INTERNATIONAL STANDARD 3211

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION • МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ • ORGANISATION INTERNATIONALE DE NORMALISATION

Anodizing of aluminium and its alloys — Assessment of resistance of anodic oxide coatings to cracking by deformation

Anodisation de l'aluminium et de ses alliages — Évaluation de la résistance des couches anodiques à la formation de criques par déformation

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FOREWORD

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO Member Bodies). The work of developing International Standards is carried out through ISO Technical Committees. Every Member Body interested in a subject for which a Technical Committee has been set up 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.

Draft International Standards adopted by the Technical Committees are circulated to the Member Bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 3211 was drawn up by Technical Committee ISO/TC 79, *Light metals and their alloys.*

This second edition was submitted directly to the ISO Council, in accordance with clause 6.12.1 of the Directives for the technical work of ISO. It cancels and replaces the first edition (ISO 3211-1974), which had been approved by the Member Bodies of the following countries :

Australia	Germany	Romania
Austria	Hungary	South Africa, Rep. of
Belgium	India	Spain
Bulgaria	Ireland	Sweden
Chile	Israel	Thailand
Czechoslovakia	Italy	Turkey
Egypt, Arab Rep. of	Japan	United Kingdom
Finland	New Zealand	U.S.A.
France	Poland	

The Member Body of the following country had expressed disapproval of the document on technical grounds :

Canada

Printed in Switzerland

Anodizing of aluminium and its alloys — Assessment of resistance of anodic oxide coatings to cracking by deformation

1 SCOPE AND FIELD OF APPLICATION

This International Standard specifies an empirical method for assessing the resistance of anodic oxide coatings to cracking by deformation which these coatings may undergo.

This method is applicable particularly to sheet with thin anodic oxide coatings (thickness less than 5 μm).

2 PRINCIPLE

Bending of a test piece along a spiral, graduated with a radius-of-curvature index, using a simple instrument.

Determination of the radius of curvature corresponding to the region where the first cracks in the oxide layer appear.

Calculation of the percentage elongation of the test piece corresponding to this radius of curvature.

3 APPARATUS

Measuring instrument, as shown in the figure, which includes :

a) **Two screws** for clamping the ends of the test piece;

b) **Steel former,** mounted on a wooden base, in the shape of a spiral graduated in indexes from 1 to 18. These indexes correspond to radii of curvature which are given by the formula

$$\text{Radius} = 21 - \text{Index}$$

and are shown in the following table :

Index E	Radius of curvature, R cm	Index E	Radius of curvature, R cm
1	20	10	11
2	19	11	10
3	18	12	9
4	17	13	8
5	16	14	7
6	15	15	6
7	14	16	5
8	13	17	4
9	12	18	3

4 PROCEDURE

4.1 Test piece

Take a strip of anodized aluminium having approximately the following dimensions :

- length : 25 cm
- width : 2 cm
- maximum thickness : 0,5 cm

4.2 Determination

Clamp one end of the test piece with the clamping screw adjacent to index 18, with the significant surface outward.

Bend the test piece progressively over the spiral in such a way that the test piece remains in contact with the spiral, and clamp the end with the second screw.

Mark the region where the first cracks appear in the anodic coating.

If the cracks are difficult to detect, they can be rendered visible by immersing the bent test piece for 5 min in a solution at 20 °C with the following composition :

- copper(II) sulphate pentahydrate ($CuSO_4.5H_2O$) : 20 g
- hydrochloric acid, ρ 1,18 g/ml : 20 ml
- distilled water : 1 000 ml

NOTE — This reagent is the same as that specified in ISO 2085, *Anodizing of aluminium and its alloys — Check of continuity of thin anodic oxide coatings — Copper sulphate test.*

Replace the test piece on the apparatus. Note the index corresponding to the region where the first cracks appear.

5 EXPRESSION OF RESULTS

The percentage elongation, A, of the anodized metal is given by the formula :

$$A\,\% = \frac{100\,a}{2R + a}$$

where

a is the thickness, in centimetres, of the test piece;

R is the radius of curvature, in centimetres, given by the formula :

$$R = 21 - E$$

where E is the index corresponding to the region where the first cracks appear.

6 TEST REPORT

The test report shall include the following particulars :

a) the reference of the method used;

b) the results and the method of expression used;

c) any unusual features noted during the determination;

d) any operation not included in this International Standard, or regarded as optional.

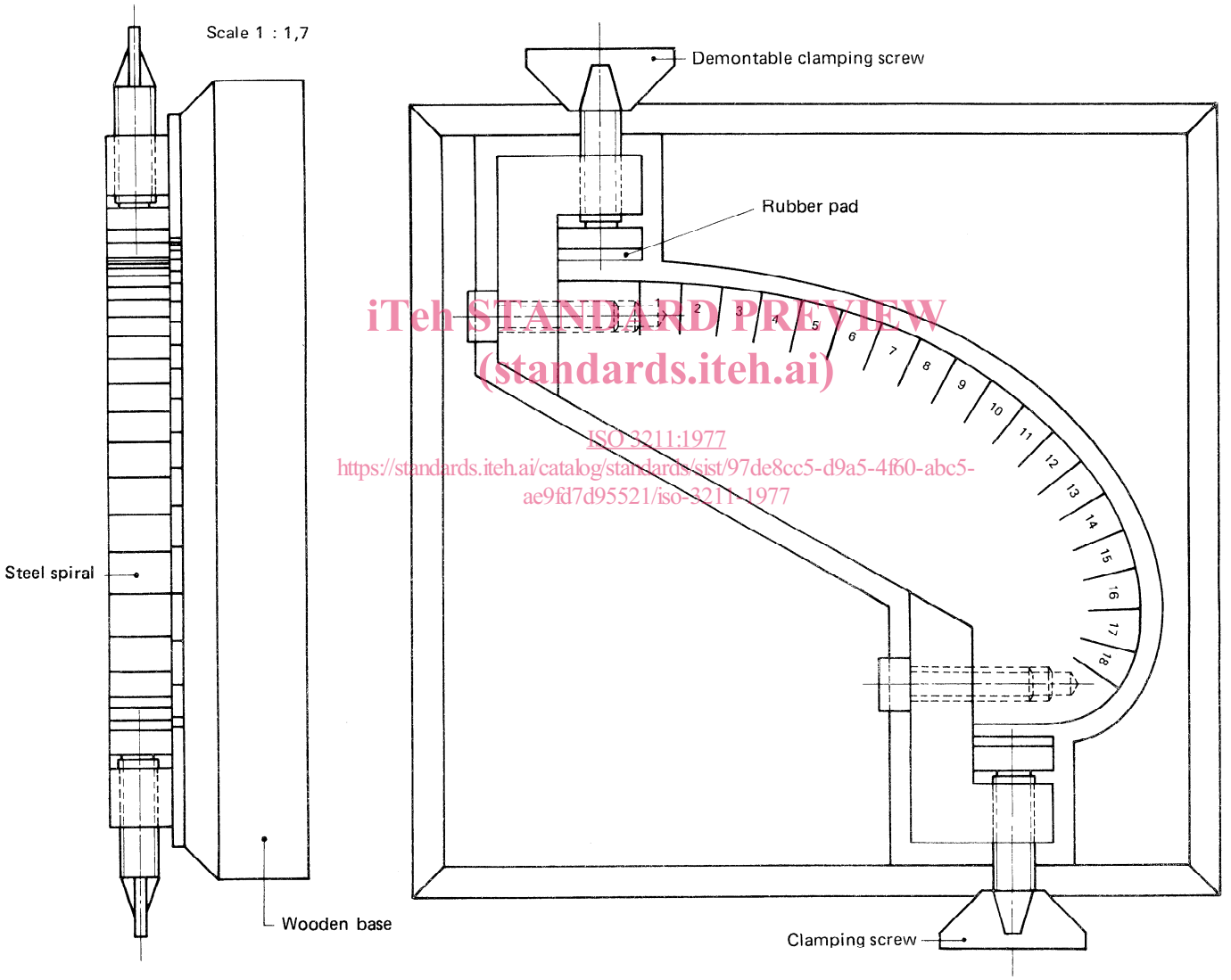

FIGURE — **Measuring instrument**