AS/NZS 4680:2006

Australian/New Zealand St

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Hot-dip galvanized (zinc
fabricated ferrous article

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AS/NZS 4680:2006

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Australasian Institute of Metal Finishing
Australian Aluminium Council
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Australian Industry Group
Australian Paint Manufacturers' Federation
Bureau of Steel Manufacturers of Australia
Department of Defence
Galvanizers Association of Australia
Institute of Materials Engineering Australasia
Pacific Coilcoaters
Society of Automotive Engineers
The Royal Australian Chemical Institute

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STANDARDS AUSTRALIA/STANDARDS NEW ZEALAND

RECONFIRMATION

OF

AS/NZS 4680:2006

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

RECONFIRMATION NOTICE

Technical Committee MT-009 has reviewed the content of this publication and in accordance with Standards Australia procedures for reconfirmation, it has been determined that the publication is still valid and does not require change.

Certain documents referenced in the publication may have been amended since the original date of publication. Users are advised to ensure that they are using the latest versions of such documents as appropriate, unless advised otherwise in this Reconfirmation Notice.

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Australian Steel Institute
Bureau of Steel Manufacturers of Australia
Galvanizers Association of Australia
Galvanizing Association of New Zealand
New Zealand Metal Roofing Manufacturers

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NOTES

Australian/New Zealand Standard™

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

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PREFACE

This Standard was prepared by the Joint Standards Australian/Standards New Zealand

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

[illegible] the objective of this revision is to revise the hot-dip galv

[illegible] Although International Standard ISO 1461 covers the hot-dip galvanizing process for general fabricated ferrous articles, Committee MT-0 009 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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CONTENTS

Page

1 SCOPE 4

2 REFERENCED DOCUMENTS 4

4 DESIGN REQUIREMENTS 6

5 BASIS METAL 6

7 APPEARANCE AND FREEDOM FROM DEFECTS 7

9 COATING MASS AND THICKNESS 9

10 ADHERENCE OF COATING 9

APPENDICES

A PURCHASING GUIDELINES 11

B MEANS FOR DEMONSTRATING COMPLIANCE WITH THIS STANDARD 12

C RECOMMENDED PROCEDURES FOR THE DESIGN AND PREPARATION OF ARTICLES FOR GALVANIZING 14

D PROCEDURE TO BE FOLLOWED WHEN STEEL TO BE COATED WILL BE AFFECTED OR BE AFFECTED BY HOT-DIP GALVANIZING

E DUPLEX ADDED PROTECTION FOR GALVANIZING PLACE BELOW GROUND

F TRANSPORT AND STORAGE OF GALVANIZED ARTICLES

G DETERMINATION OF COATING MASS AND LOCAL THICKNESS

H GENERAL INFORMATION ON FACTORS THAT AFFECT THE CORROSION OF GALVANIZED STEEL

J GUIDANCE ON THE USE OF SWEEP BLASTING OR CLEANING OF GALVANIZED STEEL PRIOR TO PAINTING

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STANDARDS AUSTRALIA/STANDARDS NEW ZEALAND

Australian/New Zealand Standard

1 SCOPE

This Standard specifies requirements and tests for hot ferrous articles including structural steel, steel reinfor assembled steel products, tubular fabrications, fabricate stampings, ferrous castings, nails and other small compon

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 1163).

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 Articles treated by hot-dip galvanizing 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 acceptable 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

1710 Pressure equipment—Glossary

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*

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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 thickne
ss
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 Bis fo.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.

3.6 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 consisting of pretreatment and immersing the steel article in a bath of molten zinc 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 to the serviceability or appearance of the article.

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 selection, construction and preparation of steels for 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 Guidance on minimizing the possibility of embrittlement is given in Appendix C.

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 effect of various steel compositions, surface 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

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 deliberately added elements to achieve special properties (see Appendix D, Paragraph D3).

6.3 Threaded components

If threaded components are galvanized in bulk, they shall be removed from the kettle 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 [illegible] shall be removed prior to the material leaving the plant [illegible] repairs have been made. The underlying coating thickness after this removal [illegible]

NOTES

1 When considering 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 [illegible] powder coated, the galvanizer should be advised of the nature of the finish as extra work may be required to ensure that the agreed finish is obtained.

6 Steels of certain compositions or certain galvanizing methods may cause the finish 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 seeping 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 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.

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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 coating to AS/NZS 3750.12 Appendix [illegible] 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 2[illegible] 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 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 mor local coating thickness requirements in Tables 1 and 2 for the relevant hot dip coating unless the purchaser advises the galvanizer otherwise e.g. when the surface is to be over coated and the thickness for renovated areas is to be the s

the hot dip galvanized coating.

[illegible] coating in the renovated area shall be capable of giving [illegible] protection [illegible] to the steel to which it is applied.

If a further coating has been specified by the purchaser for aesthetic or further [illegible] purposes, the purchaser and applicator for such coatings shall assure themselves that the [illegible] 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 paints of repair quality shall apply for any [illegible] works.

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

8.4 Site repair

Galvanizing rectification described in Clause 8.2 as part of a plant process, shal [illegible] work for the repair of damage from steel handling, impact, erection dam welding.

NOTES:

1. Optimum power tool cleaning to approach abrasive blasting preparation is [illegible] achieve the quality and film thickness required. The compromise [illegible] thermal zinc spray work which should be blast cleaned.
2. Site facilities lack workshop application access, protection fro proximity to work surface for normal quality control. Considerati choosing the method, including sufficient time and priority to ens adequate coating thickness.

Close supervision shall be required to compensate for the absence

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9 COATING MASS AND THICKNESS

9.1 Coating mass

The coating mass shall be determined on significant surfaces in accordance wit
Appendix G, Paragraph G2, G3 or G4 and shall comply with the relevant requirements o
Tables 1 and 2. In case of dispute, the test method selected shall be agreeable to both th
purchaser and the galvanizer.

If an article includes a number of different thicknesses of steel, each thickness range shal
be regarded as a separate article and the relevant values in Table 1 or 2, as appropriate,
shall apply.

Thickness measurements for routine control purposes may also be
carried out in accordance with the requirements of Clause 9.2. The results shall comply
with the requirements of
Table 1 or 2.

NOTE: General information on factors that affect the corrosion of galvanized steel is given in Appendix H.

9.2 Coating thickn

When determine
significant surfa
article includ
belonging to
shall apply.

Where large articles, e.g. structural steel fabrications, are tested by the magnetic method,
the local coating thickness may be the average of two determinations performed randomly
over an area of 20 cm² (the reference area). The average thickness shall be the mean
of the values taken from three separate test areas (i.e. the mean of 6 determinations
in positions not

Unless otherwise specified, thickness measurements shall be carried ou
less than 10 mm away from edges, flame cut surfaces and corners.

10 ADHERENCE OF COATING

The coating shall be sufficiently adherent to withstand normal handling without peeling or flaking. The
customer's
specification nominated at the time of enquiry or order.

NOTES:
1 Good adhesion between zinc and the substrate does not need to be tested, as adequ
coating is a characteristic of the galvanizing process. The coated work should be able to withstand handlin
consistent with the nature and thickness of the coating and normal usage. It may be able to
without peeling o
flaking. In general, thick coatings require more careful handling than thin coatings. Bendin
of formed steel after galvanizing is not considered to be normal handling.

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TABLE 1

REQUIREMENTS FOR COATING THICKNESS AND MASS FOR ARTICLES THAT ARE NOT CENTRIFUGED

Article thickness mm	Local coating thickness minimum µm	Average coating thickness minimum µm	Average coating mass minimum g/m²
≤1.5	35	45	320
>1.5 ≤3	45	55	390
>3 ≤6	55	70	500
>6	70	85	600

NOTE: 1 g/m² coating mass = 0.14 µm coating thickness.

TABLE 2

REQUIREMENTS FOR COATING THICKNESS AND MASS FOR ARTICLES THAT ARE CENTRIFUGED

Thickness of articles (including castings) mm	Local coating thickness minimum µm	Average coating thickness minimum µm	Average coating mass minimum g/m²
<8	35	50	390
≥8	40	55	390

NOTES:

1 For requirements for threaded fasteners see AS 1214 and AS 1275 and for requirements for threaded fasteners other than bolts, screws and nuts see AS 1219.

2 15 g/m² coating mass = 2.0 µm coating thickness.

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APPENDIX A

PURCHASING GUIDELINES

(Informative)

A1 GENERAL

This Appendix is intended to include the technical provisions for relevant particular situations. It is not purported to comprise all the necessary provisions of a contract. This Appendix contains recommendations on the information to be supplied by the purchaser at the time of enquiry or order.

A2 INFORMATION TO BE SUPPLIED BY THE PURCHASER

The purchaser should supply the following information at the time of enquiry or order:

(a) Reference to this Standard, i.e. AS/NZS 4680.

(b) The nature, chemical composition and mechanical properties of the product to be galvanized, and its end use (a drawing and sample are useful).

(c) Any mechanical work required, such as drilling (see Clause 4 and the note to Paragraph C6.1).

(d) Any special requirements for frequency of testing.

(e) Whether a passivation coating is required.

(f) Whether removal of surplus zinc on threads is required (see Clause 6.3).

(g) Whether an additional test for uniformity or adherence of the coating is required.

(h) Details of test requirements should be included.

(i) Whether a test report covering coating mass or thickness is required.

(j) Requirements for independent testing, if applicable.

(k) Whether it is the intention of the purchaser to inspect the coated product prior to delivery.

(l) Location of significant surfaces.

(m) Any special or supplementary requirements of the coating, e.g. for a special finish, such as powder coating, or requirements for pretreatment or post-treatment.

NOTE: Information on the use of sweep or brush blast cleaning of galvanized steel is given in Appendix I.

(n) Any special coating thickness requirements.

(o) Instructions for renovation of damaged or uncoated areas (see Appendix E).

(p) Relevant Quality Standard, if applicable.

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APPENDIX B

MEANS FOR DEMONSTRATING COMPLIANCE WITH THIS STANDARD

(Informative)

B1 SCOPE

This Appendix sets out the following different means by which compliance with this Standard can be demonstrated by the manufacturer or supplier:

(a) Evaluation by means of statistical sampling.

(b) The use of a product certification scheme.

(c) Assurance using the acceptability of the supplier's quality system.

(d) Other such means proposed by the manufacturer or supplier and acceptable to the customer.

B2 STATISTICAL SAMPLING

Statistical sampling is a procedure which enables decisions to be made about the quality of batches of items after inspecting or testing only a portion of those items. This procedure will only be valid if the sampling plan has been determined on a statistical basis and the following requirements are met:

(a) The sample needs to be drawn randomly from a population of product of known homogeneity. The necessary means to demonstrate the product was made from known materials at essentially the same time, by essentially the same processes and under essentially the same system of control.

(b) For each different situation, a suitable sampling plan needs to be defined. A sampling plan for one manufacturer, or even, capability, and product throughput, may not be relevant to another manufacturer producing the same items.

In order for statistical sampling to be meaningful to the customer, the manufacturer/supplier needs to demonstrate how the above conditions have been satisfied. Sampling and the establishment of a sampling plan should be carried out in accordance with AS 1199, guidance to which is given in AS 1199.0.

B3 PRODUCT CERTIFICATION

The purpose of product certification is to provide independent assurance to the customer that products comply with the stated Standard.

The certification scheme should meet the criteria described in HB 18.28 in that it as well as full type testing, from independently sampled production and subsequent verification of [illegible] production.

The certification scheme serves to indicate that the products consistently conform to the requirements of the Standard.

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B4 SUPPLIER'S QUALITY SYSTEM

onstrate an audited and registered quality Where the manufacturer or supplier can demo
irements of the appropriate or stipulated management system complying with the requ
lier's quality system or systems, this may Australian or international Standard for a supp
fied requirements will be met. The quality provide the necessary confidence that the speci
ould be assurance requirements needed to be agreed between the customer and supplier and sh
include a quality or inspection and test plan to ensure product conformity.
900. Information on establishing a quality management system is set out in AS/NZS ISO 9
and AS/NZS ISO 9004.

B5 OTHER MEANS OF ASSESSMENT

n the If the above methods are considered inappropriate, determination of compliance with
ith the requirements of this Standard may be assessed from the results of testing coupled w

APPENDIX C

RECOMMENDED PROCEDURES FOR THE DESIGN AND PREPARATION OF ARTICLES FOR GALVANIZING

(Informative)

C1 SCOPE

This Appendix contains advice for the designer and fabricator on factors which may affect the galvanizing process.

C2 SIZE AND SHAPE

The designer should consult galvanizers at an early stage to determine whether the dimensions of articles to be galvanized are within the capacity of galvanizing facilities.

NOTE: Information on facilities of galvanizers in Australia is available from the Galvanizers Association of Australia, 124 Exhibition Street, Melbourne 3000.

C5 WELDING

Any recognized welding procedure may be used. It is important that the supplier remove all welding slags and spatter prior to delivery to the galvanizer.

NOTE: Some weld metals can have a higher silicon content than the adjacent metal. This can cause distinct changes in appearance and thickness of the galvanized coating at welds.

G AND DRAINING

incorporate enclosed sections should have provision for adequate venting or filling) during galvanizing. At galvanizing temperatures, any moisture osed sections is rapidly converted to superheated steam capable of generating ces if venting to the atmosphere is not provided.

r should confer with the galvanizer during the design and fabrication stages to venting and draining (or filling) requirements are met. In this way, the s experience can often assist the purchaser to design a product that can be safely and that will have a satisfactory galvanized coating.

ired; any method of draining and resealing should g commences.

C6 VENTIN

C6.1 General

Structures that and draining (present in clo explosive for

The purchase ensure that galvanizer galvanized

NOTE: The location of vent holes, and if requ be agreed with the purchaser before galvanizin

C6.2 Hollow sections

In the case of welded hollow section assemblies, it is preferable to use full open joints. If this is not possible, vent and drain holes should be provided in accordance with the following:

(a) For hollow sections such as columns with base plates, hole diameters should be at least 25% of the cross-sectional dimensions, with a minimum of 50 mm. As an exception, for the hole diameters may be 6 mm minimum.

(b) Tubular end caps should have a vent and drain hole 50 mm diameter minimum for each 0.5 m³ of enclosed volume, at appropriate locations.

NOTE: Examples of correct design are given in AS/NZS 2312 and in booklets available from the Galvanize

ES

C7 ASSEMBLI

C10 HANDLING

Items delivered to the galvanizer should be designed to provide for any special handling requirements.

C11 CASTINGS

To produce high quality galvanized coatings on castings it is essential that the castings be sound, stress-free and have a good surface finish. To produce such castings, the following practices are recommended:

(a) Wherever possible, castings should be designed with uniform section thickness.

(b) Large fillet radii and large pattern numbers should be used; deep recesses and sharp corners should be avoided.

(c) Large grey iron castings should be stress relieved by the supplier. Heat-treated castings should be abrasive-blast cleaned by the supplier.

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APPENDIX D

PROPERTIES OF THE STEEL TO BE COATED, WHICH CAN ...DIP GALVANIZING ... AFFECT OR BE AFFECTED BY HO...

(Informative)

D1 BASIS METAL

D1.1 Composition

Whereas most ferrous metals can be satisfactorily ... is uncertainty about other types of ferrous meta... be provided by the purchaser for the galvanizer ... galvanized. Sulfur-containing free-cutting steel ... phosphorus at certain composition levels ... coatings that may be brittle and thick.

D1.2 Surface condition

The steel surface has an influence on the t... should be clean before dipping into the z... method of cleaning the surface, howeve... Surface contaminants that cannot be rem... oils, grease, paint, and welding slag, shou... The responsibility for the removal of su... galvanizer and the purchaser. Castings s... and shrinkage holes and should be cle...

Sa 2½, electrolytic pickling or by other suitable methods.

D1.3 The influence of the steel surface on the hot-dip galvan...

The roughness of the steel surface has an influence on the thick... coating. Surface unevenness of the b...

A rough steel surface, as obtained b... will result in a thicker coating than ...

NOTE: An impu... thickness of a r... and ...

...hickness and appearance of the zinc coating and ...ation zinc. Pickling in acid is the recommended ... care should be taken to avoid over-pickling. ...oved by pickling, e.g. carbonaceous films such as ...uld be removed by other methods prior to pickling. ...ch impurities is subject to agreement between the ...hould be as free as possible from surface porosity ...ned either by abrasive blasting to AS 1627.4 Class ...

...ized coating thickness

...ture and the state of the ... basis metal generally remains visible after galvanizing.

...y abrasive blasting or coarse grinding prior to pickling, ...a surface that is produced by pickling alone.

...rovement in the accuracy of the magnetic method for determining the zinc coating ...ough surface can be obtained by applying the instrument to the uncoated surface ...etting the zero adjustment, immediately prior to hot-dip galvanizing.

... cutting changes the steel composition and structure in the heat-affected zone, with ... the consequence that the coating thickness in this area may not meet the requirements of ... In order to obtain the required coating thickness, flame cut surfaces should ... Flame ... Tables 4 and ... be ground off ... the fabricator.

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D1.4 Stresses in the basis metal

Some stresses in the basis metal will be relieved during the hot-dip galvanizing process, which may cause the coated article to deform.

Whether a steel article that has been cold worked could become embrittled during galvanizing is dependent on the type of steel and the degree of cold work that it has received. Hot-dip galvanizing is a form of heat treatment and may accelerate the onset of

APPENDIX E

DUPLEX ADDED PROTECTION FOR GALVANIZING PLACE BELOW

(Informative)

E1 SCOPE

This Appendix describes typical paint coating for galvanized steel used for underground service. Where added protective coatings are required, reference should be made to appropriate soil conditions.

l elements submerged in soil together with the first 20 cm of [illegible] The areas may involve steel ent contact with the ground.

URES

ocedure the soil conditions should be assessed to assist with the pecification.

[illegible] arranted provided back fill is of the same composition as for the and shaped to a ground configuration surrounding the column or

ment as described may be adequately applied to the footings of vertical e ground on a 20 cm above and below ground basis.

are to be painted should be either sweep or brush abrasive fix'n by dry degreasing and abrading wit, wet or dry sandpaper to

should be considered are a 2-pack epoxy zinc phosphate primer to [illegible]

E2 PAINTING PROCED

E2.1 General

Before commencing the pr paint supplier's choice of s

When the conditions are ex underground may not be w surrounding ground layers post, ground penetration.

NOTE: In such cases, treat elements in contact with th

E2.2 Preparation

The galvanized areas that [illegible] refer to appen obtain a key for painting

E2.3 Painting system

The painting system that 50 µm and 2 pack appro

NOTE: The paint system should be applied to the manufacturer's instructions.

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APPENDIX F

TRANSPORT AND STORAGE OF GALVANIZED ARTICLES

(Informative)

Attention should be paid to the conditions of transport, shipment and storage of galvanized articles to avoid the possibility of wet-storage stain. A corrosion product known as 'white rust', can occur on freshly galvanized articles that are transported or stored under damp and/or badly ventilated conditions. The attack is frequently superficial despite the bulkiness of the corrosion product and may be unattractive, but is not usually detrimental to the other properties of the coating.

If it is desired to retain the initial bright appearance of the galvanized coating, dry storage conditions are necessary. Post-treatments, such as chromating applied immediately after galvanizing, can prevent or reduce the formation of white rust.

The packed product should be kept under clean, dry and ventilated conditions. Galvanized articles should never be stored in contact with cardboard or paper products, timbers, linkers, unseasoned or treated timber or harmful chemicals.

The storage of galvanized articles under covers which restrict ventilation (e.g. tarpaulins) is not recommended.

If the galvanized coating is subjected to excessively rough treatment during transit or erection, damage to small areas may be renovated by the procedures described in Appendix C.

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APPENDIX G

DETERMINATION OF COATING MASS AND LOCAL THICKNESS

(Normative)

G1 GENERAL

This Appendix sets out four alternative procedures for determining the mass of the zinc coating on galvanized articles, as follows:

(a) Gravimetric method (see Paragraph G2).

(b) Volumetric method (see Paragraph G3).

(c) Mass-on-mass method (see Paragraph G4).

(d) Magnetic, eddy current, or other nondestructive measurement methods (see Paragraph G5).

NOTES:

1 The methods in Item (d) determine local thickness which can be converted to a value of the

G3 VOLUMETRIC METHOD

G3.1 Method

method for zinc coatings, given in, The method used shall be the hydrogen evolution AS 2331.2.3

G3.2 Calculation of coating mass

of coating mass Calculation of coating mass

following equation: The coating mass shall be calculated using the

$$m_A = \frac{V}{A} \times 2748$$

Where

are metre m_A = coating mass, in grams per squ

n millilitres V = volume of hydrogen evolved, i

millimetres A = stripped surface area, in square

bove equation is based on the measurement of the hydrogen volume at 1013 hPa and NOTE: The al 20°C.

G4 MASS-ON-MASS METHOD

tem shall be determined by weighing the articles The coating mass in grams per square m

before and after galvanizing and dividing the difference by the area of the surface before galvanizing.

The mass before galvanizing shall be determined after pickling and drying, and the mass after galvanizing when the article has cooled to ambient temperature.

G5 MAGNETIC, MAGNETIC/NON-MAGNETIC, EDDY CURRENT METHODS FOR LOCAL THICKNESS

G5.1 General

The method used shall be in accordance with either AS 2331.1.3, AS 2331.1.4 or AS 3894.3.

G5.2 Calculation of coating mass

If required, the coating mass can be calculated by multiplying the thickness, in micrometres, by 7.15.

G6 TEST REPORT

A test report shall include the following information

(a) Name of testing authority.

(b) Report number and date of issue.

(c) Batch number and details of the m

(d) (a) Test method used.

(e) Location and details of test sa

(f) Results of the test, and a state of this Standard.

(g) Results of any retests carried

(h) Reference to this test method

material under test.

mples and test specimens.

ement of compliance or otherwise with the requirements

out.

, i.e. AS/NZS 4680, Appendix G.

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APPENDIX H

GENERAL INFORMATION ON FACTORS THAT AFFECT THE CORROSION OF GALVANIZED STEEL

(Informative)

H1 SCOPE

This Appendix provides general information on factors that affect the corrosion rate of galvanized steel. A classification of atmospheric environments encountered in Australia and New Zealand is given in AS/NZS 2312.

H2 EXTERNAL ATMOSPHERIC CORROSIVITY FACTORS

There are a large number of factors that influence external atmospheric corrosivity, but the four most important ones are—

(a) time of wetness;

(b) atmospheric chloride content;

(c) atmospheric sulfur dioxide content; and

(d) atmospheric hydrogen sulfide content.

Time of wetness is the length of time during which the metal surface is covered by a film of water which renders atmospheric corrosion possible. It is influenced by factors such as metal mass, orientation and pollution, and can be quantified to sufficient accuracy in terms of the number of hours per year that the relative humidity is above 80% for temperatures above 0°C.

Airborne salinity, sulfur dioxide and hydrogen sulfide are powerful stimulants for atmospheric corrosion and their deposition rate in non-sheltered situations is directly proportional to their concentration in the atmosphere. Airborne salt has a major influence on corrosion rates. In Australasia sulfur dioxide and hydrogen sulfide have been found to play only a minor role in corrosion and can be neglected except when occurring near recognized point sources, such as certain fossil-fuel-burning industries (sulfur dioxide) and geothermal areas (hydrogen sulfide).

Rainfall also influences corrosion rates and has the effect of either stimulating or reducing corrosion [illegible] effect of rain reduces corrosion, while at less polluted sites or those well away from the [illegible] corrosive action of rain is more important [illegible]

Temperature influences corrosion rate but can have contradictory effects; increasing temperature accelerates the rate of the corrosion reactions but, on the other hand, leads to more rapid evaporation, thus shortening the time of wetness and decreasing the corrosion rate.

H3 LOCAL ENVIRONMENT EFFECTS

In addition to the macroclimatic effects described in Paragraph H2, local environmental effects, microclimatic effects and the circumstances of use of the coated article, may present an influence and, therefore, should be taken into account if the durations of the corrosion protection sought is to be realized.

For example, a coating employed in a macroclimatic atmosphere classified as mildly corrosive, may have its life reduced significantly if no consideration has been taken of fumes from a nearby effluent-treatment plant.

oated steel are as follows: factors that can significantly affect the corrosion rate of c

om rain (a) *Protection fr*

n be many times that which would result in exposed but sheltered from rain, ca particularly localized effects caused by aerosol and fertilizer drift.

(b) *Prolonged dampness*

(i) *Wind erosion*

The expected life of a coating, based purely on climatic considerations, will be seriously reduced by the abrasive effects of windborne particles. This is a particular problem in arid regions.

(j) *Effect of temperature*

Temperature may have a marked effect on the behaviour of zinc coatings subjected to immersion in aerated water. At temperatures above 60°C to 65°C, zinc may become cathodic to steel, the reverse of the normal behaviour, such as in damaged areas of coating resulting from uncoated fittings, corrodes preferentially.

H4 SEA WATER IMMERSION

The life of a zinc coating in sea water depends on a large number of factors, such as whether the coating is partly or wholly immersed, the velocity of water flow, the time of wetness, contamination, water temperature and the presence of any contaminants. The depth at which the coating is immersed and the degree of water turbulence are important because the corrosion rate increases with increasing velocity and temperature.

NOTE: Further research is currently being undertaken which influence the information in this clause.

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APPENDIX I

INFORMATION ON THE USE OF SWEEP BLAST CLEANING OF GALVANIZED STEEL PRIOR TO PAINTING

(Informative)

I1 GENERAL

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The first national Standards organization was created in New Zealand in 1932. The Standards Council of New Zealand is the national authority responsible for the production of Standards. Standards New Zealand is the trading arm of the Standards Council established under the Standards Act 1988.

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in published Standards are a consensus of the
account of comments received from other sou
experience. Australian/New Zealand Standard
and are updated regularly to take account of

International involvement

s Australia and Standards New Zealand are responsible for ensuring that the Australian
Zealand viewpoints are considered in the formulation of international Standards and that
international experience is incorporated in national and Joint Standards. This role is vital
ng local industry to compete in international markets. Both organizations are the national
of ISO (the International Organization for Standardization) and IEC (the International
echnical Commission).

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