
International Standard



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Binders for paints and varnishes — Estimation of colour of clear liquids by the Gardner colour scale

Liants pour peintures et vernis — Estimation de la couleur des liquides non opaques à l'aide de l'échelle de couleur Gardner

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Foreword

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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 4630 was developed by Technical Committee ISO/TC 35, *Paints and varnishes*, and was circulated to the member bodies in November 1979.

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It has been approved by the member bodies of the following countries :

ISO 4630:1981

- | | | |
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No member body expressed disapproval of the document.

Binders for paints and varnishes — Estimation of colour of clear liquids by the Gardner colour scale

1 Scope and field of application

This International Standard specifies a method of estimating the colour of clear liquids, used as binders for paints and varnishes, by means of the Gardner colour scale.

It is applicable to drying oils, varnishes, and solutions of fatty acids, polymerized fatty acids and resins. Its applicability to other materials has not been established.

2 References

ISO 842, *Raw materials for paints and varnishes — Sampling*, 1981.

CIE Publication No. 15, *Colorimetry*.

3 Principle

Visual comparison of the colour of a sample, in a glass tube of standard diameter, with the colours of arbitrarily numbered colour standards, identification of the standard that most closely matches the colour of the sample, and expression of the result in terms of a Gardner colour number.

4 Apparatus

4.1 Gardner colour standards.

4.1.1 Reference standards.

Reference standards are glass colour standards having chromaticity coordinates and luminous transmittances as specified in table 1.

Eighteen glass colour standards are required.

The colour shall be produced by the glass components only. The width of the glass colour standards shall be not less than 14 mm. The standards should be mounted in such a way that they may be conveniently manipulated and allow simultaneous appearance of two adjacent standards in the colour comparator (4.3).

NOTE — Glass colour standards that do not conform to the requirements in the table should be rejected.

Before being used, glass colour standards should be checked by the method specified in annex A.

4.1.2 Working standards.

Working standards are 18 glass or liquid colour standards having chromaticity coordinates that differ from those of the reference standards by no more than one-third of the difference in x or y (see table 1) between adjacent reference standards.

In any one set, no two standards shall be closer together than two-thirds of the difference in x or y between corresponding reference standards.

The luminous transmittances shall be as specified in table 1.

NOTES

- 1 In case of dispute, only glass reference standards should be used.
- 2 The chromaticity coordinates of the glass standards and those of the liquid standards differ slightly. However, the difference does not affect the accuracy of the estimation.

The liquid working standards are freshly prepared, coloured solutions contained in glass test tubes (4.2).

Potassium chloroplatinate solutions are used for the lighter standards (1 to 8), and solutions of iron(III) chloride and cobalt(II) chloride in hydrochloric acid are used for the darker standards (9 to 18).

The compositions of the liquid colour standards are specified in annex B.

4.2 Glass test tubes, clear, colourless, round, of inside diameter $10,65 \pm 0,025$ mm, outside diameter about 12,5 mm, and outside length about 114 mm.

NOTE — Test tubes that approximate to the stated diameter and that are, preferably, not less than 10 mm or not more than 11 mm in inside diameter may be used. In such cases, the results should be multiplied by a correction factor equal to $10,65/d$, where d is the inside diameter of the test tube.

4.3 Colour comparator, constructed to illuminate uniformly, and to permit simultaneously visual comparison of light transmitted through two colour standards and through a test tube in a transverse direction.

The apparatus may be of any design but should have the following characteristics.

4.3.1 Illumination

CIE illuminant C.

4.3.2 Surrounding field

The field should not differ significantly in brightness from the samples and standards and should be essentially achromatic.

4.3.3 Field of view

Two standards and a sample should always be in the field of view.

4.3.4 Arrangement of standard and sample

There should be a perceptible gap between sample and standard, but this should be as small as possible.

5 Sampling

Take a representative sample of the product to be tested as specified in ISO 842.

6 Procedure

6.1 Fill a clean test tube (4.2) to a height of at least 70 mm with the sample, passing it through a sintered glass filter if there is any visual turbidity.

6.2 Place the sample tube (6.1) in the sample compartment of the comparator (4.3). Switch on the light source and compare simultaneously the colour of the sample with the colours of two adjacent standards, at a viewing distance of between 30 and 50 cm.

6.3 Determine which standard most closely matches the sample in brightness and saturation, ignoring any differences of hue.

7 Expression of results

7.1 Reporting

Report the number of the standard most closely matching the colour of the sample. If more precise measurements are needed, report as either lighter than, matching or darker than the standard.

7.2 Precision

7.2.1 Repeatability (r)

The value below which the absolute difference between two single test results on identical material, obtained by one operator in one laboratory using the same equipment within a short interval of time, using the standardized test method, may be expected to lie with a 95 % probability, is two-thirds of a colour number.

7.2.2 Reproducibility (R)

The value below which the absolute difference between two test results, each the mean of duplicate measurements, on identical material, obtained by operators in different laboratories, using the standardized test method, may be expected to lie with a 95 % probability, is four-thirds of a colour number.

Table 1 – Colour specifications of reference standards

Gardner colour standard number	Chromaticity coordinates		Luminous transmittance Y %	Transmittance tolerance (±) %
	x	y		
1	0,317 7	0,330 3	80	7
2	0,323 3	0,335 2	79	7
3	0,332 9	0,345 2	76	6
4	0,343 7	0,364 4	75	5
5	0,355 8	0,384 0	74	4
6	0,376 7	0,406 1	71	4
7	0,404 4	0,435 2	67	4
8	0,420 7	0,449 8	64	4
9	0,434 3	0,464 0	61	4
10	0,450 3	0,476 0	57	4
11	0,484 2	0,481 8	45	4
12	0,507 7	0,463 8	36	5
13	0,539 2	0,445 8	30	6
14	0,564 6	0,427 0	22	6
15	0,585 7	0,408 9	16	2
16	0,604 7	0,392 1	11	1
17	0,629 0	0,370 1	6	1
18	0,647 7	0,352 1	4	1

8 Test report

The test report shall include at least the following information :

- a) the type and identification of the product tested;
- b) a reference to this International Standard (i.e. ISO 4630);
- c) the result, expressed as a Gardner colour number, and whether glass colour standards or liquid colour standards were used;
- d) whether the sample was filtered;
- e) any deviation, by agreement or otherwise, from the procedure specified;
- f) the date of the test.

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Annex A

Calibration of glass reference standards

A.1 Select a dual beam spectrophotometer with a sufficiently small light beam at the sample position so that all rays will pass through the standards to be calibrated. Alternatively equip the spectrophotometer with a condensing lens to achieve this.

A.2 Place the standards in turn in the sample position of the spectrophotometer. If the comparator is provided with a separate green filter in front of the light source, place this filter in the reference beam of the dual beam spectrophotometer during calibration of each standard.

A.3 Obtain spectral transmittance data for each glass reference standard by following the procedure given in CIE Publication No. 15.

A.4 From the spectral transmittance data for each reference standard, calculate the CIE tristimulus values, X , Y , Z , and the chromaticity coordinates, x and y , for CIE illuminant C.

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Annex B

Liquid Gardner colour standards

B.1 Reagents

Use only reagents of recognized analytical grade, and distilled water or water of equivalent purity.

B.1.1 Hydrochloric acid, (1 + 17) solution.

Mix one volume of concentrated hydrochloric acid (ρ approximately 1,19 g/ml) with 17 volumes of water.

B.1.2 Potassium chloroplatinate solutions.

Dissolve 790 mg of potassium hexachloroplatinate (K_2PtCl_6) in the hydrochloric acid solution (B.1.1) in a 100 ml one-mark volumetric flask. Warm the solution until all the potassium hexachloroplatinate is dissolved. Cool to 20 °C, dilute to the mark with the same hydrochloric acid solution and mix well.

B.1.3 Cobalt(II) chloride solution.

Dissolve 40 g of cobalt(II) chloride hexahydrate ($CoCl_2 \cdot 6H_2O$) in 120 g of the hydrochloric acid solution (B.1.1).

B.1.4 Iron(III) chloride solution.

Dissolve 1 000 g of iron(III) chloride hexahydrate ($FeCl_3 \cdot 6H_2O$) in 240 g of the hydrochloric acid solution (B.1.1), heating gently if necessary. Adjust the concentration so that the solution has exactly the same colour as a freshly prepared 30 g/l solution of potassium dichromate in concentrated sulphuric acid (ρ approximately 1,84 g/ml).

B.2 Preparation of liquid colour standards

B.2.1 Gardner colour standards 1 to 8

Into each of a series of one-mark volumetric flasks of the capacities indicated in table 2, transfer from a burette the corresponding volumes of the potassium hexachloroplatinate solution shown in table 2, dilute each to the mark with the hydrochloric acid solution (B.1.1) and mix well.

B.2.2 Gardner colour standards 9 to 18

Into a series of 100 ml one-mark volumetric flasks, transfer from burettes the volumes of the iron(III) chloride solution (B.1.4) and the cobalt(II) chloride solution (B.1.3) shown in table 3. Dilute each to the mark with the hydrochloric acid solution (B.1.1) and mix well.

Table 2 — Composition of potassium hexachloroplatinate solutions (Gardner colour standards 1 to 8)

Gardner colour standard number	Potassium hexachloroplatinate solution	Nominal capacity of the one-mark volumetric flask
	ml	ml
1	3,48	50
2	5,47	50
3	8,42	50
4	6,58	25
5	9,60	25
6	5,35	10
7	8,10	10
8	10,00	10

Table 3 — Composition of iron and cobalt solutions (Gardner colour standards 9 to 18)

Gardner colour standard number	Iron and cobalt solutions		
	Iron(III) chloride solution (B.1.4)	Cobalt(II) chloride solution (B.1.3)	Hydrochloric acid solution (B.1.1)
	ml	ml	ml
9	3,8	3,0	93,2
10	5,1	3,6	91,3
11	7,5	5,3	87,2
12	10,8	7,6	81,6
13	16,6	10,0	73,4
14	22,2	13,3	64,5
15	29,4	17,6	53,0
16	37,8	22,8	39,4
17	51,3	25,6	23,1
18	100,0	0,0	0,0

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