Reusée

INTERNATIONAL STANDARD **ISO** 2813

Paints and varnishes — Measurement of specular gloss of non-metallic paint films

Peintures et vernis — Mesurage de la réflexion spéculaire de feuils de peinture non métallisée

First edition — 1974-03-01

FOREWORD

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO Member Bodies). The work of developing International Standards is carried out through ISO Technical Committees. Every Member Body interested in a subject for which a Technical Committee has been set up 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.

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 2813 was drawn up by Technical Committee ISO/TC 35, *Paints and varnishes*, and circulated to the Member Bodies in May 1972.

It has been approved by the Member Bodies of the following countries :

Austria	Ireland	Sweden
Chile	Israel	Switzerland
Czechoslovakia	New Zealand	Thailand
Egypt, Arab Rep. of	Poland	Turkey
Germany	Portugal	United Kingdom
India	Romania	U.S.A.
Iran	South Africa, Rep. of	U.S.S.R.

The Member Bodies of the following countries expressed disapproval of the document on technical grounds :

Canada
France

Paints and varnishes — Measurement of specular gloss of non-metallic paint films

0 INTRODUCTION

This International Standard is one of a series dealing with the sampling and testing of paints, varnishes and related products. It should be read in conjunction with ISO/R 1512, *Paints and varnishes – Sampling*, and ISO/R 1513, *Paints and varnishes – Examination and preparation of samples for testing.*

The gloss of a paint film is a complex property, being dependent on the geometrical conditions of illuminating and viewing. Many specular reflection glossmeters have been devised to measure an objective counterpart of visual gloss; their readings differ considerably because of differences in the angle of reflection adopted, the angular spread of the incident beam and the acceptance angle of the viewing receptor. After consideration of the glossmeters available it has been concluded that the apparatus specified for 60° gloss measurement in ASTM D 523, *Standard method of test for specular gloss*, is the most widely used for routine measurements on paint films. Accordingly this International Standard is based on that apparatus. The method is intended for the general classification of gloss level of paint films and for the assessment of gloss changes during weathering.

More sensitive methods for both high and low gloss paints are being examined with consideration of other angles of incidence such as 20° and 85°. A 2,0° aperture at 60° incidence is being considered in order to provide a single instrument that will give improved differentiation over a wide gloss range. Consideration will also be given to the use of goniophotometric methods.

The method of test described requires to be completed, for any particular application, by the following supplementary information. This information shall be derived from the national standard or other document for the product under test or, where appropriate, shall be the subject of agreement between the interested parties.

1) Material and surface preparation of substrate.

2) Method of application of test coating to substrate.

3) Thickness, in micrometres, of the coating, including method of measurement, and whether it is a single coating or a multicoat system.

4) Duration and conditions of drying of the coated panel (or conditions of stoving and ageing, if applicable).

1 SCOPE AND FIELD OF APPLICATION

This International Standard specifies the method to be used in comparing the specular gloss of films of paints. The method is not suitable for the comparison of the gloss of highly glossy paints or the sheen of near matt paints or for comparison of metallic paints. Two procedures are given in section 4, the first (4.1) being for assessment of a film prepared from a liquid paint sample, and the second (4.2) for assessment of an existing painted surface.

2 APPARATUS

2.1 Substrate (for tests where liquid paint samples are supplied)

Unless otherwise agreed, the substrate shall be plate glass, of mirror quality, preferably at least 3 mm thick and at least 80 mm X 80 mm in area.

NOTE — Although the method as written is restricted to paints, clear varnishes may be tested by using as substrate black glass or clear glass covered on the back and edges by black paint.

2.2 Film applicator (to be used only if no other application method is specified or agreed)

A block applicator, having a slot ground from the underface to form a gap $100 \pm 2 \, \mu m$ deep when the applicator is placed on an optically plane surface, shall be used to apply the test film. Such an applicator applies a wet film of thickness approximately $50 \, \mu m$ corresponding to a spreading rate of 20 m²/l.

2.3 Glossmeter

The glossmeter shall consist of an incandescent filament lamp and housing with a lens which directs a parallel or slightly converging beam of light on to the surface under test and a receptor housing containing a lens, field stop and photoelectric cell to receive the required cone of reflected light. The combination of lamp, photoelectric cell and

associated colour filters shall give a spectral sensitivity approximating to the CIE photopic luminous efficiency function weighted for CIE Standard Illuminants C or D_{65}.

a) *Geometric conditions.* The axis of the incident beam shall be at $60 \pm 0,5°$ to the perpendicular to the surface under test. The axis of the receptor shall be at the mirror reflection of the axis of the incident beam. With a flat piece of polished black glass or other front-surface mirror in the specimen position, an image of the source shall be formed at the centre of the receptor field stop (receptor window). The length of the illuminated area of the specimen shall be equal to not more than one-third of the distance from the centre of this area to the receptor field stop. The angle between the axis of the receptor beam and the perpendicular shall be equal to the corresponding angle of the incident beam with a tolerance of $0,1°$. The dimensions and tolerances of the source and receptor shall be as indicated in the Table. The angular dimensions of the receptor field stop are measured from the receptor lens. See the Figure for a generalized illustration of the dimensions. The tolerances are chosen so that errors in the source and receptor apertures will not produce an indication error of more than 1 gloss unit at any point on the 100 unit scale (see 2.4 a)).

b) *Vignetting.* There shall be no vignetting of rays that lie within the field angles specified in 2.3 a).

c) *Receptor meter.* The receptor measurement device shall give an indication proportional to the light flux passing the receptor field stop within ± 1 % of full scale reading.

2.4 Standards

a) *Reference standards.* The primary standard shall be highly polished black glass or clear glass with back and edges roughened and coated with black paint, the top surface being plane to within two fringes per centimetre. Glass of refractive index $n_D = 1,567$ shall be assigned a specular gloss value of 100. Where glass of this refractive index is not available other material of known refractive index may be used, the gloss value being raised or lowered by 0,16 for each 0,001 departure from the standard value. For example, for glass of refractive index 1,523 the assigned value would be 93,0. The refractive index shall be indicated on the reference standard.

b) *Secondary working standards* may be of ceramic tile, vitreous enamel, polished or de-polished opaque glass or other uniform gloss materials but must be of good planarity and have been calibrated against a primary standard for an indicated area and direction of illumination. Such standards shall be checked periodically by comparison with primary standards. The secondary standards shall be uniform and stable, and shall be calibrated by technically competent and authorized organizations.

3 PREPARATION OF PAINT SAMPLE

When tests are to be made on liquid paints, samples of the product under test shall be taken as described in ISO/R 1512. The samples shall be prepared for testing as described in ISO/R 1513.

4 PROCEDURE FOR TESTING

4.1 Assessment of liquid paint samples

4.1.1 *Preparation of test film*

Preferably the test film shall be applied in a manner and at a film thickness corresponding to normal use of the paint, the method being specified or agreed.

If no other method is specified or agreed, the paint shall be applied at $23 \pm 2 °C$ and $50 \pm 5 \%$ relative humidity, at a spreading rate of approximately $20 \, m^2/l$ to freshly degreased plate glass (2.1, but see Note for testing of clear varnishes), using a block applicator (2.2). The paint samples shall be mixed thoroughly by vigorous stirring, immediately before application, to break down any thixotropic structure, taking care not to incorporate air bubbles into the paint. About 2 ml of paint shall be applied in a line across one end of the glass plate and should be spread to a smooth film by drawing down the applicator block with a firm pressure at a velocity of about 100 mm/s.

The coated test panels shall be dried (or stoved and aged) for the specified time and under the specified conditions in a horizontal position and in a dust-free atmosphere and, unless otherwise specified, shall be conditioned at a temperature of $23 \pm 2 °C$ and relative humidity of $50 \pm 5 \%$ for a minimum of 16 h, with free circulation of air and not exposed to direct sunlight. The appropriate test procedure shall then be carried out as soon as possible.

4.1.2 *Thickness measurement*

The thickness, in micrometres, of the film shall be measured and reported along with the method of measurement.

4.1.3 *Gloss measurement techniques*

Calibrate the glossmeter at the start and completion of every period of operation and during operation at intervals sufficiently frequent to ensure that the instrument response is constant. To calibrate, adjust the instrument to read correctly the gloss of the primary reference standard and then read the gloss of a calibrated secondary standard having poorer image-forming characteristics (see 2.4 b)). If the instrument reading for the secondary standard does not agree within 1 % of its assigned value, do not use the glossmeter without re-adjustment, preferably by the manufacturer.

After calibrating the glossmeter, make three readings on the test film in different positions parallel to the direction of application, checking back to the primary reference standard or a calibrated secondary standard to ensure that

there is no drift in readings. If the spread of results is less than 5 units the mean value shall be reported as the specular reflection value; otherwise three further measurements shall be made and the mean and extremes of all six values reported. For measurement on films on substrates other than plate glass, six measurements, for preference three in each of two directions at right angles, shall be taken, the mean and the extreme values being reported.

4.2 Assessment of paint films on substrates

4.2.1 *General*

Gloss measurements by this method are only meaningful for films on surfaces of good planarity because any curvature or local unevenness of the substrate may seriously affect test results. If not otherwise agreed, the direction of brush marks, raised wood grain or similar regular texture effects shall be parallel to the plane of incidence and reflection of the instrument.

4.2.2 *Gloss measurement technique*

Proceed as in 4.1.2, making six measurements on different areas or in different directions on the surface (except for films with directional texture, such as brush marks). Where the variation between extreme values is greater than 10 units or 20 % of the mean value, the test panel shall be rejected. Otherwise the mean and extreme values shall be reported.

5 PRECISION (Applicable to films on plate glass only)

5.1 Repeatability

The difference between the means of two separate sets of three values obtained by the same operator with the same apparatus within a short time interval on a film on plate glass shall not exceed, at the 95 % confidence level, one unit.

5.2 Reproducibility

The difference between the means of two separate sets of three values on a film of the same product on plate glass, obtained by different operators in different laboratories, shall not exceed, at the 95 % confidence level, 5 % of the means or one unit, whichever is the larger.

5.3 For some types of paint, particularly semi-gloss paints, specular gloss is sensitive to variations in conditions and the method of film preparation, so that the reproducibility of tests made from such liquid paints will be poorer than that specified in 5.2. In cases of dispute, prepared paint films shall be interchanged between laboratories.

6 TEST REPORT

The test report shall include the following particulars :

a) a reference to this International Standard or to a corresponding national standard;

b) type and identification of the coating under test;

c) the items of supplementary information referred to in the introduction of this International Standard;

d) the national standard or other document supplying the information referred to in c) above;

e) any deviation, by agreement or otherwise, from the test procedure described;

f) the results of the test as mean specular reflection value and, where required, the number and range of replicate results;

g) date of the test.

TABLE — Angles and relative dimensions of source image and receptor

	In plane of measurement			Perpendicular to plane of measurement		
	θ degree	$2 \tan \theta/2$	Relative dimension	θ degree	$2 \tan \theta/2$	Relative dimension
Source image aperture	0,75 ± 0,25	0,013 1 ± 0,004 4	0,171 ± 0,057	3,0[1]	0,052 4	0,682
Receptor aperture	4,4 ± 0,1	0,076 8 ± 0,001 8	1,000 ± 0,023	11,7 ± 0,2	0,204 9 ± 0,003 5	2,668 ± 0,046

1) Maximum; no minimum specified.