

Australian Standard™

**Metallic coatings—Rating of test
specimens and manufactured articles
subject to corrosion tests**



This Australian Standard was prepared by Committee MT-009, Metal Finishing. It was approved on behalf of the Council of Standards Australia on 27 January 2004.

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The following are represented on Committee MT-009:

Australian Institute of Metal Finishing
Australian Aluminium Council
Australian Industry Group
Australian Paint Manufacturer's Federation
Department of Defence
Galvanizers Association of Australia
Powder Coaters Association
The Royal Australian Chemical Institute
Society of Automotive Engineers—Australasia
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STANDARDS AUSTRALIA

RECONFIRMATION

OF

AS 1247—2004

Metallic coatings—Rating of test specimens and manufactured articles subject to corrosion tests

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.

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NOTES

Australian Standard™

**Metallic coatings—Rating of test
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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 1247—1991. After consultation with stakeholders in both countries, Standards Australia and Standards New Zealand decided to develop this Standard as an Australian Standard rather than an Australian/New Zealand Standard.

This Standard incorporates Amendment No. 1 (December 2004). The changes required by the Amendment are indicated in the text by a marginal bar and amendment number against the clause, note, table, figure or part thereof affected.

This Standard is identical with and has been reproduced from ISO 10289:1999, *Methods for corrosion testing of metallic and other inorganic coatings on metallic substrates—Rating of test specimens and manufacturing articles subjected to corrosion tests*.

The object of this revision is to replace the adopted ISO Standard. AS 1247—1991 was an adoption of ISO 1462:1973, *Metallic coating—Coatings other than those anodic to the basis metal—Accelerated corrosion tests—Method for the evaluation of the result*. ISO have withdrawn this Standard and have replaced with ISO 10289:1999.

The Committee decided to change the title of the Standard to *Metallic coatings—Rating of test specimens and manufactured articles subject to corrosion tests*, so that the title would give a clearer understanding of the nature of the Standard.

The significant change in this Standard is the change in the rating numbers in Table 1. In the previous edition the acceptance rating number 8 has now been changed to 7, this is due to a broadening of the rating number range.

As this Standard is reproduced from an International Standard, the following applies:

- (a) Its number does not appear on each page of text and its identity is shown only on the cover and title page.
- (b) In the source text, ‘this International Standard’ should read ‘this Australian Standard’.
- (c) A full point substitutes for a comma when referring to a decimal marker.
- (d) The source text should be altered as follows:
 - (i) Contents, *delete* the word ‘colour’ from the title of Annex A.
 - (ii) Annex A, Title, *delete* the word ‘colour’.
 - (iii) Annex A, Clause A2, Paragraph 2, *delete* the word ‘colour’
 - (iv) Annex A, Clause B1, Paragraph 2, *delete* the word ‘colour’

NOTES:

- 1 These changes are indicated in the source text by the use of margin bars.
- 2 The changes were required as the figures illustrating projection rating original published in colour.

The term ‘informative’ has been used in this Standard to define the application of the annex to which it applies. An ‘informative’ annex is only for information and guidance.

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INTRODUCTION

The rating method described in this International Standard recognizes that decorative and protective metallic and inorganic coatings on metallic substrates can be either anodic or cathodic to the substrate. In rating these coatings for the effects of corrosion, two evaluations shall be made:

- the ability of the coating to protect the substrate from corrosion and thus prevent degradation of the base metal;
- the ability of the coating to retain its integrity and thus maintain a satisfactory appearance.

Although these functions overlap, they can be evaluated separately in terms of:

- a protection rating (R_p) relating to the corrosion of the base metal;
- an appearance rating (R_A) relating to the deterioration of the coating.

The protection rating (R_p) assigns a number representing the ability of the coating to protect the base metal from corrosion.

The appearance rating (R_A) assigns a sequence of letters and numbers to the overall appearance of the specimen which includes all deterioration caused by the corrosion test or environment.

NOTE 1 Imperfections on a panel or article before exposure testing should be noted and given due consideration when evaluating the results of the examination. Deliberate imperfections may also be introduced as part of a test programme.

The coating system has to be known and reported if this rating system is applied. It is especially important to know, if possible, whether the coating is anodic or cathodic to the base metal.

NOTE 2 Determination of the anodic and cathodic corrosive mechanisms can be extremely difficult in some cases (chromated zinc on steel or multiple coatings). For the purposes of this document knowledge of these mechanisms is not necessary.

AUSTRALIAN STANDARD

Metallic coatings—Rating of test specimens and manufactured articles subject to corrosion tests

1 Scope

This International Standard gives a method of evaluating the condition of decorative and protective metallic and inorganic coated panels or articles which have been exposed to corrosive environments for test or for other purposes.

It is applicable to test panels or components exposed to natural atmospheres, in mobile or static conditions, or subjected to accelerated tests.

NOTE 1 Examples of such tests are given in the Bibliography.

This International Standard recognizes that the protection rating can be assessed objectively in accordance with clause 6. However, the assessment of appearance depends on many subjective factors (see 6.2).

NOTE 2 The edges of test panels or components may be protected, e.g. by tape or wax (paraffin), if this is an agreed part of the test and is recorded in the test report. This is essential if the specimens are cut from larger pieces and have exposed uncoated edges.

2 Terms and definitions

2.1

protection rating

R_p

rating number (see Table 1) assigned to the ability of the coating to protect the base metal from corrosion

2.2

protection defect

defect used to assess the protection rating, including crater corrosion, pin-hole corrosion, corrosion stain due to corrosion from the substrate, blisters and other defects that involve base metal corrosion

NOTE Blisters on electroplated aluminium and zinc alloy die castings usually signify base metal corrosion, but the inspector's judgement may be required to decide whether a blister does or does not arise at the substrate-coating interface.

2.3

appearance rating

R_A

rating number and symbols (see Table 2) assigned to describe the overall appearance of the specimen, including all defects caused by exposure

2.4

appearance defect

defect that detracts from the appearance of the specimen (see Table 2)

2.5**performance rating**

combination of the protection rating number (R_p) followed by a slash mark followed by the appearance rating number (R_A), i.e. R_p/R_A

2.6**coating system**

particular series of deposits including the thickness and type of layers in multilayer deposits and treatments which have been applied to the base metal

2.7**significant surface**

part of the surface which is essential in the appearance or serviceability of the article and which is to be covered or is covered by the coating (see clause 5)

3 Principle

This International Standard establishes a rating system for evaluating the deterioration of the coating and the base metal due to corrosion. The rating method described in this International Standard is applied to evaluate the appearance of the coating, as well the extent of the corrosion on test panels or the significant surfaces of components which have been subjected to performance tests.

The result of inspecting a surface, called the performance rating, is recorded as two separate ratings, the protection rating (R_p) and the appearance rating (R_A).

When recording the rating of a surface, the type(s) and severity of defect(s) contributing to the rating shall be noted if this information is required. This information is recorded using agreed symbols for the defects and the extent of these defects.

When only the protection rating (R_p) is required, it is permitted to omit the appearance rating (R_A). However, in such a case, a written dash should follow the protection rating in order to indicate deliberate omission of the appearance rating.

4 Types of defect

It is possible for defects to affect both the protection rating (R_p) and the appearance rating (R_A). In this rating system, the protection rating is a simple numerical rating while the appearance rating is permitted to include specific defects along with a numerical rating designating the intensity.

A list of defects is given in Table 2. Additions may also be made to the list, as appropriate, when recording specific defects.

Defects include crater corrosion, pin-hole corrosion, general corrosion of the coating, corrosion products, blisters, and any other defect that involves the coating. Some defects, such as blisters, can be associated with the coating, the base metal, the interface between the coating and the base metal, or between layers in the coating.

Other defects can have a small corrosion content but an appreciable affect on the appearance, e.g., staining, tarnishing, cracks, etc.

Defects on the surface of the basis metal such as scratches, porosity, non-conducting inclusions, roll and die marks, cold shuts and cracks can adversely affect the performance of coatings applied thereto, despite the observance of the best finishing practices. Such defects shall be reported and rated separately.

Ensure that the coating system is reported, because the significance of certain defects can be dependent on whether the coating is anodic or cathodic to the base metal.

Note defects that develop on exposure, e.g. peeling or spalling of the coating, since this indicates possible improper preparation of the base metal or improper application of the coating.

5 Method of inspection

Use drawings or suitably marked samples to indicate the significant surface.

It may sometimes be necessary or appropriate to expose material which is defective in certain respects before carrying out environmental testing. In such cases, make an inspection and record the findings before the specimens are tested.

If deliberate damage is applied to a surface, record the damage before the specimens are tested and so reported. If the specimen is purposely deformed, rate the deformed areas separately.

Material may be inspected either on the exposure racks or in a more suitable location. Ensure that lighting during inspection is as uniform as possible; avoid direct reflection from sun or clouds, and use various angles of inspection to ensure that all defects are revealed.

At the conclusion of the test, if the condition of the specimens allows, inspect them in the uncleaned condition. If dirt, salt deposits, etc., mask the defects and create difficulties with inspection, the surface may be sponged with a mild soap solution and then rinsed with water. However, exert no pressure during such cleaning in order to avoid accidentally upgrading the rating by, for example, cleaning off the corrosion products. Cleaning solutions should be compatible with the coatings and not cause any degradation of the coating. In the case of intermediate, periodic inspections do not clean or otherwise disturb the specimens.

Allow surfaces to dry before they are inspected.

Defects to be noted and taken into account when rating surfaces include only those which can be seen by normal or corrected vision.

NOTE 1 Optical aids may be used subsequently to characterize defects, after initial detection.

Edge defects, occurring within 5 mm of the edge of a specimen or tape/wax, may be noted in the report, but should not normally influence the numerical rating. Similarly, disregard contact and rack marks, mounting holes, etc.

NOTE 2 Edge defects may be difficult to assess on deeply worked manufactured specimens, such as threads, bores etc. In these cases it may be necessary to obtain agreement between purchaser and supplier regarding the exact defective area to be reported.

When the coating is anodic to the base metal, white corrosion product developed from the edges of the specimen shall not constitute failure.

Rubbing, polishing, chemical cleaning, etc., of the surface of the specimen may be used to facilitate study of the surface but confine it to the minimum practicable area, preferably not more than 100 mm² on a surface of 100 mm × 150 mm. Note this area for subsequent ratings.

6 Assignment of ratings

6.1 Assignment of protection rating (R_p)

The numerical rating system is based on the area of the substrate that exhibits corrosion, by the following formula:

$$R_p = 3 (2 - \log A) \quad (1)$$

where A is the percentage of the total area which shows base metal corrosion. R_p is rounded off to the nearest whole number, leading to the tabulation given in Table 1.

NOTE 1 In some cases, calculating the exact area may be difficult, especially on deeply worked specimens such as thread, bores, etc. In these cases, it may be necessary for the inspector to estimate the area as closely as possible.

Strict application of equation (1) would lead to ratings greater than 10 for specimens with extremely small defective areas. Therefore, equation (1) is only defined for areas where $A > 0,046\,416\%$. A rating of 10, accordingly, is arbitrarily assigned to a surface showing no corrosion of the base metal.

If desired, fractional ratings may be assigned between the ratings listed in Table 1.

NOTE 2 When coating systems anodic to the base metal are used, it may be impossible to assess a legitimate protection rating number due to the extreme voluminous corrosion products formed by the coating. Because of the highly absorbable nature of these corrosion products, they would tend to obliterate the true area of substrate corrosion. An example would be a zinc coating on steel exposed in a saline atmosphere. Although this International Standard may be used to rate the performance of zinc on steel, it may be difficult in some environments to define the protection rating.

If the defects are very localized, standards in the form of dot charts or photographs, such as those given in annexes A and B, may be used. Flexible graticules having 1 mm, 2 mm, or 5 mm squares could also be used to assess the corroded area.

If a large group of specimens is being inspected at one time, it is recommended that they be assessed individually by use of equation (1). When the entire group has been rated, the individual ratings should then be reviewed to ensure that each of the ratings assigned actually reflects the extent of the defects relating to those of the other specimens. The review acts as a check on individual ratings and helps to ensure that the inspector's judgement or frame of reference has not changed during the course of the inspection because of such factors as changes in lighting conditions or fatigue.

Inspection is improved by:

- a) removing individual items from their racks and grouping them with other specimens for comparison;
- b) arranging all of the specimens in order of merit.

Table 1 — Protection (R_p) and appearance (R_A) ratings

Area of defects A (%)	Rating R_p or R_A
No defects	10
$0 < A \leq 0,1$	9
$0,1 < A \leq 0,25$	8
$0,25 < A \leq 0,5$	7
$0,5 < A \leq 1,0$	6
$1,0 < A \leq 2,5$	5
$2,5 < A \leq 5,0$	4
$5,0 < A \leq 10$	3
$10 < A \leq 25$	2
$25 < A \leq 50$	1
$50 < A$	0

Examples of assessing the protection rating R_p by this method are:

- a) slight rusting over 1 % of the surface 5/—;
- b) no visible defects 10/—.

6.2 Assignment of appearance rating (R_A)

The appearance rating is assessed in terms of:

- a) the type of defect, as given in Table 2;
- b) the area affected by a particular defect using the scale 10 to 0 as described in Table 1;