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

Aluminium et alliages d'aluminium anodisés — Détermination de la netteté d'image sur couches anodiques — Méthode des échelles graduées

INTERNATIONAL ISO

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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.

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.

International Standard ISO 10215 was prepared by Technical Committee ISO/TC 79, *Light metals and their alloys*, Sub-Committee SC 2, *Anodized aluminium*.

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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 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 were 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 10216:1992, *Anodized aluminium and aluminium alloys — Determination of image clarity of anodic oxidation coatings — Instrumental method*) 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.

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Anodized aluminium and aluminium 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 lightness scale which are defined in clause 5. The test can only be applied to a flat surface which can reflect the image of the chart scale pattern.

2 Normative reference

The following standard contains provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the edition indicated was valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent edition of the standard indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO/TR 8125:1984, *Anodizing of aluminium and its alloys — Determination of colour and colour difference of coloured anodic coatings.*

3 Definitions

For the purposes of this International Standard, the following definitions apply.

3.1 image clarity, C_V: The ability of the surface of an anodic oxidation coating to produce a clear image of an object facing the surface. In this method, it is represented by a symbol C_V and expressed in 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; image sharpness, C: The limit of visual resolution of fine details of the chart scale when reflected by a surface. It is given by the grade number of the chart scale.

NOTE 1 Image clearness relies heavily on the microevenness of the surface being measured, and the better the microevenness the clearer or sharper the image becomes. In other words, the nearer the surface becomes to a perfect mirror, the clearer the image becomes.

3.3 image distortion, I: The degree of distortion of the image caused by the waviness of the surface. It is given by the grade number on the chart scale.

NOTE 2 Image distortion depends on the macroevenness of the surface being measured. The distortion occurs because part of the light flux is reflected in a direction different from that of the bulk of the light due to an uneven surface. Even if a surface is mirror-finished, it will present a distorted image if waviness is present.

3.4 haze value, H_n: The degree of opacity of the coating on a surface. It is given by the lightness value, V.

NOTE 3 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. 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.

4 Principle

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

5 Apparatus

5.1 Chart scale, comprising two translucent plastic films or glasses on which patterns (Grades 1 to 6 and Grades 6 to 11) of optical combs are arranged using black and white lines with a range of specified widths. The light transmittance of the dark lines should be virtually zero. Each comb has lateral and perpendicular patterns, as shown in figure 1.

The widths of the black lines and the white lines (which are the spaces between two adjoining black lines) for each grade are the same, and they 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.

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. Grades 7, 9 and 11 form a geometric progression, Grade 8 is the median of 7 and 9, and Grade 10 is the median of 9 and 11.

NOTE 4 The black lines can easily be printed, by aluminium metallizing techniques, on glass, or printed on a photographic art film. The printed glass or film can be further overlayed by translucent plastic film for light diffusion.

5.2 Observation box, shown in figures 2 and 3, which accommodates the chart scales used. It has a window in which one of two scales (Grades 1 to 6 or 6 to 11) may be set, and an observation window on the other side. The window for the test samples is at the base of the box.

5.3 Lightness scale, a neutral colour scale which has 18 lightness chips ranging from $V = 9,5$ to $V = 1,0$, with a pitch of 0,5.[1)]

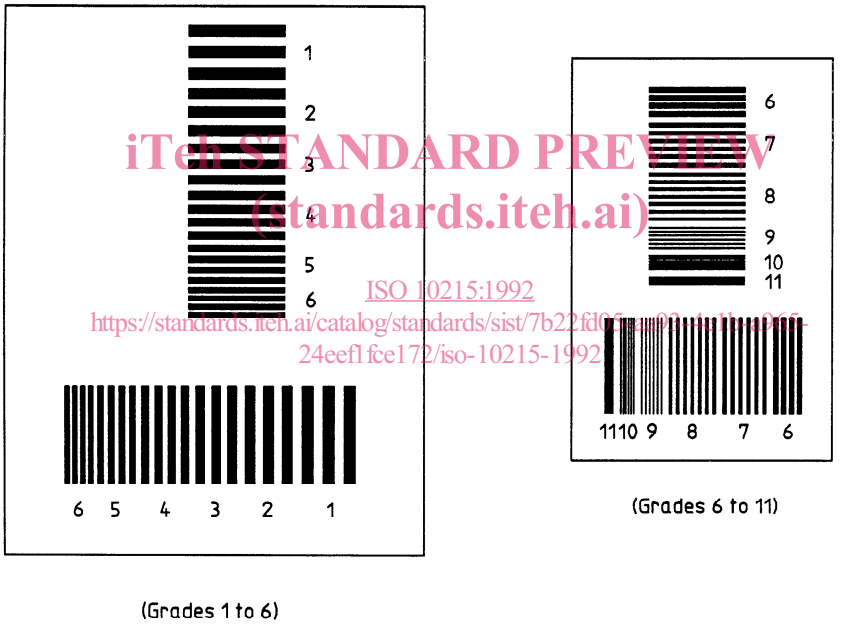

Figure 1 — Chart scale

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

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

1) For this method, the value of each colour scale is chosen from table 2 of ISO/TR 8125:1984.

6 Test specimen

The test specimen shall be visually flat and it usually needs to be more than 90 mm long by 65 mm wide.

7 Procedure

7.1 General

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

The image clarity, C_v, is calculated from these values.

7.2 Determination of image clearness, C

Place the appropriate chart scale (Grades 6 to 11 or 1 to 6) on the observation box (5.2) and put the box on the test sample. Illuminate the chart scale and observe the range of white and black lines reflected by the sample, as illustrated in figure 2. Establish the highest grade number for which a clear image can be distinguished in the lateral and perpendicular directions. For example, for a sample 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 sample 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, estimate the image clearness of the sample as Grade 9.

Dimensions in millimetres, unless otherwise indicated

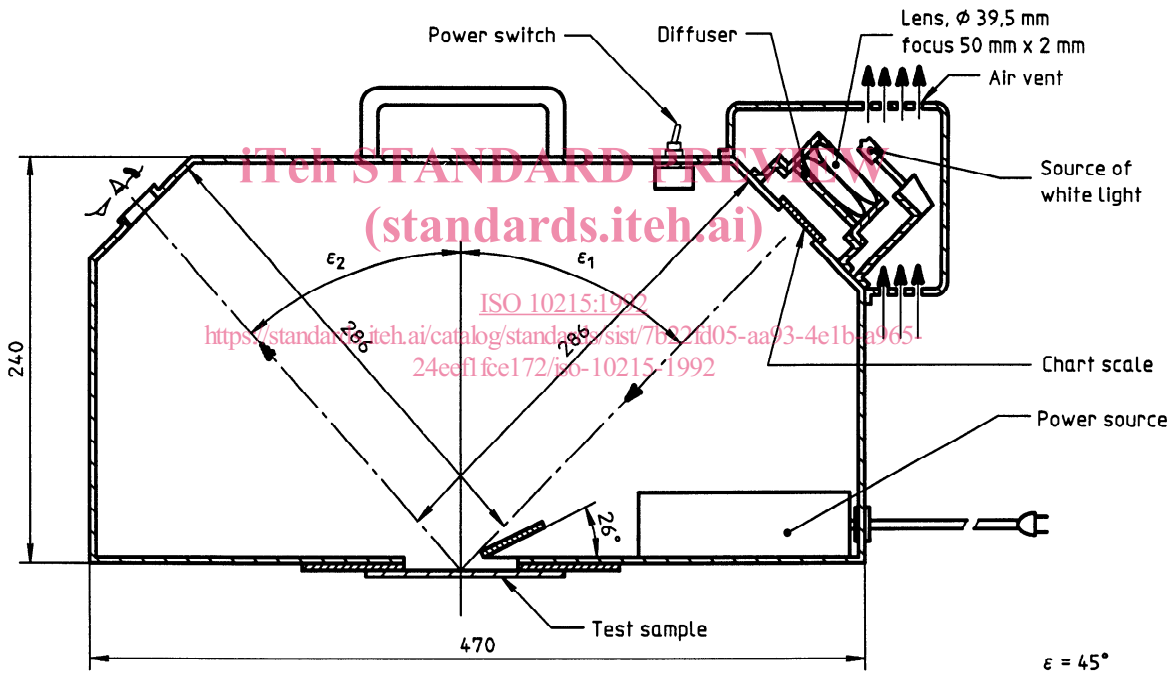

Figure 2 — Diagram of a typical observation box

Dimensions in millimetres

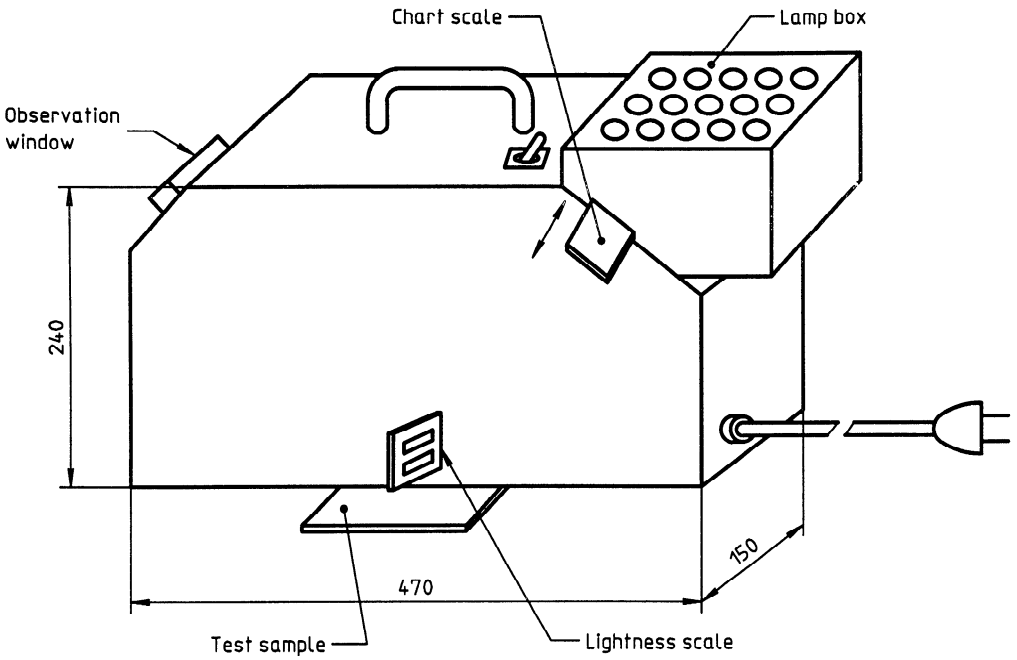

Figure 3 — Overall appearance of observation box

7.3 Determination of image distortion, I

After estimating the image clearness, observe the distortion in the width of the black lines and rate the grade for lateral and perpendicular 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 3), assign the next lower grade to this sample. For example, assign Grade 4 for the case in figure 3.

Dimensions in millimetres

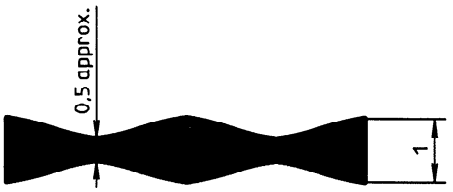

Figure 4 — Example of distortion of image — Line of Grade 5

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 which gives identical lightness to the black line. Assign this lightness value to the sample as the haze value.

8 Expression of results

Calculate image clarity, C_v, from image clearness, image distortion and haze values using the following equation:

$$C_v = \frac{1}{2}\left(C_L + C_P + \frac{I_L + I_p}{H_n}\right)$$

where

C_v is the image clarity, expressed in grade number;

C_L and C_p are the image clearness in lateral and perpendicular directions respectively, expressed in grade number;

I_L and I_p are the image distortion in lateral and perpendicular directions respectively, expressed in grade number;

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

9 Test report

The test report shall contain at least the following information:

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

b) a reference to this International Standard;

c) the specification of the material used;

d) the type of finishing treatment used;

e) the image clarity value, C_v, and, if necessary, the image clearness, C, image distortion, I, and haze values, H_n.