

Australian/New Zealand Standard™

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



AS/NZS 4680:2006

This Joint Australian/New Zealand Standard was prepared by Joint Technical Committee MT-009, Metal Finishing. It was approved on behalf of the Council of Standards Australia on 3 August 2006 and on behalf of the Council of Standards New Zealand on 11 August 2006.

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Australian Aluminium Council
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Australian Paint Manufacturers' Federation
Bureau of Steel Manufacturers of Australia
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STANDARDS AUSTRALIA/STANDARDS NEW ZEALAND

RECONFIRMATION
OF
AS/NZS 4680:2006
Hot-dip galvanized (zinc) coatings on fabricated ferrous articles

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NOTES

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PREFACE

This Standard was prepared by the Joint Standards Australian/Standards New Zealand Committee MT-009, Metal Finishing, to supersede AS/NZS 4680:1999, *Hot-dip galvanized (zinc) coatings on fabricated ferrous articles*.

The objective of this Standard is to specify the requirements for hot-dip galvanized (zinc) coatings applied to general fabricated ferrous products.

The objective of this revision is to revise the hot-dip galvanized coating specifications.

Although International Standard ISO 1461 covers the hot-dip galvanizing process for general fabricated ferrous articles, Committee MT-009 considered that the present document is more appropriate to Australian industry conditions and is more user friendly.

The term ‘normative’ and ‘informative’ have been used in this Standard to define the application of the appendix to which they apply. A ‘normative’ appendix is an integral part of a Standard, whereas an ‘informative’ appendix is only for information and guidance.

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STANDARDS AUSTRALIA/STANDARDS NEW ZEALAND

Australian/New Zealand Standard**Hot-dip galvanized (zinc) coatings on fabricated ferrous articles**

1 SCOPE

This Standard specifies requirements and tests for hot-dip zinc coatings on fabricated ferrous articles including structural steel, steel reinforcements, steel sheet fabrications, assembled steel products, tubular fabrications, fabricated wire work, steel forgings, steel stampings, ferrous castings, nails and other small components.

This Standard applies to both centrifuged and non-centrifuged articles.

This Standard does not apply to products such as wire and welded wire fabric (see AS/NZS 4534), sheet (see AS 1397) or open sections (see AS/NZS 4791) and tube hot-dip galvanized in continuous, semi-continuous or specialized plants (see AS/NZS 4792).

NOTES:

- 1 Advice and recommendations on information to be supplied by the purchaser to the hot-dip galvanizer at the time of enquiry or order are contained in the purchasing guidelines set out in Appendix A.
- 2 Means for demonstrating compliance with this Standard are given in Appendix B.
- 3 After-treatment of hot-dip galvanized articles is not covered by this Standard. Such treatment (if any) should be specified separately by the purchaser.

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 thread series) |
| 1397 | Steel sheet and strip—Hot dipped zinc-coated or aluminium/zinc-coated |
| 1627 | Metal finishing—Preparation and pretreatment of surfaces |
| 1627.4 | Part 4: Abrasive blast cleaning of steel |
| 1815 | Metallic materials—Rockwell hardness test (series) |
| 1816 | Metallic materials—Brinell hardness test (series) |
| 1817 | Metallic materials—Vickers hardness test (series) |
| 2331 | Methods of test for metallic and related coatings |
| 2331.1.3 | Method 1.3: Local thickness tests —Magnetic method |
| 2331.1.4 | Method 1.4: Local thickness tests—Magnetic induction and eddy current methods |
| 2331.2.1 | Method 2.1: Tests for average coating mass per unit area or for thickness—Dissolution methods—Strip and weigh, and analytical |
| 2331.2.3 | Method 2.3: Tests for average coating mass per unit area or for thickness—Hydrogen evolution method for zinc coatings |

AS

2331.3.1 Method 3.1: Corrosion and related property tests—Neutral salt spray test (NSS) test

3894 Site testing of protective coatings

3894.3 Method 3: Determination of dry film thickness

AS/NZS

2243 Safety in laboratories

2243.1 Part 1: Planning and operational aspects

2243.2 Part 2: Chemical aspects

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

3750 Paints for steel structures

3750.9 Part 9: Organic zinc-rich primer

3750.15 Part 15: Inorganic zinc silicate paint

4534 Zinc and zinc/aluminium-alloy coatings on steel wire

4791 Hot-dip galvanized (zinc) coatings on ferrous open sections, applied by an in-line process

4792 Hot-dip galvanized (zinc) coatings on ferrous hollow sections, applied by a continuous or a specialized process

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

2063 Thermal spraying—Metallic and other inorganic coatings—Zinc, aluminium and their alloys

3 DEFINITIONS

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

3.1 Coating mass

The total mass of hot-dip galvanized coating per unit surface area of steel base, *on a single surface*, expressed in grams per square metre.

3.2 Coating mass, average

The mean value of local coating masses measured using test pieces representing either one large article or all items of an inspection batch.

3.3 Coating mass, local

The coating mass at a reference area, expressed in grams per square metre.

3.4 Coating thickness

The total thickness of hot-dip galvanized coating, *on a single surface*, expressed in micrometres.

3.5 Coating thickness, average

The mean value of local thicknesses measured either on one large article or on all items of an inspection batch, expressed in micrometres.

3.6 Coating thickness, local

The coating thickness at a reference area, expressed in micrometres.

3.7 Galvanizer

A person, persons or organization responsible for the coating of the article with molten zinc.

3.8 Hot-dip galvanized coating

A coating consisting of zinc-iron alloys covered by zinc, obtained by the hot-dip galvanizing process.

NOTE: The term 'hot-dip galvanized coating' is subsequently referred to as the 'coating'.

3.9 Hot-dip galvanizing

A process comprising pretreatment, and molten zinc baths in which steel products are dipped so as to form adherent zinc and zinc-iron alloy coatings.

3.10 Reference area

The area within which a specific number of single measurements is required to be made.

3.11 Significant surface

The surface of the article to be covered by the coating and which is essential for serviceability and/or appearance.

4 DESIGN REQUIREMENTS

The article should be designed to suit the galvanizing process. It shall contain the necessary holes or sheared corners for filling, venting or draining, and shall be designed to minimize the possibility of dimensional change and embrittlement occurring during the galvanizing process.

NOTES:

- 1 Recommended procedures for the design, selection, composition and preparation of materials prior to galvanizing are listed in Appendix C. Guidelines to minimize the possibility of dimensional change resulting from the galvanizing process are also given in Appendix C.
- 2 Guidelines to minimize the possibility of embrittlement are given in Appendix D.

5 BASIS METAL

The mechanical properties of some steel types can be adversely affected by the coating process; these steels may require special treatment.

NOTES:

- 1 The mechanical properties of the structural steels most commonly galvanized are not affected by the galvanizing process.
- 2 Information on the effects of chemical composition, surface condition, mass of the article to be galvanized, the galvanizing conditions, and the appearance, thickness, texture and physical/mechanical properties of the galvanized coating, is given in Appendix D.

6 GALVANIZING PROCESS

6.1 Pretreatment

The articles to be galvanized shall be cleaned and fluxed to a condition that will allow the galvanizing reaction to take place.

6.2 Bath composition

The molten metal in the working area of the galvanizing bath shall contain not less than 98% by mass of zinc. The bath may contain certain deliberately added elements to achieve special properties (see Appendix D, Paragraph D3).

6.3 Threaded components

If threaded components are galvanized in batches, surplus zinc shall be removed from threads by a process such as centrifuging or brushing. If threaded components are attached to fabricated articles, the extent of removal of excess zinc from the threads is subject to agreement between the purchaser and the galvanizer.

7 APPEARANCE AND FREEDOM FROM DEFECTS

The galvanized coating shall be continuous and as smooth and evenly distributed as possible and shall be free of defects that may affect the stated use of the article. The coating shall be free from blisters, i.e. raised areas separated from the solid metal, roughness, sharp points and flux residues. Lumps and zinc ash are not permitted where they may affect the intended end use of the galvanized product. Any wet storage staining which is formed at the galvanizer's plant shall be removed prior to the material leaving the plant, unless prior arrangements have been made. The underlying coating thickness after this removal treatment shall exceed the specified minimum value.

NOTES:

- 1 When renovating damaged coatings or uncoated areas the method should be one of those specified in Appendix E.
- 2 Advice on the transport and storage of galvanized articles is given in Appendix F.
- 3 Where a superior surface finish is required or the presence, size or frequency of any defects in the coating is considered to be of concern, appropriate arrangements should be made between the purchaser and the galvanizer. This may be achieved by the provision of acceptable type samples or methods of test.
- 4 Articles galvanized after fabrication have a thicker, less smooth coating when compared with continuously galvanized products such as sheet or wire.
- 5 If the galvanized product is to be subsequently painted or powder coated, the galvanizer should be advised at the time of order, as extra work may be required to ensure that the agreed finish is obtained.
- 6 Steels of certain compositions or articles slowly cooled after galvanizing may cause the finish of the coated object to become partly or wholly grey in colour. Provided that such a coating has adequate adhesion, the grey finish is not detrimental, although it may cause premature staining to occur in service.
- 7 Wet storage stain (white or dark corrosion products primarily of basic zinc oxide, formed during storage in humid conditions after hot-dip galvanizing) which occurs after the product leaves the galvanizer's factory is not a cause for rejection.
- 8 Stains resulting from acid salts weeping from overlapping surfaces cannot be avoided and should not be cause for rejection.

8 REPAIR AFTER GALVANIZING

8.1 Extent of repairable damaged or uncoated areas

For objects galvanized after fabrication, the sum total of the damaged or uncoated areas shall not exceed 0.5% of the total surface area or 250 cm², whichever is the lesser, and no individual damaged or uncoated area shall exceed 40 cm². Uncoated areas greater than 40 cm² which have been caused by unavoidable air locks or prior contamination of the steel surface shall be repaired. Repairs shall be carried out in accordance with Clause 8.2.

8.2 Repair requirements

Surfaces that remain uncoated during the galvanizing process as outlined above and require repair, shall be repaired by the application of one of the following coatings:

- (a) Organic zinc rich epoxy paint complying with AS/NZS 3750.9. This is to be applied to the repair areas in two coats. Each coat shall have a minimum dry film thickness of 50 μm .
- (b) Inorganic zinc silicate paint complying to AS/NZS 3750.15. This shall have a minimum dry film thickness of 100 μm .

NOTE: For subsequent powder coating, these two coating repair systems should be capable of passing 1000 hour neutral salt spray performance when tested in accordance with AS 2331.3.1 and should be stable under powder coating curing conditions.

- (c) Zinc metal spray to ISO 2063 or AS/NZS 2312.
- (d) Zinc alloy solder stick.

All of the above treatments shall be applied as per manufacturers' requirements and shall include any necessary pre-treatment to ensure good adhesion to the substrate.

The coating thickness on the renovated area shall be a minimum of 30 μm more than the local coating thickness requirements in Tables 1 and 2 for the relevant hot dip galvanized coating unless the purchaser advises the galvanizer otherwise e.g., when the galvanized surface is to be over coated and the thickness for renovated areas is to be the same as for the hot dip galvanized coating.

The selected coating on the renovated areas shall be capable of giving sacrificial protection to the steel to which it is applied.

If a further coating has been specified by the purchaser for aesthetic or further protective purposes, the purchaser and applicator of such coatings shall assure themselves that they are compatible with the repair methods and materials used in the repair of uncoated areas.

8.3 Repair after site handling and installation

The same procedures and quality of repair products shall apply as for galvanizing process works.

Given the less specific facilities available on site, particular care is required with surface preparation and ensuring the most suitable method needed with the minimum 100 μm dry film thickness described.

8.4 Site repair

Galvanizing rectification described in Clause 8.2 as part of a plant process, shall also apply to site work for the repair of damage from steel handling impact, erection damage or site welding.

NOTES:

- 1 Optimum power tool cleaning to approach abrasive blasting preparation is a necessity to achieve the quality and film thickness required. The compromise not available in the case of thermal zinc spray work which should be blast cleaned.
- 2 Site facilities lack workshop application access, protection from weather or the close proximity to work surface for normal quality control. Consideration of the above factors in choosing the method, including sufficient time and priority to ensure preparation to achieve adequate coating thickness.

Close supervision shall be required to compensate for the absence on workshop controls.