INTERNATIONAL STANDARD 2813

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Paints and varnishes — Measurement of specular gloss of non-metallic paint films at 20°, 60° and 85°

Peintures et vernis — Mesurage de la réflexion spéculaire de feuils de peinture non métallisé à 20°, 60° et 85°

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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 developed by Technical Committee ISO/TC 35, *Paints and varnishes*. This second edition was circulated to the member bodies in July 1976.

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

Australia	Iran	Romania
Austria	Ireland	South Africa, Rep. of
Brazil	Israel	Sweden
Canada	Korea, Rep. of	Switzerland
Chile	Mexico	Turkey
Czechoslovakia	Netherlands	United Kingdom
France	Norway	Yugoslavia
Germany	Peru	
India	Portugal	

No member body expressed disapproval of the document.

This second edition cancels and replaces the first edition (i.e. ISO 2813-1974).

Printed in Switzerland

Paints and varnishes — Measurement of specular gloss of non-metallic paint films at 20°, 60° and 85°

0 INTRODUCTION

This International Standard is one of a series of standards dealing with the sampling and testing of paints, varnishes and related products. It should be read in conjunction with ISO 1512, ISO 1513 and ISO 2808.

This International Standard specifies methods for determining specular gloss at three angles, 60° being generally applicable, 20° giving better differentiation in the high gloss range and 85° giving better differentiation in the low gloss range.

The methods of test specified require 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, if appropriate, shall be the subject of agreement between the interested parties.

a) Material and surface preparation of substrate.

b) Method of application of test coating to substrate.

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

d) Thickness, in micrometres, of the coating, including which of the methods specified in ISO 2808 was used for its determination, and whether it is a single coating or a multicoat system.

1 SCOPE AND FIELD OF APPLICATION

1.1 This International Standard specifies three methods for the measurement of the specular gloss of paint films, with 20°, 60° and 85° geometry. The methods are not suitable for the measurement of the gloss of metallic paints.

a) The 60° geometry method is applicable to all paint films but, for very high-gloss paints or those of near-matt sheen, the 20° or the 85° geometry method may be more suitable.

b) The 20° geometry method is intended for obtaining improved differentiation of high-gloss paints, that is those with a 60° gloss higher than 70 units.

This does not mean, however, that the 60° geometry method cannot be used for paints having a 60° gloss higher than 70 units.

c) The 85° geometry method is intended for obtaining improved differentiation of low-gloss paints, that is those with a 60° gloss lower than 30 units.

This does not mean, however, that the 60° geometry method cannot be used for paints having a 60° gloss lower than 30 units.

1.2 Two procedures are given in clause 5, the first (5.1) being for assessment of a film prepared from a liquid paint sample and the second (5.2) for assessment of an existing painted surface.

2 REFERENCES

ISO 1512, *Paints and varnishes — Sampling.*

ISO 1513, *Paints and varnishes — Examination and preparation of samples for testing.*

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

3 APPARATUS

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

Unless otherwise agreed, the substrate shall be plate glass of mirror quality, preferably of thickness at least 3 mm and area at least 150 mm × 100 mm. The largest dimension shall be at least equal to the length of the illuminated area.

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

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

A block applicator, having a slot ground from the underface to form a gap 100 ± 2 μm 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 μm, corresponding to a spreading rate of 20 m^2/l.

3.3 Glossmeters

The glossmeter shall consist of a light source and a lens that 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.

NOTE – As specular reflection is, in general, spectrally non-selective, the spectral characteristics of the light source and the detector need be critically controlled only when measuring highly chromatic, low-gloss paints or those whose specular reflectance produces an obvious chromatic shift in the colour of the incident light. In this case, the combination of light source, 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 20 ± 0,5°, 60 ± 0,2° or 85 ± 0,1° respectively to the perpendicular to the surface under test. The axis of the receptor shall coincide with the mirror image of the axis of the incident beam. With a flat piece of polished black glass or other front-surface mirror in the test panel position, an image of the source shall be formed at the centre of the receptor field stop (receptor window). The width of the illuminated area of the test panel shall be not less than 10 mm.

The angle between the axis of the receptor beam and the perpendicular shall be equal to the corresponding angle of the incident beam with the same tolerance. The dimensions and tolerances of the sources and receptors shall be as indicated in tables 1, 2 and 3. The angular dimensions of the receptor field stops shall be measured from the receptor lenses. See figures 1, 2 and 3 for generalized illustrations of the dimensions. The tolerances are chosen so that errors in the source and receptor apertures will not produce indication errors of more than 1 gloss unit at any point on the 100 unit scales (see 3.4 a)).

b) **Vignetting.** There shall be no vignetting of rays that lie within the field angles specified in 3.3 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.

TABLE 1 – **Angles and relative dimensions of source image and receptor for 60° method**

	In plane of measurement			Perpendicular to plane of measurement		
	degrees	2 tan σ/2	relative dimension	degrees	2 tan σ/2	relative dimension
Source image angle, σ_2	0,75 ± 0,25	0,013 1 ± 0,004 4	0,171 ± 0,057	3,0[1]	0,052 4	0,682
Receptor aperture, σ_B	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.

TABLE 2 – **Angles and relative dimensions[1] of source image and receptor for 20° method**

	In plane of measurement			Perpendicular to plane of measurement		
	degrees	2 tan σ/2	relative dimension	degrees	2 tan σ/2	relative dimension
Source image angle, σ_2	0,75 ± 0,25	0,013 1 ± 0,004 4	0,171 ± 0,057	3,0[2]	0,052 4	0,682
Receptor aperture, σ_B	1,80 ± 0,05	0,031 4 ± 0,000 9	0,409 ± 0,012	3,6 ± 0,1	0,062 9 ± 0,001 8	0,819 ± 0,023

1) Take as unity the receptor aperture in the plane of measurement of the 60° geometry.

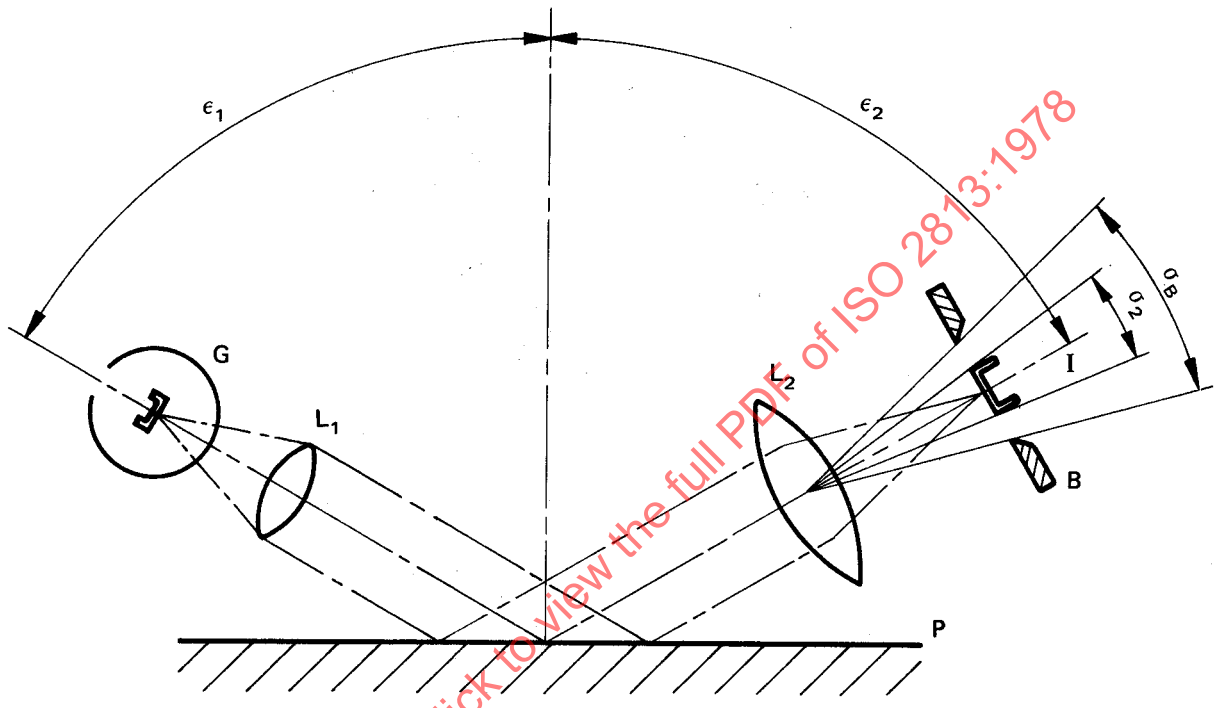
2) Maximum; no minimum specified.

TABLE 3 – **Angles and relative dimensions[1] of source image and receptor for 85° method**

	In plane of measurement			Perpendicular to plane of measurement		
	degrees	2 tan σ/2	relative dimension	degrees	2 tan σ/2	relative dimension
Source image angle, σ_2	0,75 ± 0,25	0,013 1 ± 0,004 4	0,171 ± 0,057	3,0[2]	0,052 4	0,682
Receptor aperture, σ_B	4,0 ± 0,3	0,069 8 ± 0,005 2	0,909 ± 0,068	6,0 ± 0,3	0,104 8 ± 0,005 2	1,365 ± 0,068

1) Take as unity the receptor aperture in the plane of measurement of the 60° geometry.

2) Maximum; no minimum specified.



G = lamp

L_1 and L_2 = lens

B = receptor field stop

P = paint film

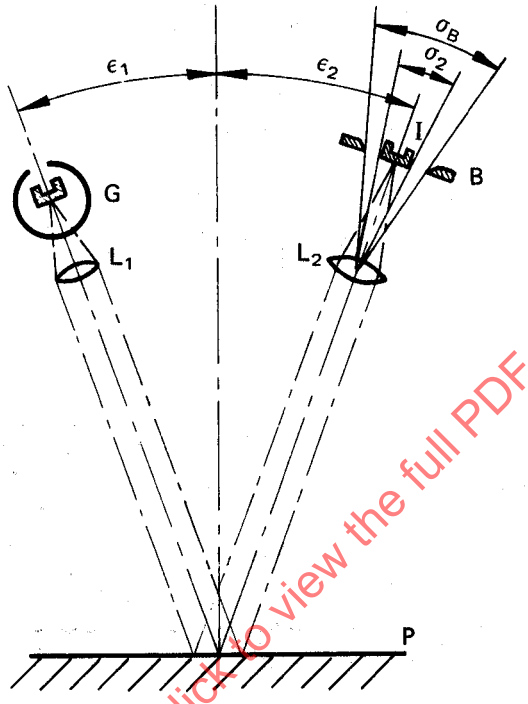
$\epsilon_1 = \epsilon_2 = 60 \pm 0{,}2°$

σ_B = receptor aperture angle = $4{,}4 \pm 0{,}1°$

σ_2 = source image angle = $0{,}75 \pm 0{,}25°$

I = image of filament

FIGURE 1 — **Generalized dimensions of the 60° glossmeter**



G = lamp

L_1 and L_2 = lens

B = receptor field stop

P = paint film

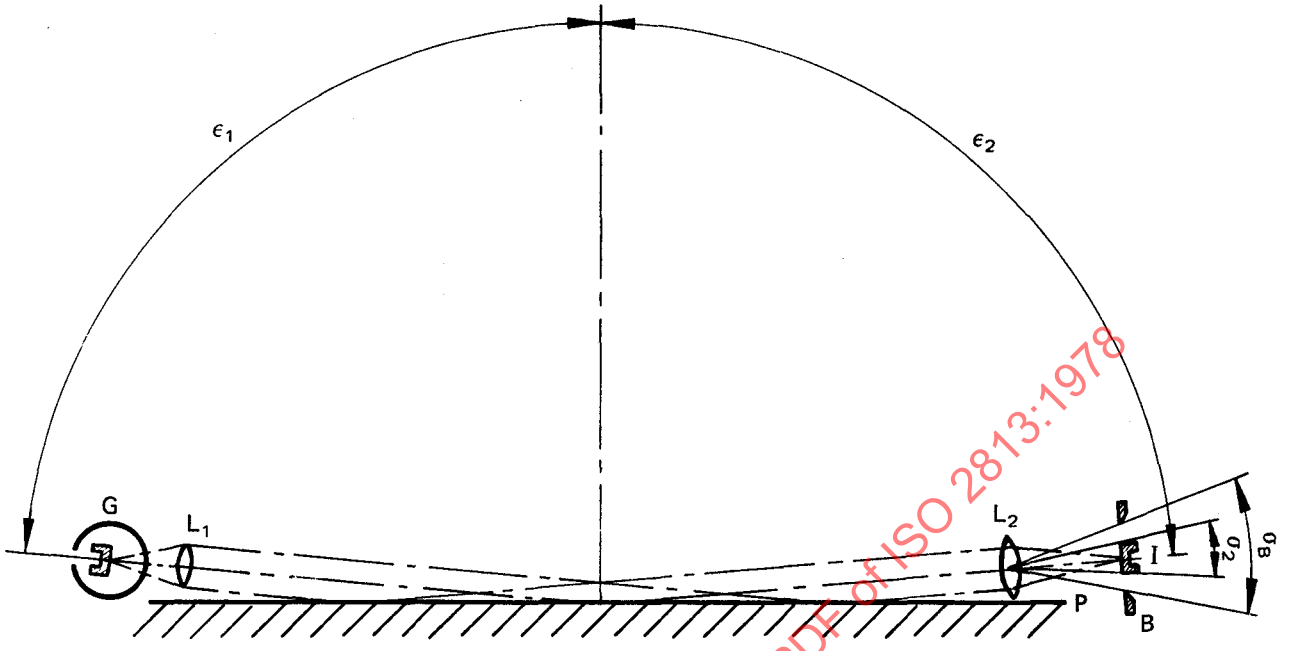
$\epsilon_1 = \epsilon_2 = 20 \pm 0{,}5°$

σ_B = receptor aperture angle = $1{,}80 \pm 0{,}05°$

σ_2 = source image angle = $0{,}75 \pm 0{,}25°$

I = image of filament

FIGURE 2 — **Generalized dimensions of the 20° glossmeter**



G = lamp

L_1 and L_2 = lens

B = receptor field stop

P = paint film

$\epsilon_1 = \epsilon_2 = 85 \pm 0{,}1°$

σ_B = receptor aperture angle = $4{,}0 \pm 0{,}3°$

σ_2 = source image angle = $0{,}75 \pm 0{,}25°$

I = image of filament

FIGURE 3 – **Generalized dimensions of the 85° glossmeter**

3.4 Standards

a) **Primary standards.** The primary standard shall be either highly polished black glass or clear glass with back and edges roughned and coated with black paint, the top surface being plane to within two fringes per centimetre, as measured by optical interference methods. It is not intended that the primary standard should be used for the daily calibration of glossmeters.

1) 60° gloss

Glass of refractive index $n_D = 1{,}567$ shall be assigned a specular gloss value of 100. If 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 primary standard.

2) 20° gloss

Glass of refractive index $n_D = 1{,}567$ shall be assigned a specular gloss value of 100. If 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 0,27 for each 0,001 departure from the standard value. For example, for glass of refractive index 1,523, the assigned value would be 88,1. The refractive index shall be indicated on the primary standard.

3) 85° gloss

Glass of refractive index $n_D = 1{,}567$ shall be assigned a specular gloss value of 100. If 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 0,016 for each 0,001 departure from the standard value. For example, for glass of refractive index 1,523, the assigned value would be 99,3. The refractive index shall be indicated on the primary standard.