.3. Any wet storage staining shall be removed by the galvanizer if formed prior to leaving the galvanizer's plant, unless late pick-up or acceptance of delivery has necessitated the material being stored in unfavourable conditions. Provided the coating thickness complies with the requirements of AS/NZS 4680, no further remedial action is required to the stained areas
9. Welding
- 9.1. Where galvanized steel is to be welded, adequate ventilation shall be provided. If adequate ventilation is not available, supplementary air circulation shall be provided. In confined spaces a respirator shall be used
- 9.2. Grinding of edges prior to welding may be permitted to reduce zinc oxide fumes formed during welding and eliminate weld porosity which can sometimes occur
- 9.3. All uncoated weld areas shall be reinstated – see Coating reinstatement or Clause 8 of AS/NZS 4680
10. Coating reinstatement
- 10.1. Areas of significant surface that are uncoated shall, by agreement between the purchaser and the galvanizer, be reinstated by following the recommendations contained in AS/NZS 4680 - Repair after Galvanizing, or by other methods nominated by the galvanizer and approved by the contractor. Similar repair methods shall be used for areas damaged by welding or flame cutting, or during handling, transport and erection
- 10.2. The size of the area able to be repaired shall be relevant to the size of the object and the conditions of service but shall normally be in accordance with the provisions of AS/NZS 4680 - Repair after Galvanizing
- 10.3. Sweep (brush) blast cleaning of galvanized steel prior to painting
- 10.3.1. Refer to AS/NZS 4680 Appendix I
- 10.4. General information on factors that affect the corrosion of galvanized steel
- 10.4.1. Refer to AS/NZS 4680 Appendix H
- 10.4.2. Galvanized products should be specified in accordance with the appropriate national standards, which have been drawn up to provide minimum standards to ensure optimum performance of galvanized products and to give guidance in selection, application, and design
- 10.4.3. AS/NZS 2312 'Guide to the protection of structural steel against atmospheric corrosion by the use of protective coatings' is a particularly valuable reference in the selection of the most practical, economic coating in particular applications
- 10.4.4. Refer to AS 4312:2019 Atmospheric corrosivity zones in Australia
- 10.4.5. Refer to AS 1231-2000 Aluminium and aluminium alloys - Anodic oxidation coatings
- 10.4.6. AS 3715-2002 Metal finishing - Thermoset powder coatings for architectural applications of aluminium and aluminium alloys
- 10.4.7. Refer to AS 3715/AAMA 2603 through to AAMA 2605 Aluminium coating specifications

Table 2.3 — Mechanical property requirements for structural grades

Steel grade designation	Longitudinal tensile test				Transverse bend test	
	Min. yield strength (Note 1)	Min. tensile strength	Min. elongation,% (Note 2)		Angle of bend	Diameter of mandrel in terms of test piece thickness (t)
	MPa	MPa	L ₀ ^a = 50 mm	L ₀ ^a = 80 mm	degrees	
G250	250	320	25	22	180	0
G300	300	340	20	18	180	t
G350	350	420	15	14	180	2t
G450 (Note 3)	450	480	10	9	90	4t
G500 (Note 4)	500	520	8	7	90	6t
G550 (Note 5)	550	550	2	2	—	—
^a L ₀ = original gauge length.						
NOTE 1 The yield strength is the lower yield stress. If well-defined yielding is not obvious, the 0.2 % proof stress should be determined.						
NOTE 2 Applies to test pieces equal to or greater than 0.6 mm in thickness. For material up to 0.6 mm in thickness, the minimum elongation values in the table are not covered by this Standard.						
NOTE 3 Applies to recovery annealed, i.e. not recrystallized after annealing, material equal to or greater than 1.50 mm thick.						
NOTE 4 Applies to recovery annealed, i.e. not recrystallized after annealing, material between 1.00 mm and 1.50 mm thick.						
NOTE 5 Applies to recovery annealed, i.e. not recrystallized after annealing, material up to and including 1.00 mm thick; the values of yield strength, 0.2 % proof stress and tensile strength are, for practical purposes, the same.						

Table 2.1 — Corrosivity categories according to ISO 9223

ISO 9223 category	Corrosivity	First year corrosion rate of metals, µm/y			Typical environment
		Carbon steel	Zinc	Copper	
C1	Very low	≤ 1.3	≤ 0.1	≤ 0.1	Dry indoors
C2	Low	1.3–25	0.1–0.7	0.1–0.6	Arid/urban inland
C3	Medium	25–50	0.7–2.1	0.6–1.3	Coastal or light industrial
C4	High	50–80	2.1–4.2	1.3–2.8	Sea-shore (calm)
C5	Very high	80–200	4.2–8.4	2.8–5.6	Sea-shore (surf)
CX	Extreme	200–700	8.4–25	5.6–10	Shoreline (severe surf)

NOTES:

TITLE MATERIAL SPECIFICATION
HOT-DIP GALVANISED COAT

CLADDING ALL

SUBSTRATE ALL

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