INTERNATIONAL STANDARD

ISO 15397

First edition
2014-02-01

Graphic technology — Communication of graphic paper properties

Technologie graphique — Communication des propriétés des papiers graphiques

Reference number
ISO 15397:2014(E)

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Published in Switzerland

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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.

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 International Standard was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

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 130, *Graphic technology*.

Introduction

This International Standard is intended to improve communication between the graphic papermaking industry and the printing industry based on their need to be able to produce quality printing. Paper properties and their measurement are presented and their use in the printing context is described.

This International Standard describes data to be provided for reliable printing. A substrate description can be assessed to be in conformance with this International Standard, not a substrate itself.

Printing press settings depend on paper grade, and several paper properties are required in order to define a grade.

Paper measurement standards developed within ISO/TC 6 are referenced in this International Standard. They were mainly used to develop paper industry test methods and allow the papermaking processes to be reproducible and reliable within paper mills. It is advisable that paper purchasing specifications be based on paper industry standards. This recommendation also applies to paper proofing substrates. Special requirements for paper substrates for the reliable production of printed products need to be communicated on the basis of standards developed by ISO/TC 6 whenever possible.

The evaluation of colour of the unprinted paper is critical to define prepress white point settings. This measurement can be performed with either diffuse:0° integrating sphere instruments (papermakers' equipment) or 45°:0° instruments (printers' equipment). Results are often close if the UV calibration is performed correctly. This International Standard specifies 45°:0° instruments (printers' equipment) to perform this evaluation as per ISO 13655, because of their wide availability at printers' facilities.

For the evaluation of printed colours, measurement devices are developed according to ISO 13655 which differ from the colour measurement devices which conform to ISO 2469 and ISO 5631-1, ISO 5631-2 and ISO 5631-3. The latter type of instrument is used within paper mills for quality evaluation during paper manufacturing and unprinted paper colour evaluation.

Properties linked to the printing process (e.g. dimensions, blistering and picking resistance in offset, missing dots in gravure) are not described in this International Standard, since they are implicitly needed when purchasing the paper meant for this printing process.

Properties that are not based on ISO standards are not described here.

The bibliography lists basic references in graphic technology standards,[1][2] Paper and board standards,[3] previously published references,[4] commercial classifications,[5] conditions of sale,[6] and reference lists of printing characterization data publicly available.[8]

Graphic technology — Communication of graphic paper properties

1 Scope

This International Standard specifies the list of relevant properties of paper substrates to be communicated between the paper and printing industries.

This International Standard is applicable to papers intended to be printed in rotogravure, cold-set web offset, heat-set web offset, sheet-fed offset, and flexographic printing processes and to proofing substrates.

Where multiple methods exist, the preferred procedure and its International Standard are specified.

All methods for measuring of properties specified in this International Standard are described in other ISO Standards.

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 187, *Paper, board and pulps — Standard atmosphere for conditioning and testing and procedure for monitoring the atmosphere and conditioning of samples*

ISO 534, *Paper and board — Determination of thickness, density and specific volume*

ISO 536, *Paper and board — Determination of grammage*

ISO 2470-1, *Paper, board and pulps — Measurement of diffuse blue reflectance factor — Part 1: Indoor daylight conditions (ISO brightness)*

ISO 2470-2, *Paper, board and pulps — Measurement of diffuse blue reflectance factor — Part 2: Outdoor daylight conditions (D65 brightness)*

ISO 2471, *Paper and board — Determination of opacity (paper backing) — Diffuse reflectance method*

ISO 2493-1, *Paper and board — Determination of bending resistance — Part 1: Constant rate of deflection*

ISO 2813, *Paints and varnishes — Determination of specular gloss of non-metallic paint films at 20 degrees, 60 degrees and 85 degrees*

ISO 5627, *Paper and board — Determination of smoothness (Bekk method)*

ISO 5631-2, *Paper and board — Determination of colour by diffuse reflectance — Part 2: Outdoor daylight conditions (D65/10 degrees)*

ISO 8254-1, *Paper and board — Measurement of specular gloss — Part 1: 75 degree gloss with a converging beam, TAPPI method*

ISO 8254-2, *Paper and board — Measurement of specular gloss — Part 2: 75 degree gloss with a parallel beam, DIN method*

ISO 8254-3, *Paper and board — Measurement of specular gloss — Part 3: 20 degree gloss with a converging beam, TAPPI method*

ISO 8791-2, *Paper and board — Determination of roughness/smoothness (air leak methods) — Part 2: Bendtsen method*

ISO 8791-4, *Paper and board — Determination of roughness/smoothness (air leak methods) — Part 4: Print-surf method*

ISO 11475, *Paper and board — Determination of CIE whiteness, D65/10 degrees (outdoor daylight)*

ISO 11476, *Paper and board — Determination of CIE whiteness, C/2 degrees (indoor illumination conditions)*

ISO 12647-7, *Graphic technology — Process control for the production of half-tone colour separations, proof and production prints — Part 7: Proofing processes working directly from digital data*

ISO 13655, *Graphic technology — Spectral measurement and colorimetric computation for graphic arts images*

3 Terms and definitions

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

3.1
grammage
basis weight
mass of a unit paper area, expressed in grams per square metre

[SOURCE: ISO 536:2012, 3.1, modified]

3.2
single sheet thickness
distance between one surface of a paper and the other, measured under an applied static load

Note 1 to entry: This term is most commonly used for paper thickness.

[SOURCE: ISO 534:2011, 3.1, modified]

3.3
bulking thickness
thickness of a single sheet of paper, calculated from the thickness of several superimposed sheets in a pack, and measured under an applied static load

[SOURCE: ISO 534:2011, 3.2, modified]

3.4
apparent sheet density
mass per unit volume, expressed in grams per cubic centimetre, and calculated from the single sheet thickness

[SOURCE: ISO 534:2011, 3.3]

3.5
apparent bulk density
mass per unit volume, expressed in grams per cubic centimetre, and calculated from the bulking thickness

[SOURCE: ISO 534:2011, 3.4]

3.6
apparent specific sheet volume
volume per unit mass, expressed in cubic centimetres per gram, and calculated from the single sheet thickness

Note 1 to entry: This term is normally applicable to paper and most commonly calculated for paper bulk.

[SOURCE: ISO 534:2011, 3.5]

3.7
apparent specific bulk volume
volume per unit mass, expressed in cubic centimetres per gram, and calculated from the bulking thickness

[SOURCE: ISO 534:2011, 3.6]

3.8
Parker Print-Surf roughness
PPS
mean gap between a sheet of paper or board and a flat circular land pressed against it under specified conditions

Note 1 to entry: It is expressed in micrometres and calculated based on the airflow between the measuring land and the test piece.

[SOURCE: ISO 8791-4:2007, 3.1, modified]

3.9.1
Bendtsen roughness
measure of the rate at which air will pass between a flat circular land and a sheet of paper, when tested under specified conditions and at operating pressure

Note 1 to entry: It is expressed in millilitres per minute.

[SOURCE: ISO 8791-2:2013, 3.1, modified]

3.9.2
Bekk smoothness
time in seconds which, under a defined pressure differential, is required to draw a definite quantity of air at atmospheric pressure between the surface of the test piece and a ring-shaped plane surface, under specified conditions of contact

[SOURCE: ISO 5627:1995, 3.1]

3.10
gloss
mode of appearance by which reflected highlights of objects are perceived as superimposed on the surface due to the directionally selective properties of that surface

[SOURCE: ISO 8254-1:2009, 3.1]

3.11
opacity (paper backing)
ratio of the single-sheet luminance factor (C), R_0, to the intrinsic luminance factor (C), R_∞, of the same sample

Note 1 to entry: Opacity is expressed as a percentage.

Note 2 to entry: Luminance factor (C): (luminous reflectance factor or Y(C/2°)-value or R_y) is reflectance factor or radiance factor defined with reference to the CIE illuminant C.

Note 3 to entry: Single-sheet luminance factor (C) R0, is luminance factor (C) of a single sheet of paper with a black cavity as backing. Intrinsic luminance factor (C) R∞, is luminance factor (C) of a layer or pad of material thick enough to be opaque, i.e. such that increasing the thickness of the pad by doubling the number of sheets results in no change in the measured reflectance factor.

[SOURCE: ISO 2471:2008, 3.5, modified]

3.12
ISO brightness
R_{457}
intrinsic radiance (reflectance) factor measured with a reflectometer having the characteristics described in ISO 2469, equipped with a filter or corresponding function having an effective wavelength of 457 nm and a half bandwidth of 44 nm, and adjusted so that the UV content of the irradiation incident upon the test piece corresponds to that of the CIE illuminant C

Note 1 to entry: Brightness measures the paper's ability to reflect light within a specific wavelength of blue, ignoring shade.

[SOURCE: ISO 2470-1:2009, 3.4]

3.13
D65 brightness
$R_{457,\,D65}$
intrinsic radiance (reflectance) factor measured with a reflectometer having the characteristics described in ISO 2469, equipped with a filter or corresponding function having an effective wavelength of 457 nm and a half-peak bandwidth of 44 nm, and adjusted so that the UV content of the irradiation incident upon the test piece corresponds to that of the CIE standard illuminant D65

Note 1 to entry: Brightness measures the paper's ability to reflect light within a specific wavelength of blue, ignoring shade.

[SOURCE: ISO 2470-2:2008, 3.4]

3.14
CIE whiteness, C/2° indoor illumination conditions

$W_{C/2}$
measure of whiteness derived from the CIE tristimulus values under standard illuminant C, expressed as whiteness units

[SOURCE: ISO 11476:2010, 3.5, modified]

3.15
CIE whiteness, D65/10° outdoor daylight
$W_{D65/10}$
measure of whiteness derived from the CIE tristimulus values under standard illuminant D65, expressed as whiteness units

Note 1 to entry: Whiteness measures the paper's ability to reflect light across wavelengths comprising the full visible spectrum. It gives single figure information, including both luminance and shade and is therefore increasingly replacing brightness as first criterion of quality.

Note 2 to entry: The CIE whiteness equation defines a line along the dominant wavelength 425 nm in the CIE chromaticity diagram along which the whiteness increases the most. This equation has thus a preference towards red. It is important to note that the equation is only valid within a relative narrow interval of the colour space.

[SOURCE: ISO 11475:2004, 3.4, modified]

3.16
fluorescence component
measure of the extent to which the whiteness of the material is affected by excitation of the added fluorescent whitening agent (FWA) or optical brightening agent (OBA)

[SOURCE: ISO 11476:2010, 3.7, modified]

Note 1 to entry: Fluorescent whitening agents (FWA) are also called optical brightening agents (OBA)

Note 2 to entry: Fluorescence component is calculated as the difference between the whiteness/brightness measured with a source of light having a UV-content corresponding to the chosen illuminant and the whiteness/brightness measured with a source without radiation in the UV excitation band.

Note 3 to entry: Fluorescence component measured with Brightness and D65 illuminant is most widely used with notation $F_{B, D65}$

3.17
CIELAB colour space and CIELAB values
three-dimensional, approximately uniform colour space, produced by plotting, in rectangular coordinates L*, a*, b*

Note 1 to entry: The quantity L* is a measure of the lightness, where L* = 0 corresponds to black and L* = 100 corresponds to the perfect reflecting diffuser. Visually, the quantities a* and b* represent respectively the red-green and yellow-blue axes in colour space, such that:

— +a* is a measure of the degree of redness;

— −a* is a measure of the degree of greenness;

— +b* is a measure of the degree of yellowness;

— −b* is a measure of the degree of blueness.

If both a* and b* are equal to zero, the test piece is grey.

[SOURCE: ISO 5631-2:2008, 3.6, modified]

3.18
bending resistance
force required to bend a rectangular test piece clamped at one end through a given angle

[SOURCE: ISO 2493-1:2010, 3.1 and 3.2, modified]

Note 1 to entry: Bending stiffness is the resistance that a test piece offers to bend, in the region of elastic deformation, as described in ISO 5628:2012, 3.1.

4 List of required criteria for communication of paper properties

When communicating the characteristics of printing papers, the intended use or printing process shall be identified and the following data with target values shall be used.

a) Brand name and optionally paper mill (as per 5.2).

b) Grammage (as per 5.3).

c) Bulk and/or thickness (as per 5.4).

d) Roughness PPS (Parker-Print Surf) or roughness Bendtsen or smoothness Bekk (as per 5.5).

For Rotogravure substrates, only roughness PPS is meaningful, values being usually below 3. When roughness PPS values are above 3, the use of roughness Bendtsen is recommended. When roughness Bendtsen is below 100, smoothness Bekk may be used, in particular in smooth writing papers.

e) Gloss value and for proofing substrates characterization according to ISO 12647-7 (“glossy”, “semi-matte” or “matte”) (as per 5.6).

The gloss level and the equipment used will determine the standard to be used. That standard shall therefore be cited when communicating gloss values.

NOTE 1 ISO 12647-7 characterizes proofing substrates measured according to ISO 8254-1 as “glossy” for values larger or equal to 60, as “matte” for values smaller or equal to 20 and “semi matte” in between.