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Clear liquids — Estimation of colour by the platinum-cobalt colour scale

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The UK participation in its preparation was entrusted to Technical Committee STI/3, Paints, media and related products.

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Liquides clairs - Évaluation de la couleur au moyen de l'échelle platine-cobalt (ISO 6271:2015)

Klare Flüssigkeiten - Bestimmung der Farbe nach der Platin-Cobalt-Farbskala (ISO 6271:2015)

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CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

European foreword

This document (EN ISO 6271:2015) has been prepared by Technical Committee ISO/TC 35 "Paints and varnishes" in collaboration with Technical Committee CEN/TC 139 “Paints and varnishes” the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by June 2016, and conflicting national standards shall be withdrawn at the latest by June 2016.

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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).

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

ISO 6271 was prepared by Technical Committee ISO/TC 35, *Paints and varnishes*, Subcommittee SC 10, *Test methods for binders for paints and varnishes*, in collaboration with ASTM D 01.34, *Naval Stores*. It has been harmonized with ASTM D 1209-05, *Standard Test Method for Color of Clear Liquids (Platinum-Cobalt Scale)*.

This third edition of ISO 6271 cancels and replaces ISO 6271-1:2004 and ISO 6271-2:2004, which have been technically revised. The main changes are:

a) both standards have been combined into one standard;

b) the spectrophotometric method (formerly described in ISO 6271-2:2004) is the only one standardized now;

c) the original visual comparison of colours (formerly described in ISO 6271-1:2004) has been deleted, and the description of manufacture of the original platinum-cobalt colour standards has been moved to Annex A.

Clear liquids — Estimation of colour by the platinum-cobalt colour scale

1 Scope

This International Standard specifies a spectrophotometric method for estimating the colour of clear liquids in terms of platinum-cobalt units (Pt-Co units). It is applicable to clear liquids having a colour characteristic similar to those of the platinum-cobalt colour scale specified in Annex A. For products with colours more intense than the Pt-Co stock solution the method specified in ISO 4630 applies.

The spectrophotometric method provides a more precise way of measuring Pt-Co colour than a visual sample comparison by human eyes.

NOTE The term "Pt-Co colour" used here is preferred over the terms "Hazen colour" and "APHA colour".

2 Normative references

The following referenced documents, in whole or in part, are normally referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 3696, *Water for analytical laboratory use — Specification and test methods*

ISO 5725-2, *Accuracy (trueness and precision) of measurement methods and results — Part 2: Basic method for the determination of repeatability and reproducibility of a standard measurement method*

ISO 15528, *Paints, varnishes and raw materials for paints and varnishes — Sampling*

CIE Publication No. 15:2004, *Colorimetry*

3 Principle

The colour of a liquid sample is measured using an instrument capable of measuring transmitted colour and reporting in Pt-Co colours or in a colour system that can be converted into Pt-Co colours.

4 Apparatus and materials

4.1 Colour-measuring instrument, spectrophotometer capable of measuring transmitted colour (0°/180° geometry) and reporting the results in the Pt-Co colour scale. If such an instrument is not available, one may be used which is capable of measuring transmitted colour and reporting in tristimulus values using standard illuminant C and the 2° observer, described in CIE Publication No. 15:2004.

4.2 Absorption cells, 50 mm light path length recommended, unless a different path length is specified by the instrument manufacturer or

4.3 Glass tubes, 11 mm path length. Glass test tubes designed for a specific instrument may be used. Glass tubes might provide less accuracy in the very low colour range than 50 mm absorption cells and should be used only when a decrease in accuracy is tested and considered acceptable.

5 Sampling

Take a representative sample of the product to be tested, as described in ISO 15528.

6 Procedure

Baseline calibration of the instrument shall be performed following the instrument manufacturer's recommendations.

If the material shows any visual haziness, remove the haze e.g. by filtration, centrifugation, heating, ultrasonic treatment or any other suitable means (see Note).

If the haziness cannot be removed, the measured value will be unreliable.

Then, using the same type of glass tube or absorption cell as used for the baseline calibration, fill the glass tube or absorption cell with the product. Take care not to touch the measurement area of the glass tube or absorption cell.

Avoid creating air bubbles when filling the glass tube or absorption cell. If air bubbles are formed and remain trapped, remove them by heating, vacuum, ultrasonic treatment or any other suitable means (see Note).

NOTE Some sample pre-treatments can change the colour.

Insert the glass tube or absorption cell in the instrument and measure the Pt-Co colour, following the instrument manufacturer's recommended procedure.

Regular checks as per the instrument manufacturer's recommendations should be carried out. These will normally be in the form of checks with certified reference materials.

7 Expression of results

Report the colour in Pt-Co colour units as given by the instrument.

8 Precision

8.1 General

The precision of the test method was determined by inter-laboratory testing in accordance with ISO 5725-2.

Four different materials were tested by 143 laboratories.

8.2 Repeatability limit, *r*

The repeatability limit *r* is the value below which the absolute difference between two single test results, each the mean of duplicates, obtained on identical material by one operator in one laboratory within a short interval of time using the standardized test method can be expected to lie with a probability of 95 %.

The repeatability for three repeated measurements, made in accordance with this International Standard and expressed as the repeatability limit *r*, is 1,9 %, relative to the mean.

8.3 Reproducibility limit, *R*

The reproducibility limit *R* is the value below which the absolute difference between two test results, each the mean of duplicates, obtained on identical material by operators in different laboratories using the standardized test method can be expected to lie with a probability of 95 %.

The reproducibility for three repeated measurements, made in accordance with this International Standard and expressed as the reproducibility limit *R*, is 4,8 %, relative to the mean.

8.4 Bias

Since there is no accepted reference material suitable for determining the bias of the procedure in this test method, bias has not been determined.

9 Test report

The test report shall contain at least the following information:

a) all details necessary to identify the product examined;

b) a reference to this International Standard (ISO 6271);

c) any type of pretreatment of the test sample;

d) the result of the test as indicated in Clause 7;

e) any deviation from the test method specified;

f) any unusual features (anomalies) observed during the test;

g) the date of the test.

Annex A
(normative)

Platinum-cobalt colour standards

A.1 Reagents

In preparing these standards, use only reagents of recognized analytical grade and only water of at least grade 3 purity as defined in ISO 3696.

A.1.1 Potassium hexachloroplatinate(IV), K_2PtCl_6.

A.1.2 Cobalt(II) chloride hexahydrate, $CoCl_2 \cdot 6H_2O$.

A.1.3 Hydrochloric acid, 38 % (by mass), ρ = 1,19 g/ml.

A.2 Preparation of colour standards

A.2.1 Pt-Co stock solution, 500 Pt-Co units

Introduce 1,245 g of potassium hexachloroplatinate(IV) and 1,000 g of cobalt(II) chloride hexahydrate into a 400 ml beaker. Add 100 ml of water and 100 ml of hydrochloric acid and warm, if necessary, to obtain a clear solution. After cooling, transfer quantitatively to a 1 000 ml one-mark volumetric flask, dilute to the mark with water and mix well.

The stock solution prepared in this way shall have tristimulus values *X*, *Y*, *Z* which lie within the limits specified in Table A.1 when measured in accordance with 4.1 and 4.2 using cells of 50 mm optical path length in the spectrophotometer.

Table A.1 — Tristimulus tolerance limits for 500 Pt-Co units stock solution

X	*Y*	*Z*
79,5 ± 0,3	81,4 ± 0,5	29,7 ± 1,2

A.2.2 Pt-Co standard matching solution

Prepare a series of standard matching solutions covering the range required (see Table A.2). Place the indicated volumes of stock solution (A.2.1) into a series of 100 ml flask, dilute to the mark with water and mix well. Cap the flask, seal the caps with shellac or waterproof cement and mark the flask with the corresponding Pt-Co number.

Table A.2 — Pt-Co standard matching solutions

Colour Pt-Co units	**Volume of stock solution (A.2.1)** ml
0	0
10	2
20	4
30	6

Table A.2 *(continued)*

Colour Pt-Co units	**Volume of stock solution (A.2.1)** ml
40	8
50	10
60	12
70	14
80	16
90	18
100	20
125	25
150	30
200	40
250	50
300	60
350	70
400	80
450	90
500	100

A.2.3 Storage

Store the stock solution (A.2.1) in a stoppered bottle in the dark. Under these conditions, this solution is stable for one year. The standard matching solutions (A.2.2) are stable for about 6 months when stored in the dark at room temperature. They shall remain clear without any sediment but should preferably be prepared immediately before use.

Bibliography

[1] ISO 4630, *Clear liquids — Estimation of colour by the Gardner colour scale*

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