
**Anodizing of aluminium and its
alloys — Rating system for the
evaluation of pitting corrosion —
Grid method**

*Anodisation de l'aluminium et de ses alliages — Système de cotation
de la corrosion par piqûres — Méthode par quadrillage*

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 79, *Light metals and their alloys*, Subcommittee SC 2, *Organic and anodic oxidation coatings on aluminium*.

This third edition cancels and replaces the second edition (ISO 8994:2011), which has been technically revised.

The main changes compared to the previous edition are as follows:

- two terms have been added in [Clause 3](#).

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Anodizing of aluminium and its alloys — Rating system for the evaluation of pitting corrosion — Grid method

1 Scope

This document specifies a grid rating system that provides a means of defining levels of performance of anodic oxidation coatings on aluminium and its alloys that have been subjected to corrosion tests.

This rating system is applicable to pitting corrosion resulting from

- accelerated tests,
- exposure to corrosive environments, and
- practical service tests.

This document takes into account only pitting corrosion of the basis metal resulting from penetration of the protective anodic oxidation coating.

NOTE 1 ISO 8993^[1] describes a similar rating system based on defined chart scales.

NOTE 2 The grid rating system is frequently used for rating the results of short-term corrosion tests for relatively thin anodic oxidation coating, such as those used in the automotive industry.

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. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 7583, *Anodizing of aluminium and its alloys — Terms and definitions*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 7583 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

3.1

pitting corrosion

localized corrosion which results in *corrosion pit* (3.2)

3.2

corrosion pit

surface corrosion defect having a shortest diameter of 0,1 mm or larger, at which the anodic oxidation coating is penetrated

Note 1 to entry: Discoloration or other surface defects which do not penetrate the anodic coating do not count as corrosion pits.

3.3

defective square

grid square including one or more *corrosion pits* (3.2) where the significant surface is divided by a grid of 5 mm pitch in longitudinal and lateral directions

3.4

grid rating number

number expressing the degree of occurrence of *corrosion pits* (3.2) on the product

4 Procedure for rating

4.1 Preparation of test specimen

A test specimen area of more than 5 000 mm² is required.

Use one of the following methods to remove corrosion products or deposits on the surface so that corrosion pits can be clearly discerned, as appropriate:

- a) wipe with a slurry of fine pumice to abrade away corrosion products and dirt, then rinse in clean water and air dry;
or
- b) dip for 5 min to 10 min in a mass fraction of 30 % nitric acid, prepared by diluting 1 volume of concentrated nitric acid ($\rho_{20} = 1,40$ mg/ml) with 1 volume of water at 20 °C to 25 °C; rinse and dry as indicated in a);
or
- c) dissolve the anodic oxidation coating in a hot phosphoric acid/chromic acid mixture; rinse and dry as indicated in a) so that pitting in the aluminium substrate can be discerned;

NOTE 1 ISO 2106[2] describes the preparation and use of this reagent for the purposes of dissolution of the anodic oxidation coating.

NOTE 2 This method is particularly useful for dark-coloured anodic oxidation coatings.

WARNING — Chromium(VI) is toxic and shall be handled properly. Chromium(VI) solutions are hazardous to the environment and severely hazardous to waters.

or

- d) wipe with soft textile gauze dipped in dilute hydrochloric acid solution (100 ml of a mass fraction of 35 % to 37 % HCl, made up to 1 000 ml with distilled water or deionized water) to remove deposited copper, then rinse and dry as indicated in a).

4.2 Determination of grid rating number

Place a preprinted transparent grid with an area of at least 5 000 mm², and with grid squares of 5 mm × 5 mm over a selected area of the significant surface of the prepared test specimen. Count the number of grid squares occupied by one or more pits, disregarding effects on the edges of test specimen. Calculate the percentage of defective squares, i.e. grid squares containing pits, using [Formula \(1\)](#):

$$D_s = \frac{N \times 100}{N_t} \quad (1)$$

where

D_s is the percentage of defective squares (%);

N is the number of defective squares;

N_t is the total number of squares.

Determine the grid rating number from [Table 1](#).

Table 1 — Conversion of percentage and number of defective squares to grid rating number

Percentage of defective squares, $D_s, \%$	Number of defective squares, N , of 200 squares, N_t	Grid rating number
0	0	0
> 0 to 0,5	1	1
> 0,5 to 1	2	2
> 1 to 2	3 or 4	3
> 2 to 4	5 to 8	6
> 4 to 8	9 to 16	12
> 8 to 16	17 to 32	25
> 16 to 32	33 to 64	50
> 32 to 64	65 to 128	100
> 64	> 128	200

NOTE The greater the number of squares, the more discriminating is the performance level.

5 Expression of results

Express the result of the examination as the percentage of defective squares, and/or the number of defective squares, and/or the grid rating number, as appropriate.

6 Test report

The test report shall include at least the following information:

- a reference to this document, i.e. ISO 8994:2018;
- the type and identification of the product tested and, where appropriate, the anodizing, exposure and corrosion test procedure;
- the preparation method of test specimen used (see [4.1](#));
- the percentage of defective squares, and/or the number of defective squares, and/or the grid rating number (see [Clause 4](#));

NOTE The acceptable grid rating number will normally be specified in the relevant corrosion test or product specification.

- any unusual features observed;
- the date of the test.

Bibliography

- [1] ISO 8993, *Anodizing of aluminium and its alloys — Rating system for the evaluation of pitting corrosion — Chart method*
- [2] ISO 2106, *Anodizing of aluminium and its alloys — Determination of mass per unit area (surface density) of anodic oxidation coatings — Gravimetric method*

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