
**Paper and board — Measurement of
specular gloss —**

**Part 2:
75° gloss with a parallel beam, DIN
method**

iTeh STANDARD PREVIEW
Papiers et cartons — Mesurage du brillant spéculaire —
(standards.iteh.ai) Partie 2: Brillant à 75° avec un faisceau parallèle, méthode DIN

ISO 8254-2:2003

<https://standards.iteh.ai/catalog/standards/sist/10d8b92a-524e-43f7-a8c5-ca9b6fb2c478/iso-8254-2-2003>



PDF disclaimer

This PDF file may contain embedded typefaces. In accordance with Adobe's licensing policy, this file may be printed or viewed but shall not be edited unless the typefaces which are embedded are licensed to and installed on the computer performing the editing. In downloading this file, parties accept therein the responsibility of not infringing Adobe's licensing policy. The ISO Central Secretariat accepts no liability in this area.

Adobe is a trademark of Adobe Systems Incorporated.

Details of the software products used to create this PDF file can be found in the General Info relative to the file; the PDF-creation parameters were optimized for printing. Every care has been taken to ensure that the file is suitable for use by ISO member bodies. In the unlikely event that a problem relating to it is found, please inform the Central Secretariat at the address given below.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

ISO 8254-2:2003

<https://standards.iteh.ai/catalog/standards/sist/10d8b92a-524e-43f7-a8c5-ca9b6fb2c478/iso-8254-2-2003>

© ISO 2003

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

Published in Switzerland

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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this part of ISO 8254 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 8254-2 was prepared by the European Committee for Standardization (CEN) in collaboration with Technical Committee ISO/TC 6, *Paper, board and pulps*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

Throughout the text of this document, read "...this European Standard..." to mean "...this International Standard...".

ISO 8254 consists of the following parts, under the general title *Paper and board — Measurement of specular gloss*:

- *Part 1: 75° gloss with a converging beam, TAPPI method*
- *Part 2: 75° gloss with a parallel beam, DIN method*
- *Part 3: 20° gloss*

Annex A forms a normative part of this part of ISO 8254. Annex B is for information only.

Contents

Foreword.....	v
Introduction	1
1 Scope	1
2 Normative references	1
3 Terms and definitions.....	2
4 Principle	2
5 Equipment.....	2
5.1 Reflectometer	2
5.2 Gloss standards.....	2
5.2.1 Zero-gloss standards	3
5.2.2 Primary gloss standards.....	3
5.2.3 Working standards	3
5.2.4 Intermediate gloss standards.....	3
6 Sampling.....	4
7 Preparation of test pieces.....	4
7.1 Conditioning.....	4
7.2 Preparation	4
8 Procedure	5
8.1 Calibration	5
8.2 Determination of reflectometer value.....	5
8.3 Calculation and expression of results.....	5
9 Test report	6
Annex A (normative) Description of the instrument.....	7
A.1 Design of the reflectometer value	7
A.2 Properties of the reflectometer.....	9
A.2.1 Dimensions and tolerances of angles	10
A.2.2 Spectral adaptation.....	10
A.2.3 Linearity and drift to display.....	11
A.2.4 Polarization.....	11
A.3 Test piece-holding device.....	11
Annex B (informative) Nominated organizations for calibration of intermediate gloss standards	12
Annex C (informative) Bibliography	13

iTeH STANDARD PREVIEW
(standards.iteh.ai)

ISO 8254-2:2003

<https://standards.iteh.ai/catalog/standards/sist/10d8b92a-524e-43f7-a8c5-9b6fb2c478/iso-8254-2-2003>

Foreword

This document (EN ISO 8254-2:2003) has been prepared by Technical Committee CEN /TC 172, "Pulp, paper and board", the secretariat of which is held by DIN, in collaboration with Technical Committee ISO/TC 6 "Paper, board and pulps".

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 July 2003, and conflicting national standards shall be withdrawn at the latest by July 2003.

This Standard contains the following parts:

- Part 1: 75° gloss with a converging beam, TAPPI method
- Part 2: 75° gloss with a parallel beam, DIN method
- Part 3: 20° gloss

In addition, CEN has developed the European Standard EN 14086 "Paper and board - Measurement of specular gloss - 45° gloss with a parallel beam, DIN-method.

The European Standard EN 14086 and the International Standard ISO/DIS 8254-3 are intended for use with high gloss papers.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and the United Kingdom.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

ISO 8254-2:2003

<https://standards.iteh.ai/catalog/standards/sist/10d8b92a-524e-43f7-a8c5-ca9b6fb2c478/iso-8254-2-2003>

Introduction

Visual gloss is a sensory impression which cannot yet be described completely. Some important physical variables which influence gloss are however known. The sensory perception of gloss under a suitable illumination results from a physical stimulus due to reflection of light from a surface. This reflection is defined by an indicatrix which changes with the angle of incidence. The maximum indicatrix value which is decisive for visual gloss impression is associated with specular reflection, at an angle of reflection which is approximately equal to the angle of incidence. The reflectometer value is determined by averaging the reflection in a defined angular region centered in the specular direction.

NOTE 1 A reflectometer value is a measure of the visual gloss only when the optical conditions of measurement, such as angles and apertures of illumination and observation are similar to the conditions of viewing.

NOTE 2 Because luminance and structure enter to some extent into the reflectometer value of the test piece, only the comparison of test pieces with nearly the same luminance and structure is meaningful. The influence of luminance on the measurement result decreases rapidly with increasing reflectometer value and increasing angle of reflection.

The proportion of specular reflection in the entire reflection increases with increasing angle of incidence. Very matt surfaces generate a noticeable degree of specular reflection and, therefore, a noticeable gloss effect only above a certain minimum angle of incidence. On the other hand, a large angle of incidence reduces the ability to differentiate between surfaces of high gloss.

NOTE 3 Manufacturers of coated papers usually divide their products into two classes, according to their surface gloss: matt coating and gloss coating. However, these classes are only defined approximately. The matt class has reflectometer values, measured according to this European Standard, from 0 to approximately 20. The glossy class has reflectometer values higher than this value. As there is no precise correlation between reflectometer values measured with different geometries, it is advisable to compare the reflectometer values only within a single class of papers and using the same measuring geometry.

This European Standard describes measurement at an angle of incidence of 75° using a parallel beam geometry commonly known as the 75° DIN method. A second European Standard describes measurement at an angle of 45° (see EN 14086).

1 Scope

This European Standard specifies a photometric test method for the assessment of visual gloss by means of a reflectometer value measured at an angle of 75°. It is applicable to plane paper and board surfaces of gloss levels below 65, measured according to this European Standard. It should be the preferred method for paper and board surfaces of gloss levels below 20, measured according to this European Standard. Materials containing optical brightening agents may be measured.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text, and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

CIE-Publication No. 38, *Radiometric and photometric characteristics*.

EN ISO 186, *Paper and board — Sampling to determine average quality (ISO 186:1994)*.

EN 20187, *Paper, board and pulps — Standard atmosphere for conditioning and testing and procedure for monitoring the atmosphere and conditioning of samples (ISO 187:1990)*.

ISO 10110-5, *Optic and optical instruments — Preparation of drawings for optical elements and systems — Part 5: Surface form tolerances..*

3 Terms and definitions

For the purposes of this part of ISO 8254, the following terms and definitions apply.

3.1

indicatrix

angular distribution of the reflected light which is measured as illuminance on the receptor.

3.2

reflectometer

instrument for measuring quantities pertaining to reflection of light.

3.3

reflectometer value

measured variable which, for a given angle of incidence, is proportional to the integral of the reflection indicatrix within the solid angle defined by the apertures (see Annex A.2.1) and is equal to 100 times the ratio of the value obtained for the sample to that of a defined specularly reflecting surface (5.2.2).

3.4

specular gloss

reflectometer value as defined in 3.3.

[ISO 8254-2:2003](https://standards.iteh.ai/catalog/standards/sist/10d8b92a-524e-43f7-a8c5-10001177ba05/iso-8254-2-2003)

<https://standards.iteh.ai/catalog/standards/sist/10d8b92a-524e-43f7-a8c5-10001177ba05/iso-8254-2-2003>

NOTE 1 The defined specularly reflecting surface thus has an assigned reflectometer value of 100. Reflectometer values are therefore not percentages.

NOTE 2 These definitions are based on definitions in CIE-Publication No. 17.4.

4 Principle

The sample is illuminated with a collimated beam at an angle of 75 ° to the normal, and the reflectometer value is measured within a solid angle defined by a given aperture at an angle of reflection equal to the angle of incidence. The scale of the reflectometer is calibrated with reference to the reflection from a black glass plate or a quartz wedge with a specific refractive index.

5 Equipment

5.1 Reflectometer

The reflectometer shall consist of the following principal components: a collimator, a decollimator, an electric supply for the light source device, a photoelectronic receptor and a sample holder, as described in annex A.

5.2 Gloss standards

The reflectometer is calibrated by means of a zero-gloss standard and a high gloss standard with a reflectometer value between about 80 and 100. This high gloss standard can be either a primary gloss standard or a working gloss standard.

Intermediate gloss standards with assigned reflectometer values are used to check the adjustment of the device.

NOTE As reflectometer values of gloss standards may change due to environmental influences, they should be checked at least once per year.

5.2.1 Zero-gloss standards

A zero-gloss standard is a gloss standard which, in the ideal case, absorbs all light falling on it. A black cavity lined with black velvet or felt is one realisation of such a gloss standard that has been proven in practice.

5.2.2 Primary gloss standards

A primary gloss standard is a gloss standard whose reflectometer value can be calculated by means of its refractive index using the Fresnel equation. The reflectometer value is defined as being equal to 100 for a black glass plate or a fused quartz wedge with a nominal refractive index of $n = 1,567$ at a wavelength of 587,6 nm (He-d-line). A black glass plate or quartz wedge with a refractive index at a wavelength of 587,6 nm (see ISO 7944) known to 3 decimal places can be used as primary gloss standard. The top surface of the glass plate or quartz wedge shall be plane to within 2 fringes per centimetre as measured by an optical interference method in a wavelength region of (600 ± 100) nm according to ISO 10110-5. If the refractive index n differs from 1,567, the reflectometer value R shall be calculated as:

$$R = 100 \cdot K \quad (1)$$

where

$$K(n, \epsilon_1) = \frac{\left[\frac{n^2 \cos \epsilon_1 - (n^2 - \sin^2 \epsilon_1)^{1/2}}{n^2 \cos \epsilon_1 + (n^2 - \sin^2 \epsilon_1)^{1/2}} \right]^2 + \left[\frac{(n^2 - \sin^2 \epsilon_1)^{1/2} - \cos \epsilon_1}{(n^2 - \sin^2 \epsilon_1)^{1/2} + \cos \epsilon_1} \right]^2}{\left[\frac{1,567^2 \cos \epsilon_1 - (1,567^2 - \sin^2 \epsilon_1)^{1/2}}{1,567^2 \cos \epsilon_1 + (1,567^2 - \sin^2 \epsilon_1)^{1/2}} \right]^2 + \left[\frac{(1,567^2 - \sin^2 \epsilon_1)^{1/2} - \cos \epsilon_1}{(1,567^2 - \sin^2 \epsilon_1)^{1/2} + \cos \epsilon_1} \right]^2} \quad (2)$$

For $\epsilon_1 = 75^\circ$:

$$K(n, 75^\circ) = 1,890 \cdot \left[\left[\frac{0,2588 \cdot n^2 - (n^2 - 0,9330)^{1/2}}{0,2588 \cdot n^2 + (n^2 - 0,9330)^{1/2}} \right]^2 + \left[\frac{(n^2 - 0,9330)^{1/2} - 0,2588}{(n^2 - 0,9330)^{1/2} + 0,2588} \right]^2 \right] \quad (3)$$

NOTE It is recommended that the refractive index be defined by means of the critical angle of total reflection, i. e. by means of an Abbé refractometer.

5.2.3 Working standards

Any clean non-fluorescent flat surface, which has a reflectometer value between 80 and 100, can be used as a working gloss standard. Care has to be taken to ensure that only a negligible reflection from the reverse side of the gloss standard can reach the surface which is measured. This can be achieved by giving the gloss standard the shape of a wedge, or making it opaque. The surface which is not measured should be matt. A reflectometer system conforming to the description given in annex A must be used to establish the relationship with the primary gloss standard. When the gloss standard is measured in two perpendicular directions and in the directions of their diagonals, the difference shall not be more than ± 1 unit. If this is not the case, the reflectometer value of the working gloss standard must be assigned only for a particular direction of the incident light radiation and the working gloss standard must be used only in that direction.

5.2.4 Intermediate gloss standards

Intermediate gloss standards are gloss standards with assigned reflectometer values between 0 and 100 and which are calibrated by technically competent organisations.

For the purpose of this European Standard, an intermediate gloss standard with an assigned reflectometer value of about 20 is required.

NOTE 1 The surfaces of gloss standards should not be touched with hard instruments, as this can damage the surface. Gloss standards are generally put against the sample port of the reflectometer. Measurements should always be made at the same position on the gloss standard. If the sample port of the reflectometer is located at this place, any damage will be avoided. Gloss standards should be cleaned very carefully with a soft cloth to avoid surface deterioration.

NOTE 2 As reflectometer values of gloss standards may change due to environmental influence, they should be checked once per year.

NOTE 3 An organisation capable of calibrating gloss standards is listed in annex B.

6 Sampling

Sampling is not included in this European Standard. If the mean quality of a lot is to be determined, sampling shall be in accordance with EN ISO 186. If the tests are made on an other type of sample, make sure that the test pieces are representative of the sample received.

7 Preparation of test pieces

7.1 Conditioning

iTeh STANDARD PREVIEW

(standards.iteh.ai)

Condition the samples at 23°C and 50 % r.h. according to EN 20187 and keep them in this climate throughout the test.

[ISO 8254-2:2003](#)

7.2 Preparation

<https://standards.iteh.ai/catalog/standards/sist/10d8b92a-524e-43f7-a8c5-ca9b6fb2c478/iso-8254-2-2003>

Prepare test pieces, ensuring that they are free from any scratches, dust, folds or other damage. For each side of the paper to be tested, cut at least five test pieces. The surface to be measured must not be touched by hand.

If the measurement field area (see annex A.1) is less than 100 mm², the minimum number of test pieces shall be increased. In that case, the minimum number of test pieces is determined as:

$$N = 5 \cdot \frac{100}{A} \tag{4}$$

where

A is the actual measurement area in mm²;

N is the minimum number of test pieces rounded to the next higher integer.

8 Procedure

8.1 Calibration

8.1.1 Place the zero-gloss standard (5.2.1) against the test piece port of the instrument. Adjust the reflectometer value to $0,0 \pm 0,1$ scale unit by means of the zero adjustment device.

8.1.2 Place the primary gloss standard (5.2.2) or a working standard (5.2.3) against the test piece port of the instrument. Adjust the reflectometer value by means of the calibration device so that the scale reading agrees with the value assigned to the primary gloss standard or the working gloss standard.

8.1.3 Place an intermediate gloss standard with a reflectometer value of about 20 (5.2.4) against the port of the reflectometer. Check that the reflectometer value agrees to within 0,5 reflectometer unit with the value assigned to the gloss standard.

If the reflectometer value does not agree with the assigned value within the given limits, no measurements may be made in accordance with this European Standard until the fault is remedied.

NOTE Possible sources of error are:

- the optical system of the reflectometer does not conform to this European Standard;
- the instrument scale is not linear;
- the intermediate gloss standard has deteriorated.

8.1.4 Check the calibration sufficiently frequently to ensure the stability of the instrument.

8.2 Determination of reflectometer value

Using the test piece holding device (see A.3), place the test piece against the sample port so that its surface is absolutely flat in the illuminated field. The illuminated field shall be free from any surface irregularities.

On each test piece make four measurements, one in each of the four directions in the plane of the paper. This means that two measurements shall be made with the incidence plane parallel to the machine direction and two measurements with the incidence plane perpendicular to the machine direction. In each of these pairs of measurements, the second measurement is made at an angle of 180° to the first measurement. Make the four measurements at different positions on each test piece, but make sure that each measurement is made at a position where the paper surface has not been damaged by a previous measurement. If the reverse side is to be measured, make measurements on new test pieces.

8.3 Calculation and expression of results

Calculate the mean reflectometer value and the standard deviation to one decimal place for each measured side of the material.

If required, calculate the mean reflectometer value and the standard deviation to one decimal place in the machine direction and cross direction separately.