INTERNATIONAL STANDARD

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Anodizing of aluminium and its alloys — Visual determination of image clarity of anodic oxidation coatings — Chart scale method

Anodisation de l'aluminium et de ses alliages — Détermination de la netteté d'image sur couches anodiques — Méthode des échelles graduées

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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.

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The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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.

ISO 10215 was prepared by Technical Committee ISO/TC 79, *Light metals and their alloys*, Subcommittee SC 2, *Organic and anodic oxidation coatings on aluminium*.

This second edition cancels and replaces the first edition (ISO 10215:1992), which has been technically revised.

Introduction

Estimation of the image clarity of anodic oxidation coatings on aluminium and its alloys is normally carried out visually by observing the clearness of an image on the surface. However, the image can be observed at various angles and can be confused with the gloss level of a surface; and while the degree of image clarity is mainly influenced by the clearness of the coating, it is also affected by image distortion caused by surface irregularities and the haziness of the coating layer. Standardized methods of determining image clarity are therefore required.

This International Standard specifies the use of a chart scale based on optical combs, together with a lightness scale to rank image clarity, and has been found to give good correlation with visual evaluation. A related International Standard (ISO 10216) specifies an instrumental method of measuring image clarity, also by using optical combs. The instrumental method provides a more accurate measurement of image clarity and should be used in cases of dispute.

Anodizing of aluminium and its alloys — Visual determination of image clarity of anodic oxidation coatings — Chart scale method

1   Scope

This International Standard specifies a visual method for determining the image clarity of anodic oxidation coatings on aluminium and aluminium alloys, using a chart scale and a lightness scale, which are defined. The method can be applied only to flat surfaces that can reflect the image of the chart scale pattern.

2   Normative references

The following referenced documents are indispensable for the application 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/TR 8125:1984, *Anodizing of aluminium and its alloys — Determination of colour and colour difference of coloured anodic coatings*

3   Terms and definitions

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

3.1
image clarity
C_v
ability of the surface of an anodic oxidation coating to produce a clear image of an object reflected in the surface

NOTE   In the method described in this International Standard, image clarity is represented by a symbol C_v and is expressed as a numerical unit which is calculated by taking into account the image clearness, the image distortion and the haze value (see Clause 8).

3.2
image clearness
C
limit of visual resolution of fine details of a chart scale when reflected by a surface, given by the grade number on the chart scale

NOTE   Image clearness relies heavily on the roughness of the surface being measured, and the lower the roughness the clearer or sharper the image becomes, i.e. the nearer the surface becomes to a perfect mirror, the clearer the image becomes.

3.3
image distortion
I
degree of distortion of an image caused by the waviness of a surface, given by the grade number on the chart scale

NOTE   Image distortion depends on the evenness of the surface being measured. The distortion occurs because part of the incident light is reflected in a direction different from that of the bulk of the light due to an uneven surface. Even if the surface is mirror-finished, it will present a distorted image if waviness is present.

3.4
haze value
H_n
degree of opacity of the coating on a surface, expressed as a lightness unit

NOTE   Haze represents the opacity or transparency of the coating layer. Poor transparency causes absorption and scattering of normally reflected light, thus reducing the clarity of the image.

4   Principle

The image clarity of an anodic oxidation coating is determined by visual estimation of three properties of the coating layer: image clearness, image distortion and haze. These properties are determined by evaluating the image of a chart scale on the test pieces.

5   Apparatus

5.1   Chart scale, as shown in Figure 1, comprising a translucent plastic film or glass on which a pattern of optical combs is arranged using black and white lines with a range of specified widths (Grades 1 to 11). The light transmittance of the dark lines should be virtually zero.

The widths of the black lines, and the spaces between two adjoining black lines, for each grade, are the same and the lines are perfectly parallel. The lines for Grade 1 are the widest and those for Grade 11 are the narrowest. The widths of the lines for each grade are given in Table 1.

NOTE   The widths of lines for Grades 1 to 7 form an arithmetical progression. The grades above Grade 7 are used for estimating comparatively high image clarity and Grades 7, 9 and 11 form a geometrical progression. Grade 8 is the median of Grades 7 and 9, and Grade 10 is the median of Grades 9 and 11.
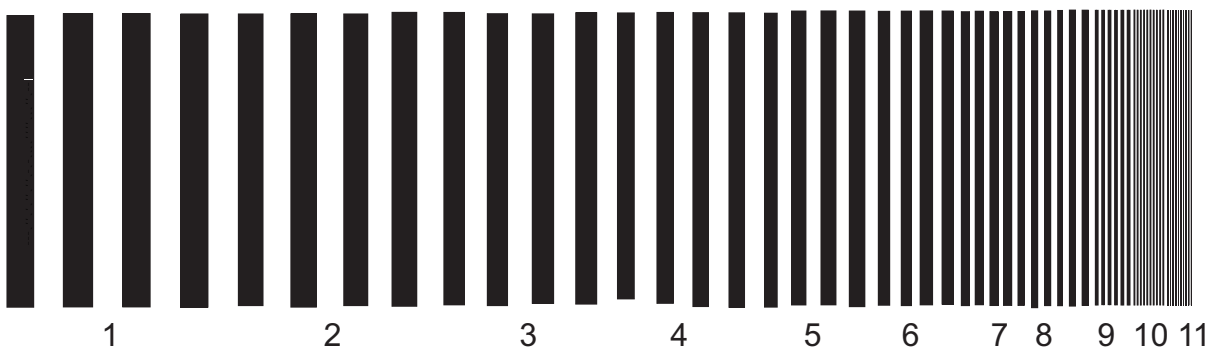
Figure 1 — Chart scale

Table 1 — Width of lines for each grade of the chart scale

Grade	1	2	3	4	5	6	7	8	9	10	11
Width, mm	2,0	1,75	1,5	1,25	1,0	0,75	0,5	0,375	0,25	0,188	0,125

5.2   Observation box, as shown in Figures 2 and 3, which accommodates the chart scales used. It has a window in which the scale (Grades 1 to 11) may be set, and an observation window on the other side. The window for the test pieces is at the base of the box.

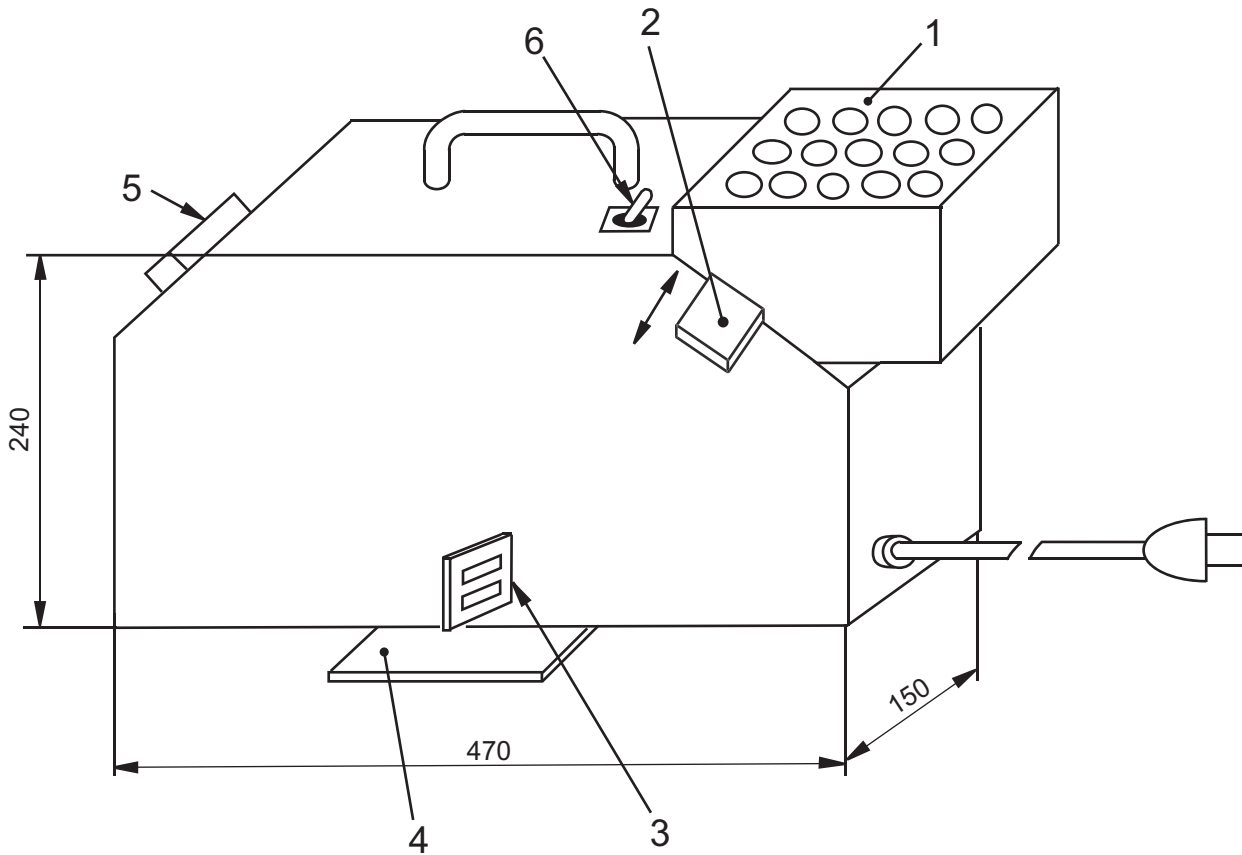Dimensions in millimetres, unless otherwise indicated

Key
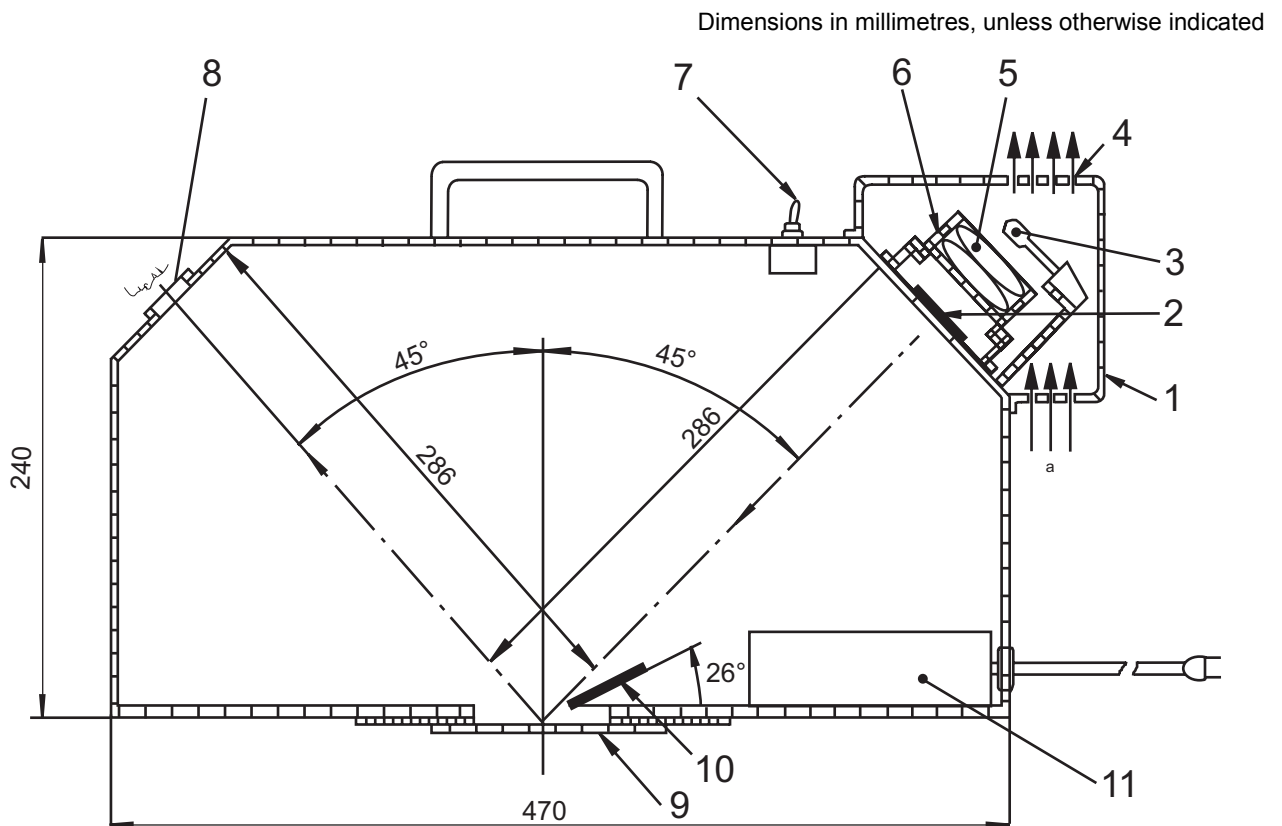
1   lamp box

2   chart scale

3   source of white light

4   air vent

5   lens φ 39,5 mm, focus 50 mm $\times$ 2 mm

6   diffuser

7   power switch

8   observation window

9   test piece

10   lightness scale

11   power source

a   Air.

Figure 2 — Diagram of a typical observation box

Dimensions in millimetres

Key

1   lamp box

2   chart scale

3   lightness scale

4   test piece

5   observation window

6   power switch

Figure 3 — Appearance of typical observation box

5.3   Lightness scale, a neutral scale which has 18 lightness chips ranging from $H_n = 9,5$ to $H_n = 1,0$, with a pitch of 0,5; the value of each chip is assigned according to Table 2 of ISO/TR 8125:1984.

NOTE   Manufacturers often use symbol V instead of H_n on lightness chips.

6   Test piece

The test piece shall be visually flat and should be greater than 90 mm long by 65 mm wide.

7 Procedure

7.1 General

Image clearness, C, and image distortion, I, are determined using the chart scale (5.1) and the haze value, H_n, is determined using the lightness scale (5.3).

Image clarity, C_v, is calculated from these values.

7.2 Determination of image clearness C

Place the chart scale on the observation box (5.2) and put the box on the test piece. Illuminate the chart scale and observe the range of white and black lines reflected by the test piece, as illustrated in Figure 2. Establish the highest grade number for which a clear image can be distinguished in the longitudinal and transverse directions.

EXAMPLE   For a test piece having high image clearness (mirror-like), the boundary of a black and a white line for Grade 11 can be clearly distinguished and the image clearness of the test piece is Grade 11. If it cannot be distinguished clearly, observe the group of lines for the next lower grade in turn. If it can be distinguished for Grade 9, but not for Grade 10, the image clearness of the sample is Grade 9.

7.3 Determination of image distortion I

After estimating the image clearness, observe the distortion in the width of the black lines and the rate the grade for longitudinal and transverse directions in a similar way to 7.2. When the line is distorted and the width of a thin portion is about half the normal width of a black line for a certain grade (see Figure 4), assign the next lower grade to this test piece.

EXAMPLE   If the line of Grade 5 with a width of 1 mm (see Table 1) is distorted and the width of the thin portion is about half (0,5 mm) as illustrated in Figure 4, assign Grade 4, as image distortion, which is one grade lower than Grade 5.
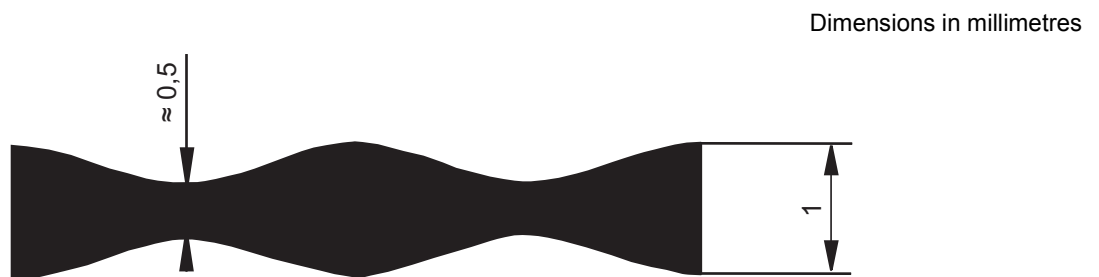
Dimensions in millimetres

Figure 4 — Example of distortion of image — Line of Grade 5

7.4 Determination of haze value H_n

Place the lightness scale in the sample position in the observation box and compare the black lines for Grade 1 with it to find a lightness scale chip that gives identical lightness to the black line. Assign this lightness unit value to the test piece as the haze value. If the lightness of a test piece is identical with Grade 5 of the lightness scale, assign 5 as the haze value.

NOTE   A simple visual method in which the visual estimation is performed by judging the shape of a reflected object or the image of a light source is not sufficient, as individual observers appear to find it difficult to differentiate between gloss and image clarity.

8   Expression of results

Calculate the image clarity, C_v, from the image clearness, image distortion and haze values using Equation (1):

$$C_v = \left(\frac{C_L + C_T}{2} + \frac{I_L + I_T}{2} \right) \times \frac{1}{H_n} \tag{1}$$

where

C_v is the image clarity, expressed in grade number;

C_L and C_T are the image clearness, in longitudinal and transverse directions respectively, expressed in grade number;

I_L and I_T are the image distortion, in longitudinal and transverse directions respectively, expressed in grade number;

H_n is the haze value, expressed in lightness units, V.

9   Test report

The test report shall include at least the following information:

a)   a reference to this International Standard (ISO 10215);

b)   the type, application and identification of the product tested;

c)   the designation of the aluminium used and its finishing treatment;

d)   the image clarity value C_v and, if required, the image clearness C, image distortion I, and haze value H_n (see Clause 8);

e)   the date of the test.

Bibliography

[1]   ISO 10216:2010, *Anodizing of aluminium and its alloys — Instrumental determination of image clarity of anodic oxidation coatings — Instrumental method*

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