

AS 4506:2024



STANDARDS  
Australia



# Metal finishing — Thermoset powder coatings



AS 4506:2024

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- Australasian Institute of Surface Finishing
- Australian Aluminium Council
- Australian Chamber of Commerce and Industry
- Australian Industry Group
- Australian Paint Manufacturers Federation
- Bureau of Steel Manufacturers of Australia
- CSIRO
- Galvanizers Association of Australia
- Materials Australia
- National Painting and Decorating Institute
- The Australasian Corrosion Association

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## Preface

This Standard was prepared by the Australian members of the joint Standards Australia/Standards New Zealand Committee MT-009, Metal Finishing, to supersede AS 4506:2005.

After consultation with stakeholders in both countries, Standards Australia and Standards New Zealand decided to develop this document as an Australian Standard rather than an Australian/New Zealand Standard.

The objective of this document is to provide test procedures and performance requirements for powder-coated metal products excluding aluminium products intended for architectural applications.

The major changes in this edition are as follows:

- (a) Alignment with AS 4312.
- (b) Alignment of improved surface preparation with the AS 1627 series.
- (c) Expression of surface preparation by substrate instead of corrosion category.

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®

## Metal finishing — Thermoset powder coatings

### Section 1 Scope and general

#### 1.1 Scope

This document specifies relevant test procedures and performance requirements for thermoset powder coating systems applied to metal substrates for atmospheric exposure within five atmospheric corrosive categories (C1 to C5).

This document does not cover —

- (a) aluminium for architectural applications; or

NOTE 1 Refer to AS 3715 for requirements for aluminium intended for architectural applications.

- (b) the powder coating application process itself.

NOTE 2 For systems for use in the very severe CX category, contact the coating and pre-treatment supplier.

NOTE 3 Advice and recommendations on information to be supplied by the purchaser to the powder coater at the time of enquiry or order are contained in the purchasing guidelines set out in [Appendix A](#).

NOTE 4 Information on weathering performance of powder-coated aluminium products is given in [Appendix C](#).

NOTE 5 Advice on handling and temporary protection during transportation and installation is given in [Appendix D](#).

NOTE 6 Information on maintenance and repair of coatings is given in [Appendix F](#).

#### 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 1580.408.4, *Paints and related materials—Methods of test, Method 408.4: Adhesion (cross-cut)*

AS 1580.481.3, *Paints and related materials—Methods of test, Method 481.3: Coatings—Exposed to weathering—Degree of corrosion of coated metal substrates*

AS 1627 (all parts), *Metal finishing—Preparation and pretreatment of surfaces*

AS 2331.3.1, *Methods of test for metallic and related coatings, Method 3.1: Corrosion and related property tests—Neutral salt spray (NSS) test*

AS 1580.457.1, *Paints and related materials—Methods of test, Method 457.1: Resistance to natural weathering*

AS/NZS 1580.481.1.5, *Paints and related materials—Methods of test, Method 481.1.5: Coatings—Exposed to weathering—Change in gloss*

AS/NZS 1580.481.1.7, *Paints and related materials—Methods of test, Method 481.1.7: Coatings—Exposed to weathering—Degree of checking*

AS/NZS 1580.481.1.8, *Paints and related materials—Methods of test, Method 481.1.8: Coatings—Exposed to weathering—Degree of cracking*

AS/NZS 1580.481.1.9, *Paints and related materials—Methods of test, Method 481.1.9: Coatings—Exposed to weathering—Degree of blistering*

AS/NZS 1580.481.1.10, *Paints and related materials—Methods of test, Method 481.1.10: Coatings—Exposed to weathering—Degree of flaking and peeling*

AS/NZS 1580.481.1.11, *Paints and related materials—Methods of test, Method 481.1.11: Coatings—Exposed to weathering—Degree of chalking*

AS/NZS 1580.602.2, *Paints and related materials—Methods of test, Method 602.2: Measurement of specular gloss of non-metallic paint films at 20°, 60° and 85°*

AS 3894.3, *Site testing of protective coatings, Method 3: Determination of dry film thickness*

AS 8501.3, *Preparation of steel substrates before application of paints and related products — Visual assessment of surface cleanliness, Part 3: Treatment grades of welds, edges and other areas with surface imperfections (ISO 8501-3:2006, MOD)*

ASTM D 2244, *Test method for calculation of color tolerances and color differences from instrumentally measured colour coordinates*

ASTM D 2247, *Standard practice for testing water resistance of coatings in 100 % relative humidity*

ASTM G 87, *Standard practice for conducting moist SO<sub>2</sub> tests*

### 1.3 Terms and definitions

For the purposes of this document, the terms and definitions given in AS/NZS 2310, ISO 4618 and the following apply.

NOTE Terms and definitions from ISO 4618 can be viewed free of charge on the ISO online browsing platform: <https://www.iso.org/obp/ui/>

#### 1.3.1

##### **acceptance quality limit**

##### **AQL**

quality level that is the worst tolerable process average when a continuous series of lots is submitted for acceptance sampling

Note 1 to entry: The designation of an AQL does not imply that a manufacturer has the right to knowingly supply any non-conforming unit of product.

#### 1.3.2

##### **batch**

clearly identifiable collection of units, manufactured consecutively or continuously under the same conditions, using material or compound to the same specification

#### 1.3.3

##### **batch release test**

##### **BRT**

test performed by the manufacturer on a batch of components that is to be satisfactorily completed before the batch can be released

#### 1.3.4

##### **coating applicator**

business entity or individual that applies the coating powder onto the substrate

#### 1.3.5

##### **coating powder**

solvent-free coating material in powder form which, after fusing and curing (for thermosetting types), gives a continuous film

**1.3.6****conversion coating**

layer formed by a chemical reaction between the substrate and a surface treatment chemical to promote adhesion or corrosion protection or both

**1.3.7****degassing**

heating substrate above cure temperature for longer than cure schedule to remove gas prior to coating

**1.3.8****factory production control****FPC**

operational techniques and measures that regulate and maintain conformance of the product to the relevant product standard

**1.3.9****finishing coat**

final coat of a coating system

**1.3.10****jigging**

customised or specialised rack, hook and jig arrangement allowing goods to be hung in a manner that achieves successful pretreatment and powder coating

**1.3.11****lot**

clearly identifiable sub-division of a batch for inspection purposes

**1.3.12****may**

indicates the existence of an option

**1.3.13****passivation**

<stainless steel> treatment with an acid solution to enhance the protective chromium oxide film

Note 1 to entry: The process also removes free iron and other related fabrication contamination.

**1.3.14****powder coating**

dry film obtained by application and heat fusing of a coating powder

**1.3.15****powder manufacturer**

business entity or individual producing the coating powder to be applied onto the substrate

**1.3.16****pre-treated substrate**

substrate with a surface to which a chemical or mechanical pre-treatment or both have been applied

**1.3.17****pre-treatment chemical supplier**

business entity or individual producing the pre-treatment chemicals to be used in powder coating

**1.3.18****sample**

units of product that are drawn from a batch or lot and selected at random

Note 1 to entry: The number of units of product in the sample is the sample size.

**1.3.19****shall**

indicates that a statement is mandatory

**1.3.20****should**

indicates a recommendation

**1.3.21****significant surface**

part of the coated product on which the coating serviceability or appearance or both is essential

**1.3.22****specifier**

business entity or individual specifying the powder coating and significant surfaces of the product

**1.3.23****statistical process control****SPC**

application of statistical methods to monitor and control a process so that it operates at its full potential to produce conforming product

**1.3.24****substrate**

surface to which a coating material is applied or is to be applied; the surface can be supplied with or without a coating

**EXAMPLE**

Galvanized steel.

Note 1 to entry: [Table 2.2.4\(A\)](#) provides information on common substrates.

**1.3.25****surface smoothing of the product**

reduction, usually by means of mechanical finishing, of roughness associated with the substrate such that when the substrate is pre-treated and coated with the powder coating, no protrusions penetrate through the powder coating

**1.3.26****test piece**

single product, representative of the work being processed

**1.3.27****type testing****TT**

testing performed to prove that the material conforms to the relevant standard

**1.4 Atmospheric classifications**

This document uses corrosivity categories based on the corrosion level of the atmospheric environment which are described in AS 4312 to assist in selecting an appropriate coating. [Table 1.4](#) provides a summary of each category.

**Table 1.4 — Atmospheric classifications and typical conditions**

| Corrosivity category | Corrosion level | Typical outdoor environment | Typical outdoor environment                |
|----------------------|-----------------|-----------------------------|--------------------------------------------|
| C1                   | Very low        | —                           | Offices, shops                             |
| C2                   | Low             | Arid/rural/urban inland     | Warehouse, sports halls                    |
| C3                   | Medium          | Coastal or light industrial | Food processing plants, breweries, dairies |
| C4                   | High            | Seashore (calm)             | Swimming pools, livestock buildings        |
| C5                   | Very high       | Seashore (surf)             | Plating shops, chemical sites              |
| CX                   | Extreme         | Shoreline (severe surf)     | Adjacent to acidic processes               |

NOTE 1 See [Appendix G](#) for a more detailed description of typical locations for each corrosivity category.

NOTE 2 This document does not provide any recommendations for coatings suitable for use in corrosivity category CX. If a coating is required for this corrosion level, it is recommended to consult with a coating applicator or powder manufacturer.

NOTE 3 Some products that are mobile may not be properly described by a single corrosivity category (e.g. mobile equipment). This information should be provided to the coating applicator at the time of enquiry and order along with a more detailed description of the application to assist in selecting the appropriate surface preparation and powder.

NOTE 4 Atmospheric corrosivity is not related to weathering performance (loss of colour or gloss or both) of the topcoat, which depends on factors such as UV exposure, rainfall, binder type, pigment type and other factors, see [Appendix C](#).

## Section 2 Performance requirements

### 2.1 General

Powder coatings consist of pigments and reinforcing fillers combined with resins such as epoxy and polyester. They may be applied to suitably prepared ferrous, non-ferrous and coated substrates such as galvanized and metal sprayed steels. Similar performance should not be expected of a given coating system over different substrates, as the substrate behaviour in the environment also contributes to coating durability. Powder-coated products shall conform to the relevant requirements of this section.

Recommended surface preparation and powder coating systems are listed in [Table 2.2.4\(A\)](#) by substrate and corrosivity category. Whilst the systems recommended are industry best practice, any powder coating system that meets the performance requirements of [Table 2.7.8](#) may be used.

NOTE These requirements may not be achievable unless the substrate receives an appropriate pre-treatment.

Representative coated and cured samples shall be selected for testing in accordance with [Appendix H](#), unless otherwise specified in this section.

### 2.2 Pre-treatment

#### 2.2.1 General

The pre-treatment process prepares the substrate for the application of the powder coating system and methods include —

- (a) chemical;
- (b) mechanical; or
- (c) mechanical followed by chemical.

The appropriate pre-treatment shall be selected and applied to remove any significant chemical contamination of the substrate, including grease, dirt and corrosion products. Pre-treatment may include a chemical conversion coating for additional protection and powder coating adhesion, along with any essential rinsing and drying.

Powder coatings perform better in service when the substrate over which they are applied is smooth and free from torn metal, inclusions, pores and other defects. The specifications covering the substrate should provide limits for those defects. A metal finisher can often remove defects through special treatments such as grinding, abrasive blasting and chemical treatments, refer to AS 1627.2, AS 1627.4 and AS 1627.5.

NOTE Removal of such defects is the subject of agreement between the specifier and coating applicator.

For ferrous substrates, surface defects such as weld spatter, burrs and sharp edges should be treated to meet the requirements of Treatment Grade P2 for systems designed for C2 environments only and P3 for those designed for C3 environments and above, as defined in AS 8501.3.

Pre-treatment by surface smoothing may not fully remove mechanical defects in the substrate, such as lumps, runs, scratches, pits, non-conducting inclusions, and roll and die marks. Such defects that persist in the finish shall not be cause for rejection.

#### 2.2.2 Chemical pre-treatment

Chemical pre-treatment shall be carried out in accordance with the instructions of the pre-treatment chemical supplier or AS 1672.6 for phosphate and chromate conversion coatings. Any temporary

protective coatings on substrate metals such as polymers, surface passivation, anodic coatings, mill scale and corrosion products shall be removed prior to further processing.

NOTE 1 For recommendations for pre-treatment for common substrates, see [Table 2.2.4\(A\)](#).

NOTE 2 For advice on procedures for pre-treatment and conversion coating application, see [Appendix I](#).

### **2.2.3 Mechanical pre-treatment**

Mechanical pre-treatment appropriate to the substrate shall be carried out in accordance with AS 1627.2 or AS 1627.4.

NOTE For recommendations on mechanical pre-treatment for common substrates, see [Table 2.2.4\(A\)](#).

### **2.2.4 Quality control of pre-treatment**

Surfaces shall achieve the cleanliness and profile as required by the the specifier, pre-treatment supplier or powder manufacturer. Chemically treated surfaces shall have a conversion treatment of the specified type and weight.

Coating powder should be applied prior to any contamination or degradation of visual pre-treatment. Typically coating powder should be applied within 4 h for mechanical pre-treatment and 16 h for chemical pre-treatment.

**Table 2.2.4(A) — Recommended surface preparation and powder coating system, by substrate and corrosivity category**

| Corrosivity category                                                                                                                                 |    |    |    |    | Surface pre-treatment | Coat and powder designation |          |          |
|------------------------------------------------------------------------------------------------------------------------------------------------------|----|----|----|----|-----------------------|-----------------------------|----------|----------|
| C1                                                                                                                                                   | C2 | C3 | C4 | C5 |                       | 1st Coat                    | 2nd Coat | 3rd Coat |
| Aluminium sheet and extrusion                                                                                                                        |    |    |    |    |                       |                             |          |          |
| •                                                                                                                                                    |    |    |    |    | P                     | L1 or L2                    | —        | —        |
| For C2 and above corrosivity categories, refer to AS 3715 for pre-treatment and powder selection for aluminium sheet and extrusion recommendations . |    |    |    |    |                       |                             |          |          |
| Cast aluminium, zinc, brass and copper, thermally sprayed aluminium or zinc on steel                                                                 |    |    |    |    |                       |                             |          |          |
| •                                                                                                                                                    |    |    |    |    | A1G                   | L1 or L2                    | —        | —        |
| •                                                                                                                                                    | •  | •  |    |    | DCG                   | L1 or L2                    | —        | —        |
| •                                                                                                                                                    | •  | •  | •  | •  | DCG                   | P1                          | L2 or L3 | —        |
| Cast steel                                                                                                                                           |    |    |    |    |                       |                             |          |          |
| •                                                                                                                                                    | •  |    |    |    | DCG                   | L1 or L2                    | —        | —        |
| •                                                                                                                                                    | •  | •  |    |    | DCG                   | P2                          | L1 or L2 | —        |
| •                                                                                                                                                    | •  | •  | •  | •  | A2.5CDG               | P2                          | P1       | L2 or L3 |
| Hot dip galvanized                                                                                                                                   |    |    |    |    |                       |                             |          |          |
| •                                                                                                                                                    | •  |    |    |    | A1G                   | L1 or L2                    | —        | —        |
| •                                                                                                                                                    | •  | •  |    |    | A1DCG                 | L1 or L2                    | —        | —        |
| •                                                                                                                                                    | •  | •  | •  | •  | A1DCG                 | P1                          | L2 or L3 | —        |
| Electroplated zinc and continuous galvanized                                                                                                         |    |    |    |    |                       |                             |          |          |
| •                                                                                                                                                    | •  |    |    |    | D                     | L1 or L2                    | —        | —        |
| •                                                                                                                                                    | •  | •  |    |    | DC                    | L1 or L2                    | —        | —        |
| •                                                                                                                                                    | •  | •  | •  | •  | DC                    | P1                          | L2 or L3 | —        |
| Bright mild steel                                                                                                                                    |    |    |    |    |                       |                             |          |          |
| •                                                                                                                                                    | •  |    |    |    | A2DC                  | L1 or L2                    | —        | —        |
| •                                                                                                                                                    | •  | •  |    |    | A2                    | P2                          | L1 or L2 | —        |
| •                                                                                                                                                    | •  | •  |    |    | DC                    | L1 or L2                    | —        | —        |
| •                                                                                                                                                    | •  | •  | •  |    | A2.5DC                | P2                          | L2 or L3 | —        |
| •                                                                                                                                                    | •  | •  | •  | •  | A2.5DC                | P2                          | P1       | L2 or L3 |
| Black steel (mill scale)                                                                                                                             |    |    |    |    |                       |                             |          |          |
| •                                                                                                                                                    |    |    |    |    | A2P                   | L1 or L2                    | —        | —        |
| •                                                                                                                                                    | •  | •  |    |    | A2.5                  | P2                          | L1 or L2 | —        |
| •                                                                                                                                                    | •  | •  |    |    | PC                    | L1 or L2                    | —        | —        |
| •                                                                                                                                                    | •  | •  | •  | •  | A2.5DC                | P2                          | P1       | L2 or L3 |
| Stainless steel                                                                                                                                      |    |    |    |    |                       |                             |          |          |
| •                                                                                                                                                    | •  | •  |    |    | A1P                   | L1 or L2                    | —        | —        |
| •                                                                                                                                                    | •  | •  | •  |    | A2PV                  | L2 or L3                    | —        | —        |
| •                                                                                                                                                    | •  | •  | •  | •  | A2PV                  | P1                          | L2 or L3 | —        |
| NOTE 1 Assumes non-metallic coatings are removed prior to commencement.                                                                              |    |    |    |    |                       |                             |          |          |
| NOTE 2 Minimum allowable powder coating thickness is 60 µm for each applied coat, see <a href="#">Clause 2.7.3</a> .                                 |    |    |    |    |                       |                             |          |          |
| NOTE 3 Where the powder designation provides an option, consult the powder manufacturer in the design phase (see also key to powder designation).    |    |    |    |    |                       |                             |          |          |
| NOTE 4 Degassing and passivation are defined in <a href="#">Clause 1.3</a> .                                                                         |    |    |    |    |                       |                             |          |          |