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IS 101-4-2 (1989): Methods of Sampling and test for paints, varnishes and related products, Part 4: Optical tests, Section 2: Colour [CHD 20: Paints, Varnishes and Related Products]



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“Knowledge is such a treasure which cannot be stolen”

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Indian Standard
METHODS OF
SAMPLING AND TEST FOR PAINTS,
VARNISHES AND RELATED PRODUCTS

PART 4 OPTICAL TESTS

Section 2 Colour

(Third Revision)

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BUREAU OF INDIAN STANDARDS
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FOREWORD

This Indian Standard (Third Revision) was adopted by the Bureau of Indian Standards on 30 June 1989, after the draft finalized by the Paints and Allied Products Sectional Committee had been approved by the Chemical Division Council.

This standard is one of a series of standards on methods of sampling and test for paints and allied products. For standardized visual comparison; it is necessary to have an observer with normal colour vision, reproducible illumination and viewing conditions.

In the preparation of this standard, considerable assistance has been derived from ISO : 3668-1976 'Paints and varnishes — Visual comparison of the colour of paints' prepared by the International Organization for Standardization (ISO).

This standard supersedes clause 11 of IS : 101-1964 'Methods of test for ready mixed paints and enamels (*second revision*)'.

Indian Standard

METHODS OF SAMPLING AND TEST FOR PAINTS, VARNISHES AND RELATED PRODUCTS

PART 4 OPTICAL TESTS

Section 2 Colour

(Third Revision)

1 SCOPE

1.1 This standard prescribes two methods for comparison of colour, namely, (a) visual comparison, and (b) based on spectrophotometer.

2 VISUAL COMPARISON

2.1 Principle

The colour of films of paints or related products is compared against a standard using either diffused daylight or artificial daylight in a standard booth.

2.2 Illumination For Colour Matching

2.2.1 General

For visual colour matching, either natural northern daylight or artificial daylight may be used. Because the quality of natural daylight is variable and observers' judgements are likely to be effected by surrounding coloured objects, therefore, for referee purposes closely controlled artificial illumination in a colour-matching booth shall be used. The observer shall wear clothing of a natural colour, and no strongly coloured surfaces, other than panels under test, shall be permitted in the field of view.

2.2.2 Natural Daylight Illumination

Diffuse daylight, preferably from partially cloudy north sky in the northern hemisphere and a partially cloudy south sky in the southern hemisphere, and not reflected from any strongly coloured object, such as a red brick wall or green tree, shall be used. Illumination shall be uniform over the area in which test panel are displayed and at a level of at least 2 000 lx. Direct sunlight shall be avoided.

2.2.3 Artificial Daylight Illumination by Means of Colour Matching Booth

It shall be an enclosure from which external light is excluded and which is illuminated by a

light source giving a spectral power distribution falling in the test panel, approximating to that of CIE standard Illuminant D65.

The method for checking the closeness of conformity of the spectral distribution of the lighting device to CIE standard illumination D65 shall be as specified in IS 11472 (Part 1) : 1985 'Illuminant for colour matching and colour appraisal'. The level of illumination at the colour matching position shall be between 1 000 and 4 000 lx, a figure towards the upper end of the range being desirable for dark colours. The interior of a booth for general use shall be painted with matt black. To secure an appropriate surrounding field for colour comparison the table surface in the booth shall be covered by a neutral grey panel, its luminance factor being chosen to be similar to that of the samples to be compared. A diffusing screen shall normally be used to avoid the reflection of an image of the lamp from the test panel. The spectral distribution properties of the lightening device shall include the spectral transmission of the screen. The manufacturer of the artificial light source shall disclose the number of running hours during which his product can be expected to conform to this standard.

2.3 Observer

Observers must be selected carefully because a significant proportion of people have defective colour vision. An Ishihara test will reveal severe defects, but for selecting critical colour matches, more sensitive tests, for example the Farnsworth test or anomaloscope measurements, are desirable. If an observer wears glasses to correct his vision, these must have a uniform spectral transmission throughout the visible spectrum. As colour vision changes significantly with age, observers over 40 years of age shall be tested using an anomaloscope or a method whereby the observer is requested to choose the best match from a metameric series of colours.

To avoid eye fatigue effects, pastel or complementary colours shall not be viewed

immediately after strong colours. When comparing bright saturated colours, if a decision can not be made rapidly, the observer shall look away for some seconds at the neutral grey of the surrounding field before attempting of further comparison.

The quality of visual judgement falls off severely if the observer works continuously. Test periods of several minutes during which no colour matching is attempted shall therefore, be taken frequently.

2.4 Test Panels and Reference Standards

2.4.1 General

Both test panels and reference colour standards shall be flat and preferably at least 150 mm × 100 mm in size, but in no case less than 120 mm × 50 mm. Panels of length 120 mm, when viewed from a distance of 500 mm, subtend an angle at the eye of about 10° in accordance with CIE recommendation. Suitable materials for test panels are tinplate, hard aluminium, steel or glass, which comply with IS 101 (Part 1/Sec 3) : 1986 'Preparation of panels'.

2.4.2 Reference Standards

Only colour standards of satisfactory colour permanence shall be used for reference standards. Wherever possible, the reference standards shall be of the same size as the test panels and shall have closely similar gloss and surface texture.

2.4.3 Preparation and Coating of Test Panel

Prepare the test panel as specified and, where appropriate in accordance with IS 101 (Part 1/Sec 3) : 1986. The panel shall be coated twice, to give not more than 35 microns dry film thickness, by a closely specified or agreed method, because the method of application and film thickness may effect the colour considerably. If the test panel is to be compared against a standard paint, it shall be coated with the paint or system under test and a similar panel coated with the standard paint or system. The method of application and the applied film thickness shall be, as closely as possible, identical.

2.4.4 Drying of Test Panel

Dry (or stove) the panel for the specified time and under the specified conditions and, unless otherwise specified, condition in the standard atmosphere for a minimum of 16 h, with free circulation of air and not exposed to direct sunlight.

2.5.4 Thickness of Coating

Determine the thickness, in micrometers, of the dry coating by the method specified, using one

of the procedures specified in IS 101 (Part 3/Sec 6) 'Film thickness (under preparation)'.

2.5 Procedure for Colour Matching

2.5.1 Visual Method

The panels may be viewed either in natural daylight or in a colour-matching booth, as detailed below:

- a) *Viewing on natural daylight* — View the panels at an angle which minimizes gloss difference, for example, from a nearly normal direction so that the specular reflection does not reach the eye.
- b) *Viewing in a colour-matching booth* — View the panels at an angle of 45° with illumination of an angle of 0°.

View the two panels, or the panel and the reference colour standard, either under natural daylight [as in 2.5.1(a)] or in artificial daylight in the colour-matching booth [2.5.1(b)]. Place the panels side by side touching or overlapping and in the same plane, at a distance of about 500 mm from the eyes. Compare the colour of the paint film prepared from the material under test with that of the reference colour standard or of the film prepared from the standard paint. To improve accuracy of comparison, compare the colours with the positions of the panels reversed from time to time. In case of certain finishes, such as metallic finishes, the method of viewing shall be agreed to between the interested parties. When films of different levels of gloss are to be compared the gloss level of the shade examined shall be similar.

2.5.2 Referee Method

In case of dispute, comparisons shall be made in artificial daylight, conforming to CIE standard Illuminant D65, unless an alternative light source has been agreed to between the interested parties.

3 SPECTROPHOTOMETRIC METHOD

3.1 This instrument may be used as an aid to objective measurement of colour and whiteness and for recording reflectance characteristics of reflecting surfaces that are to be examined under normal diffused daylight. Any suitable photo-electric reflectometer using three filters, amber, green and blue, along with ICI* illuminant C may be used for this purpose. The combined response of the light source, filter and the photocell used in the instrument shall conform to the following requirements:

$$K_A E_I I_{BskB} = \zeta E_c$$

$$K_B E_I T_{AskA} = X E_c$$

$$K_G E_I T_{CskG} = Y E_c$$

*International Commission on Illumination.

where

E_I is the spectral distribution of the lamp source;

I_A , T_B , and T_C are the spectral transmission of the amber, blue and green filters, respectively;

s is the spectral response of the photocell to equal energy;

$K_A K_B$, K_G , k_A , k_B and k_C are constants that are either furnished with every instrument or eliminated by the recommended procedure of using the instrument; and

$Z E_c$, $X E_c$ and $Y E_c$ are the blue, amber and green responses respectively, of ICI Standard Observer Illuminant C.

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