INTERNATIONAL STANDARD

ISO 13803

Second edition
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Paints and varnishes — Determination of haze on paint films at 20°

Peintures et vernis — Détermination du voile sur des feuils de peinture à 20°

Reference number
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Foreword

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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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Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

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.

The committee responsible for this document is ISO/TC 35, *Paints and varnishes*, Subcommittee SC 9, *General test methods for paints and varnishes*.

This second edition cancels and replaces the first edition (ISO 13803:2000), which has been technically revised. The main technical changes are:

a) the symbols have been adapted to the revision of ISO 2813;

b) an introduction and a principle clause have been added;

c) the supplementary test conditions have been included in the test report;

d) the normative references have been updated.

Introduction

High quality surfaces are expected to have a clear and brilliant appearance. Microstructures can cause a milky appearance. This effect is described as haze. A high gloss surface with microscopic texture has diffused light with low intensity adjacent to the main direction of reflection. The majority of the incident light is reflected in the specular direction which will make the surface appear high glossy with image forming qualities, but with a milky haziness on top of it.

The phenomenon haze can be seen on high gloss surfaces only. Therefore, the 20° geometry is used like with a gloss meter. The aperture range of a 20° gloss meter is 1,8°. Two additional sensors next to the gloss detector measure the intensity of the diffused light responsible for haze. Thus, the specularly reflected and the scattered light are measured simultaneously. In order to better correlate with the visual perception, haze is displayed in a logarithmic scale – the lower the haze reading the better the surface.

Paints and varnishes — Determination of haze on paint films at 20°

1 Scope

This International Standard specifies a test method for determining the haze of coatings. The method is suitable for the haze measurement of non-textures coatings on plane, opaque substrates.

The use of the 20° geometry means that the method is closely related to the measurement of gloss at 20° in ISO 2813. The application of this method is intended to give improved differentiation between high-gloss surfaces, for example in the field of assessment of dispersion characteristics.

2 Normative references

The following documents, in whole or in part, are normatively 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 1514, *Paints and varnishes — Standard panels for testing*

ISO 2808, *Paints and varnishes — Determination of film thickness*

ISO 2813, *Paints and varnishes — Determination of gloss value at 20°, 60°and 85°*

3 Terms and definitions

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

3.1
haze
milky opalescence in high-gloss or clear coatings

[SOURCE: ISO 4618:2014, 2.137]

3.2
geometry
identification of a method of haze measurement using a specified angle with assigned apertures

[SOURCE: ISO 2813:2014, 3.2, modified — the term “gloss” has been replaced with “haze”.]

3.3
haze value
ratio of the luminous flux reflected and diffusely scattered from an object adjacent to the specular direction for a specified source and receptor angle to the luminous flux reflected from glass with a refractive index of 1,567 in the specular direction, this glass being assigned the value of 100 on the linear haze scale

Note 1 to entry: The measurement of haze value is related to the measurement of gloss in accordance with ISO 2813.

4 Principle

With a reflectometric apparatus haze values are determined on coated surfaces, correlating with the visual haze perception.

The method of haze measurement is specified by the following parameters:

— measuring angles;

— field stop apertures;

— spectral adaptation;

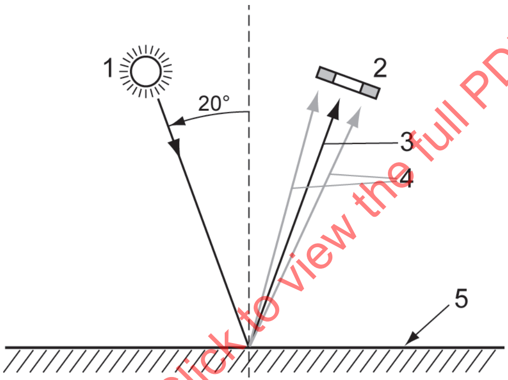
— reference refractive index.

5 Apparatus and materials

5.1 Hazemeter

5.1.1 General

The hazemeter shall consist of a light source and a lens that directs a parallel beam of light onto the surface under test, plus a receptor housing containing a lens, a field stop and a photoelectric cell to receive the required cone of reflected light. The source of the hazemeter is shown in Figure 1.



Key

1 light source

2 sensor

3 gloss

4 haze

5 test surface

Figure 1 — Measuring angle of 20°

5.1.2 Geometries

The axis of the incident beam shall be at an angle α_1 = (20,0 ± 0,1)° (see Figure 1) to the normal to the surface under test. With a flat piece of polished black glass or a front reflecting mirror instead of the test panel position, the source field stop shall be reproduced at the centre of the receptor field stop (see Figure 3).

The optical axis of the receptor shall be coincident with the mirror image of the axis of the incident beam to within ± 0,1°, i.e. the condition $|\alpha_1 - \alpha_2| < 0{,}1°$ shall be fulfilled (see Figure 2).

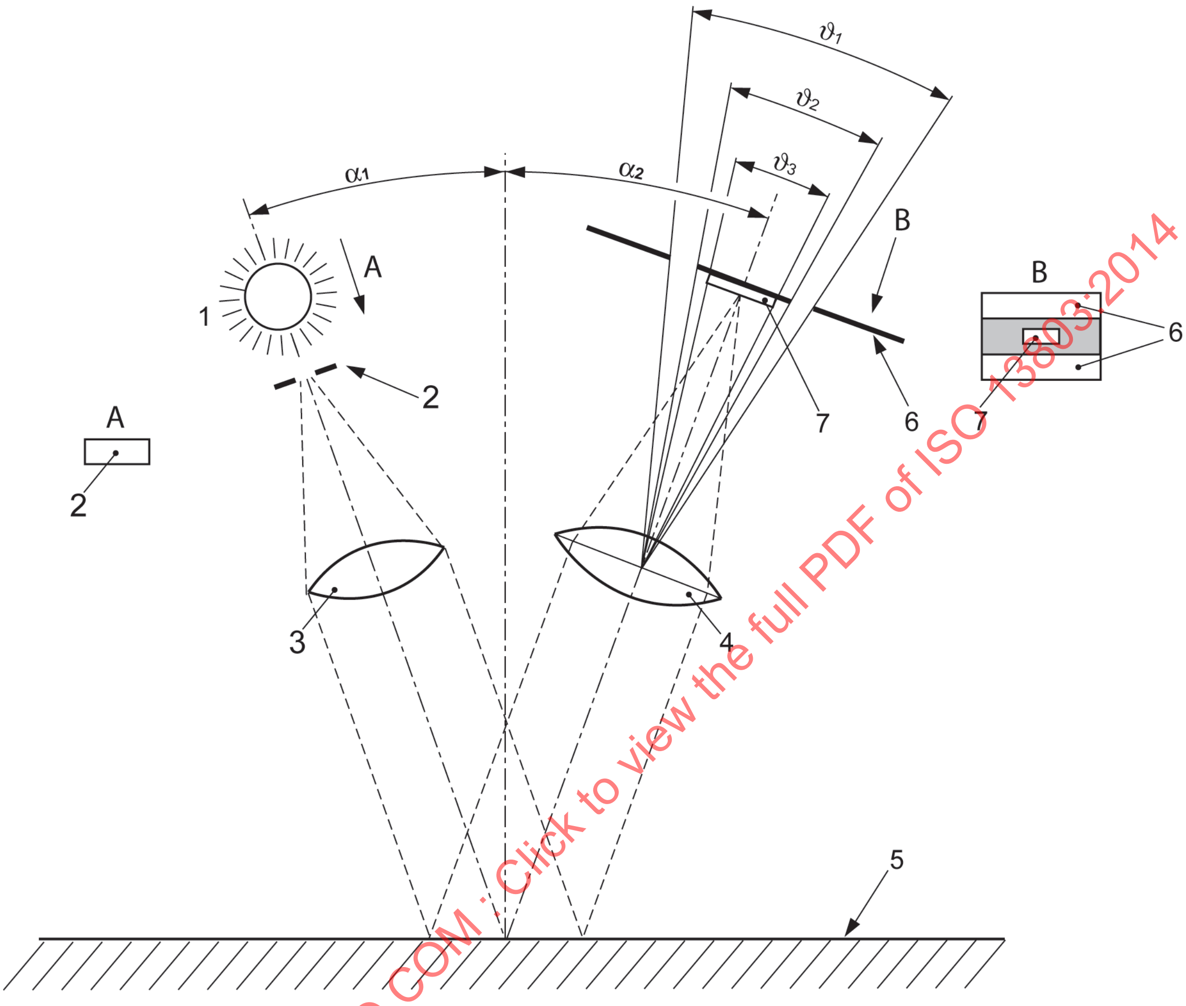
The dimensions of the source aperture and the receptor aperture and the permissible tolerances shall be as indicated in Table 1.

In order to average out the entire surface, the width of the illuminated area on the test panel shall be significantly larger than possible surface irregularities: a generally accepted value is 10 mm.

The angular dimensions of the receptor field stop shall be measured from the receptor lens.

There shall be no vignetting of rays that lie with the specified angular fields.

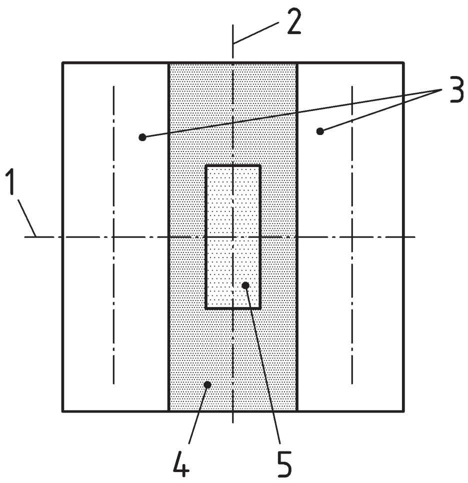
The photoelectric cell shall give a reading proportional to the light flux passing the receptor field stop, to a deviation within 1 % of the full-scale reading



Key

1 light source
2 source image aperture
3 source lens
4 receptor lens
5 test surface
6 receptor area
7 image of the source aperture in the receptor field stop
α_1 angle of the beam against surface normal
α_2 reflection angle of the beam refracted from medium 2 (against surface normal)
ϑ_1 receptor aperture
ϑ_2 central opaque zone of the receptor aperture
ϑ_3 source image aperture angle

Figure 2 — Course of beam of the hazemeter



Key

1 plane of measurement

2 plane perpendicular to plane of measurement

3 receptor area

4 receptor field stop

5 image of the source aperture in the receptor field stop

Figure 3 — Receptor field stop

5.1.3 Filtering at the receptor

Filtering at the receptor shall be done in such a way that the transmittance of the filter $\tau(\lambda)$ is given by Formula 1:

$$\tau(\lambda) = k \frac{V(\lambda) \times S_C(\lambda)}{L(\lambda)_{rel} \times L_S(\lambda)} \quad (1)$$

where

$V(\lambda)$ is the CIE photopic luminous efficiency;

$S_C(\lambda)$ is the spectral power distribution of CIE illuminant C;

$L(\lambda)_{rel}$ is the relative spectral sensitivity of the receptor;

$L_S(\lambda)$ is the spectral power distribution of the light source;

k is the calibration constant.

Table 1 — Angles of source image aperture and receptor aperture

	Angle	
	in parallel to plane of reflection	**perpendicular to plane of reflection**
Source image aperture ϑ_3	0,75° ± 0,10°	2,50° ± 0,1°
Receptor aperture ϑ_1	5,50° ± 0,25°	5,50° ± 0,25°
Central opaque part of receptor aperture ϑ_2	2,00° ± 0,1°	5,50° ± 0,25°

NOTE 1 In Figure 3 the plane of reflection corresponds to the plane of illustration.

NOTE 2 In Figure 3 only the aperture angles in parallel to the plane of reflection are illustrated.

5.2 Measurement standards (certified reference material, working measurement standards)[1)]

5.2.1 High gloss standard A (working measurement standard)

Plane black glass plate with the following properties:

— surface grinded and polished;

— gloss values ≥ 88 GU.

Thickness, rear side, and edges shall be made in such a way that interfering light, scattered light, and reflected light from the edges and the rear side are avoided.

The following specifications parameters shall be recorded on the standard:

— direction of measurement;

— geometry (geometries);

— assigned gloss value(s).

Further details are to be taken from ISO 2813.

5.2.2 Haze standard B (working measurement standard)

Haze standards, made of ceramic tile, vitreous enamel, opaque glass, or other materials with uniform haze. They shall have been calibrated against a primary reference standard for an indicated area and direction of illumination. Working reference standards shall be uniform and stable. At least two standards of different haze levels shall be available.

The haze standard shall be checked periodically by comparison with primary reference standards.

5.2.3 Zero standard C (working measurement standard) in accordance with ISO 2813

Plane plate made of metal, glass, or rigid plastics [e.g. poly(methyl methacrylate) – PMMA] with or without a coating whose gloss for all geometries is lower than 0,1 GU.

NOTE 1 Black flock has been proved suitable for use as coating material for the zero standard.

NOTE 2 Hazemeters with automatically proceeding calibration routine do not require a zero standard, since the zero calibration and the offset adjustment are carried out with the light source turned off.

1) See terms in ISO/IEC Guide 99.

6 Test panels

6.1 Substrate

Unless otherwise agreed, select the substrate corresponding to the intended practical use from the substrates described in ISO 1514. The test panels shall be plane and free of deformations.

6.2 Preparation and coating

Prepare each test panel in accordance with ISO 1514 and coat it in accordance with the specified method with the coating material or multi-coat system to be tested.

6.3 Drying and conditioning

Dry/harden (stove, if applicable) and age, if applicable, each coated test panel for the specified period of time and under the specified conditions. Condition the coated test panels before the test at (23 ± 2) °C and a relative humidity of (50 ± 5) % for at least 16 h. Other specifications for conditioning may be agreed and shall be indicated in the test report.

Finger prints, dust, or other contaminations on the surface lead to changes and/or imprecise haze values. Consequently, the coated test panels shall be stored and handled accordingly.

6.4 Thickness of coating

Determine the dry film thickness of the coating, in micrometres, in accordance with one of the methods specified in ISO 2808.

For comparative measurements the film thicknesses shall correspond.

7 Calibration and adjustment of the hazemeter

7.1 Preparation of the apparatus

Calibrate the apparatus at the start of every period of operation and during operation at intervals sufficiently frequent to ensure correct measuring values.

7.2 Zero point check

Use the zero standard C (5.2.3) to check the zero point.

If the measuring value on this standard is not within ± 0,1 gloss unit (GU) of zero, calibrate the apparatus or subtract the deviation from subsequent readings.

NOTE Hazemeters with automatically proceeding calibration routine do not require a zero reference standard, since the zero calibration and the offset adjustment are carried out with the light source turned off.

7.3 Calibration and adjustment

Using the high gloss standard A or that of the two working reference standards having higher haze value, adjust the instrument to the selected value for haze in the upper part of the scale. Calibration with the high gloss standard A may be performed in two ways (the manufacturer of the instrument should recommend one of the two calibration methods to his customer):

a) by tilting the standard in the plane of measurement by an angle of 0,7° to 0,9° (in either direction) to project the image of the light source into a non-obscured part of the receptor aperture;

b) by removing temporarily the central obscuring part of the receptor aperture.

Next take a second working reference (with lower haze) and make a measurement with the same control settings. If the reading is within one scale unit of the assigned value, the tolerance requirement is met, but if the reading is outside this tolerance carry out an additional measurement with a further working reference standard. If both values differ by more than one scale unit from the assigned values, adjust the instrument in accordance with the manufacturer's instructions and repeat the calibration procedure until the working reference standards can be measured with the required accuracy. If the repeat value is within one scale unit, tests may be carried out. However, calibration checks shall be carried out before each test determination.

8 Procedure

8.1 General

Haze measurements in accordance with this International Standard are only meaningful if determined on surfaces of good planarity. Any curvature or local unevenness of the substrate will affect the test results. Unless agreed otherwise, the direction of brush marks, raised wood grain, or similar regular texture effects shall be in parallel to the plane of incidence and reflection of the instrument.

The measured linear haze value H_{linear} will depend on the lightness of the specimen. With specimens of different lightness, comparable results can nevertheless be obtained by compensating for lightness differences and reporting as logarithmic haze values $H_{\log}20$ as specified in Annex A.

8.2 Haze measurement of coatings from liquid paints and powder coating materials on glass plates

After calibrating and adjusting the hazemeter, for test coatings on a glass plate take three readings in different positions in parallel to the direction of application. If the spread of results is less than 0,5 units, report the mean value as the H_{linear} value; otherwise take three further measurements and report the mean and range of all six values.

8.3 Haze measurement on other coated dry substrates

By means of the hazemeter measure on at least five representative positions with the 20° geometry and the agreed direction of measurement. If the deviation of the readings is less than 5 GU, report the mean value rounded to full unit as the haze value. Otherwise take further readings and report the mean value of all values.

9 Precision

9.1 General

The following precision data have been obtained under laboratory conditions. In practice there are parameters that can lead to significantly higher deviations of measuring values.

9.2 Repeatability limit *r*

The repeatability limit *r* is the value below which the absolute difference between the mean values of two separate sets of three values, obtained on a coating of the same product on glass plate, can be expected to lie when this method is used under repeatability conditions. In this case, the results are obtained on identical material by one operator in one laboratory within a short interval of time using the same equipment and following the standardized test method. In this International Standard, *r* is 1 % of the mean values or 0,2 units, whichever is the larger, with a 95 % probability.