

AS 1397:2021



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Australia



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



AS 1397:2021

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- Australian Building Codes Board
- Australian Industry Group
- Australian Steel Association
- Australian Steel Institute
- Bureau of Steel Manufacturers of Australia
- Materials Australia

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Preface

This Standard was prepared by the Australian members of the Joint Standards Australia/Standards New Zealand Committee MT-001, Iron and Steel, to supersede AS 1397—2011.

This Standard maintains the requirements of AS 1397 — 2011 and includes a reduction in the minimum aluminium content threshold for Type ZM coatings (from 5 % to 3 %). The expanded chemistry range for Type ZM coatings has resulted in nomination of two sub-Types, identified as “ZMa” and “ZMb”. The revised Standard also introduces an additional coating class for Type AM coatings, AM225.

Committee MT-001 has sought to align with the following international and national Standards, where applicable:

- (a) ISO 9364:2017, *Steel sheet, 55 % aluminium-zinc alloy-coated by the continuous hot-dip process of commercial, drawing and structural qualities*
- (b) ISO 4998:2014, *Continuous hot-dip zinc-coated and zinc-iron alloy-coated carbon steel sheet of structural quality*
- (c) ISO 3575:2016, *Continuous hot-dip zinc-coated and zinc-iron alloy-coated carbon steel sheet of commercial and drawing qualities*
- (d) ASTM A1046/A1046M, *Standard specification for steel sheet, zinc-aluminium-magnesium alloy-coated by the hot-dip process*
- (e) ASTM A902-18a, *Standard terminology relating to metallic coated steel products*
- (f) ASTM A875/A875M-13, *Standard specification for steel sheet, zinc-5 % aluminium alloy-coated by the hot-dip process*
- (g) EN 10346:2015, *Continuously hot-dip coated steel flat products for cold forming — Technical delivery conditions*
- (h) JIS G 3323:2019, *Hot-dip zinc-aluminium-magnesium alloy-coated steel sheet and strip*

The major changes in this edition are as follows:

- (i) Inclusion of additional coating chemistries within the ZM Coating Type and division of that coating Type into two sub-Types, (ZMa and ZMb).
- (ii) Inclusion of ZM Type coatings with aluminium content (by mass) in the range of 3 % to less than 5 % to broaden compatibility with coating chemistries contained within ASTM A1046/A1046M. The expanded range of coating chemistries (Type ZMb) is reflected by ASTM A1046/A1046M Type 2 coating chemistries.
- (iii) The inclusion of an additional coating class within Type AM coatings of AM225.

The terms “normative” and “informative” are used in Standards to define the application of the appendices 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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Australian Standard®

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

Section 1 Scope and general

1.1 Scope

This Standard specifies requirements for continuously hot-dip metallic coated sheet steel and strip supplied in thicknesses up to and including 5.0 mm.

Requirements for product conformity to this Standard are given in [Appendix B](#).

Requirements covered in this Standard are as follows:

- (a) Formability grades of steel.
- (b) Structural grades of steel.
- (c) Classes of zinc coating, including differential coatings.
- (d) Classes of zinc coating converted to zinc/iron alloy.
- (e) Classes of zinc/aluminium coatings.
- (f) Classes of zinc/aluminium/magnesium alloy coating.
- (g) Classes of aluminium/zinc alloy coating.
- (h) Classes of aluminium/zinc/magnesium alloy coating.
- (i) Surface finish.

NOTE 1 Advice and recommendations on information to be supplied by the purchaser at the time of enquiry or order are contained in [Appendix A](#).

NOTE 2 The specified requirements apply to the full length and full width of the product supplied, unless otherwise indicated.

NOTE 3 Within the description of the classes of coatings, the majority element present is listed first, followed by the next major element and followed by a third element if applicable.

1.2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document.

NOTE Documents referenced for informative purposes are listed in the Bibliography.

AS 1391, *Metallic materials — Tensile testing of ambient temperature*

AS 2331.2.1, *Methods of test for metallic and related coatings, Method 2.1: Tests for average coating mass per unit area or for thickness — Dissolution methods — Strip and weigh, and analytical*

AS 2331.2.3, *Methods of test for metallic and related coatings, Method 2.3: Tests for average coating mass per unit area or for thickness — Hydrogen evolution method for zinc coatings*

AS 2505.1, *Metallic materials, Method 1: Sheet, strip and plate — Bend tests*

AS/NZS 1050, *Methods for the analysis of iron and steel (all parts)*

AS/NZS 1365, *Tolerances for flat-rolled steel products*

ASTM A754, *Standard test method for coating weight (mass) of metallic coatings on steel by X-ray fluorescence*

ISO 7870-3, *Control charts — Part 3: Acceptance control charts*

1.3 Terms and definitions

For the purpose of this document, the following terms and definitions apply.

1.3.1

batch

identifiable amount of 50 t or less of one product type, i.e. of a particular thickness of steel grade, coating type and coating mass, processed sequentially under similar conditions

1.3.2

coating mass

total mass of coating on both surfaces of the steel base, measured in grams per square metre of sheet or strip. In the case of differential coatings, the different surfaces are stated separately

Note 1 to entry: The coating thickness is not subject to specification as it depends upon the coating alloy density, which varies with composition. The approximate coating thickness for various coating classes is given in [Table C.2](#) in [Appendix C](#).

1.3.2.1

one surface single spot coating mass

minimum coating mass on any one surface of any one of the three specimens used for the triple spot test

1.3.2.2

single sided coating mass

<applicable for differential coatings> mass of coating on any one surface of the steel base, measured in grams per square metre of sheet or strip, based on the average of three specimens selected from a sample representing the original cross section of the sheet or strip

Note 1 to entry: See [Table 3.6](#).

1.3.2.3

single spot coating mass

coating mass for one of the three specimens used for the triple spot coating mass test

1.3.2.4

triple spot coating mass

average coating mass of three specimens selected from a sample representing the original cross-section of the sheet or strip

1.3.3

coating type

compositions of many of the metallic coatings described in this Standard, based around a nominal element, e.g. zinc, or a nominal combination of elements, e.g. 55% aluminium with balance zinc

1.3.3.1

aluminium/zinc alloy coating

hot-dip coating of 50% to 60% aluminium, 1% to 2% silicon, with the remainder zinc, and incorporating less than 1% of minor additions of control elements. (Type AZ)

1.3.3.2

aluminium/zinc/magnesium alloy coating

hot-dip coating of 47% to 57% aluminium, 1% to 3% magnesium, 1% to 2% silicon with the remainder zinc, and incorporating less than 1% of minor additions of control elements (Type AM)

1.3.3.3**zinc coating**

hot-dip coating of 99% zinc incorporating less than 1% of minor additions of control elements (Type Z) or a coating of zinc converted to a zinc/iron alloy (Type ZF)

1.3.3.4**zinc/aluminium coating**

hot-dip coating of zinc with 3% to 15% aluminium and incorporating less than 1% of minor additions of control elements (Type ZA)

1.3.3.5**zinc/aluminium/magnesium coating**

hot-dip coating of zinc with—

(a) 5% to 13% aluminium, 2% to 4% magnesium and incorporating less than 1% of minor additions of control elements (Type ZMa); or

(b) 3% to less than 5% aluminium, 2% to 4% magnesium and incorporating less than 1% of minor additions of control elements (Type ZMb)

1.3.4**differential coating**

coating whereby the manufacturer has deliberately applied a different coating mass to each side of the steel

Note 1 to entry: In the case of a differential coating the designation states the coating mass in g/m² of sheet for each side separately, see Example 1 in [Clause 1.4.3](#).

1.3.5**control elements**

<minor additions> elements within metallic coatings that are considered minor in their percentage (present at less than 1 % by mass) and do not fundamentally alter the overall properties or performance of the coating type within which they are contained. e.g. the addition of 0.20 % aluminium to control alloying in zinc type coatings

1.3.6**may**

indicates the existence of an option

1.3.7**percent**

%

percentages referenced in context of steel base or metallic coating compositions in the Standard are mass %

1.3.8**sheet**

flat rolled product of any width and thickness coated by hot-dipping and supplied in cut lengths

1.3.9**shall**

indicates that a statement is mandatory

1.3.10**should**

indicates a recommendation

1.3.11**strip**

flat rolled product of any width and thickness coated by hot-dipping and supplied in coil form

1.4 Product designation

1.4.1 General

The product designation shall comprise, in sequence, the following elements:

- (a) The number of this Australian Standard, i.e. AS 1397.
- (b) The steel grade (see [Clause 1.4.2](#)).
- (c) The coating class and surface finish (see [Clause 1.4.3](#)).

EXAMPLE 1 AS 1397/G550 Z450

EXAMPLE 2 AS 1397/G2 Z275

EXAMPLE 3 AS 1397/G3N Z200S

1.4.2 Designation of steel grade

1.4.2.1 General

The designation of the steel grade, as given in [Tables 2.1, 2.3](#) and [2.4](#) of [Section 2](#), shall include a set of characters in accordance with the following:

- (a) *First character* — the letter “G” to indicate that mechanical properties have been achieved or modified by in-line heat treatment prior to hot-dipping.
- (b) *Second and subsequent characters* — alphanumeric in accordance with [Clauses 1.4.2.2](#) and [1.4.2.3](#).

1.4.2.2 For structural grades

The second, third and fourth characters shall represent the minimum yield strength, in megapascals, namely 250, 300, 350, 450, 500 and 550.

EXAMPLE G550

1.4.2.3 For formability grades

The second character shall consist of the number 1, 2 or 3 to indicate formability, as follows:

- (a) Profiling: 1
- (b) Commercial forming: 2
- (c) Drawing: 3

A third character, the letter N where applicable, shall be used to indicate non-ageing.

EXAMPLE G3N

1.4.3 Designation of coating class and surface finish

1.4.3.1 Zinc coating class

The zinc coating class shall be designated by the prefix “Z” or “ZF” (see [Clause 1.3.3.3](#)), followed by a number representing the minimum coating mass, in grams per square metre of sheet or strip (total both surfaces), determined by the triple spot test (see [Clause 3.2](#)). For differential coatings, the designation shall include the minimum coating mass on each surface.

1.4.3.2 Zinc/aluminium coating class

The zinc/aluminium coating class shall be designated by the prefix “ZA” (see [Clause 1.3.3.4](#)) followed by a number representing the minimum coating mass, in grams per square metre of sheet or strip (total both surfaces), determined by the triple spot test (see [Clause 3.2](#)).

1.4.3.3 Zinc/aluminium/magnesium coating classes

The zinc/aluminium/magnesium alloy coating class shall be designated by the prefix “ZMa” or “ZMb” appropriate for the corresponding coating sub-Type (see [Clause 1.3.3.5](#)), followed by a number representing the minimum coating mass in grams per square metre of sheet or strip (total both surfaces), determined by the triple spot test (see [Clause 3.2](#)).

1.4.3.4 Aluminium/zinc coating class

The aluminium/zinc alloy coating class shall be designated by the prefix “AZ” (see [Clause 1.3.3.1](#)), followed by a number representing the minimum coating mass, in grams per square metre of sheet or strip (total both surfaces), determined by the triple spot test (see [Clause 3.2](#)).

1.4.3.5 Aluminium/zinc/magnesium coating class

The aluminium/zinc/magnesium alloy coating class shall be designated by the prefix “AM” (see [Clause 1.3.3.2](#)), followed by a number representing the minimum coating mass, in grams per square metre of sheet or strip (total both surfaces), determined by the triple spot test (see [Clause 3.2](#)).

EXAMPLE 1 Z450 — a zinc coating with a total coating mass of 450 g/m² over both sides of the sheet, or Z120/60 (a different coating) — a differential zinc coating with a coating mass of 120 g/m² over one side of the sheet and 60 g/m² over the other side of the sheet.

EXAMPLE 2 ZF100 — an annealed zinc coating of 100 g/m² over both sides of the sheet.

EXAMPLE 3 ZMa180 — a zinc/aluminium/magnesium (sub-Type a) coating with a total coating mass of 180 g/m² over both sides of the sheet.

EXAMPLE 4 AZ150 — an aluminium/zinc coating with a total coating mass of 150 g/m² over both sides of the sheet.

EXAMPLE 5 AM125 — an aluminium/zinc/magnesium coating with a total coating mass of 125 g/m² over both sides of the sheet.

1.4.3.6 Surface finish

1.4.3.6.1 General

The natural appearance of continuous hot-dip metallic coated steel sheet and strip depends upon a number of factors, including the coating composition, the steel surface roughness and the cooling rate.

Designations in accordance with [Clauses 1.4.3.6.2](#) to [1.4.3.6.5](#) shall be nominated when ordering.

1.4.3.6.2 Regular spangle—designated “R” or not stated

The finish achieved on hot-dip zinc type (Z) coatings is seen as visible, multi-faceted zinc crystals referred to as spangles. The spangle size may be different from different coating facilities. In this case the coating cooling is not required to be controlled to achieve a particular visual effect.

1.4.3.6.3 Spangle free — “f”

The featureless, uniform surface finish produced on continuous hot-dip metallic coated steel sheet and strip where a distinct “spangle” appearance, and the irregularities associated with the spangles, is not visible without magnification. Type ZA and ZM coatings are typically spangle free in their nominal state.

1.4.3.6.4 Minimized spangle — designated “M”

The manufacturer has deliberately changed the solidification and/or cooling of the coating to produce a finish where the zinc crystals are still visible to the eye without magnification, but are typically smaller and less distinct than the pattern visible on regular spangled product.

1.4.3.6.5 Skin passed or smooth finish — designated “S”

Skin passing of the coated product can produce a smooth, matte finish often desirable for painting (refer to [Appendix E](#), Clause E1.2.1 and [Appendix D](#), Clause D.2.1).

EXAMPLE 1 ZMb180S for a Type ZM sub-Type b coating at a nominal coating mass of 180 g/m² that has been skin passed.

EXAMPLE 2 Z275MS for a Type Z coating at a nominal coating mass of 275 g/m² that has been manufactured with minimized spangle and has been skin passed.

1.5 Rounding of test result values

1.5.1 General

With the exception of the tensile test and coating mass results, the observed or calculated values shall be rounded to the same number of figures as in the specified values and then compared with the specified values (also refer to AS 2706).

1.5.2 For tensile test results

The determined value of tensile strength shall be rounded to the nearest 10 MPa and the determined value of yield strength shall be rounded to the nearest 5 MPa.

1.5.3 For coating mass results

The determined value of coating mass shall be rounded to the nearest 5 g/m².

1.6 Marking

1.6.1 Package

Each package for delivery shall be legibly and durably marked or tagged to enable it to be identified with this Standard. The information on the package shall also include the following:

- (a) The product designation (as per [Clause 1.4](#)).
- (b) The product dimensions.
- (c) The manufacturer's name or trademark.
- (d) For differential coated sheet or strip, identification of the side which has the heavier coating.
- (e) A unique identifier to facilitate product traceability.

1.6.2 Product

The sheet or strip shall be legibly and durably marked with the number of this Australian Standard, i.e. AS 1397, the base steel thickness, and the designation of the steel base and coating, unless such markings are clearly detrimental to the end use, in which case the package shall be so marked.