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Graphic technology - Process control for the production of half-tone colour separations, proof and production prints - Part 8: Validation print processes working directly from digital data

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Technologie graphique - Contrôle des processus de confection de sélections couleurs tramées, d'épreuves et de tirages - Partie 8: Processus d'impression de maquette couleur produite à partir de données numériques

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Part 8: Validation print processes working directly from digital data

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ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

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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 document 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 of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

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This document was prepared by Technical Committee ISO/TC 130, *Graphic technology*.

This second edition cancels and replaces the first edition (ISO 12647-8:2012), which has been technically revised.

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The main changes compared to the previous edition are as follows:

— CIE 1976 ΔE^*_{ab} has been replaced with modern ΔE_{00} colour difference formulae;

— a better metric for uniformity assessment, namely the measurement of 1D distortions of macroscopic uniformity utilizing scanning spectrophotometers, has been added;

— a more content oriented control wedge has been added;

— a new Annex A has been added to align the content with ISO 12647-7, with respect to substrate categorisation and conformance assessment;

— informative metrics that proved to be not practical, such as tonality, have been deleted.

A list of all parts in the ISO 12647 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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Introduction

This document specifies the properties, and associated test methods, required for digital prints and printing processes to meet the criteria established for “validation prints”.

In most printing workflows, there is a requirement for a visual representation of the expected appearance of the document being printed that can be used as part of the agreement between customer and printer. Where this visual representation is produced such that its characteristics (colour fidelity, tone reproduction, registration, size, etc.) simulate those of the expected printing within tight tolerances, it is usually referred to as a “contract proof”. As the name implies, contract proofs are used as part of the contractual relationship between customer and printer and are used as a visual aim for the press operator during printing as well as the absolute reference against which the finished production is compared. Not unexpectedly, systems that can produce contract proofs are usually expensive and require careful operation and maintenance. ISO 12647-7 specifies the requirements for contract proofs and systems used to produce contract proofs directly from digital data.

Recently, other visualizations of the final printed product have found a place in the printing/proofing workflow because designers and print buyers prefer not to go to the expense of using an ISO 12647-7 compliant contract proof any earlier in the process than necessary. In many situations, participants in the workflow require a hardcopy visual reference of lesser quality than a contract proof. In the past, those prints varied widely in quality and were often referred to as design proofs, concept proofs, layout prints, etc. That quality level is here being referred to as a “validation print”.

Because data are exchanged electronically, and visualizations of those data are produced at multiple sites, there is a requirement for defined requirements for validation prints to allow a degree of consistency throughout the workflow. One of the goals of having less stringent requirements, particularly on colour fidelity, is to allow the production of validation prints on less elaborate and less costly devices than are required for contract proofs. The requirements for validation prints and the systems used to produce validation prints are given in this document.

Validation prints are not intended to replace “contract proofs” for predicting colour on production printing devices. It is expected that the modifications of the requirements for validation prints, along with the requirements for contract proofs, will continue in the future as industry requirements and imaging technologies develop.

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Graphic technology — Process control for the production of half-tone colour separations, proof and production prints —

Part 8:
Validation print processes working directly from digital data

IMPORTANT — This document contains colours which are considered to be useful for the correct understanding of the document. Users should therefore consider printing this document using a colour printer.

1 Scope

This document specifies requirements that can be used for determining the conformance of systems that produce a hard-copy validation print, directly from digital data, which is intended to simulate the expected appearance of material printed in accordance with a characterized printing condition.

It is not intended for use in determining the conformance of production printing systems (digital or conventional) since many aspects of production printing are not covered in this document.

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2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. 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 2813, *Paints and varnishes — Determination of gloss value at 20°, 60° and 85°*

ISO 3664, *Graphic technology and photography — Viewing conditions*

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

ISO 12040, *Graphic technology — Prints and printing inks — Assessment of light fastness using filtered xenon arc light*

ISO 12640-1, *Graphic technology — Prepress digital data exchange — Part 1: CMYK standard colour image data (CMYK/SCID)*

ISO 12642-2, *Graphic technology — Input data for characterization of 4-colour process printing — Part 2: Expanded data set*

ISO 12647-1, *Graphic technology — Process control for the production of half-tone colour separations, proof and production prints — Part 1: Parameters and measurement methods*

ISO 13655:2016, *Graphic technology — Spectral measurement and colorimetric computation for graphic arts images*

ISO 15397:2014, *Graphic technology — Communication of graphic paper properties*

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ISO 15930-1, *Graphic technology — Prepress digital data exchange — Use of PDF — Part 1: Complete exchange using CMYK data (PDF/X-1 and PDF/X-1a)*

ISO 15930-4, *Graphic technology — Prepress digital data exchange using PDF — Part 4: Complete exchange of CMYK and spot colour printing data using PDF 1.4 (PDF/X-1a)*

ISO 15930-6, *Graphic technology — Prepress digital data exchange using PDF — Part 6: Complete exchange of printing data suitable for colour-managed workflows using PDF 1.4 (PDF/X-3)*

ISO 15930-7, *Graphic technology — Prepress digital data exchange using PDF — Part 7: Complete exchange of printing data (PDF/X-4) and partial exchange of printing data with external profile reference (PDF/X-4p) using PDF 1.6*

ISO 15930-8, *Graphic technology — Prepress digital data exchange using PDF — Part 8: Partial exchange of printing data using PDF 1.6 (PDF/X-5)*

ISO 15930-9, *Graphic technology — Prepress digital data exchange using PDF — Part 9: Complete exchange of printing data (PDF/X-6) and partial exchange of printing data with external profile reference (PDF/X-6p and PDF/X-6n) using PDF 2.0*

ISO/TS 18621-21, *Graphic technology — Image quality evaluation methods for printed matter — Part 21: Measurement of 1D distortions of macroscopic uniformity utilizing scanning spectrophotometers*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 12647-1 and the following apply.

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ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

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3.1
validation print substrate
substrate used for validation print processes, usually characterized by its light fastness or permanence properties, with only essential requirements dictated by the printing process

3.2
print stabilization period
time after which the print is chemically and physically stable

Note 1 to entry: It is necessary that this property of the validation print system be specified by the manufacturer. It is most important that the print is stable with respect to colour changes.

3.3
validation print
print produced directly from digital data early in the production chain following this document, representative of the concept for the final product

Note 1 to entry: A validation print can have reduced accuracy compared to contract proof.

3.4
production substrate
substrate to be used for production printing, including a substrate originally intended for the validation printing press under test

Note 1 to entry: A production substrate can be a paper with an ink receiving layer or a paper optimized for electrophotographic printing.

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3.5
PDF/X
title of a series of ISO standards regarding the use of the Portable Document Format (PDF) for the dissemination of digital data intended for print reproduction

4 Requirements

4.1 Data requirements for validation print systems

Validation print systems shall accept digital data delivered as PDF/X data files in accordance with one of the conformance levels defined in ISO 15930-1, ISO 15930-4, ISO 15930-6, ISO 15930-7, ISO 15930-8 or ISO 15930-9. Where the digital data is delivered as PDF/X data files, the intended printing condition being simulated shall be that defined in the OutputIntents array of the PDF/X file. Where a profile is required for data conversion, the profile that is the value of the *DestOutputProfile* key in the PDF/X file shall be used. In case of multi primary based printing conditions (e.g. 5C, 6C, 7C or 8C), data should be delivered as PDF/X-5n. Since this is currently not industrial common, the sender and receiver shall agree on the pertinent data exchange.

NOTE There are a number of industry test suites for testing PDF/X conformance such as the Ghent PDF Output Suite 4.0 or 5.0[21] or the Altona Test Suite[23].

4.2 Validation print

4.2.1 Validation print substrate qualification

In an ideal situation, the validation print substrate should be the same as the production substrate. As this ideal situation is seldom possible, the following criteria apply for the validation print substrate.

a) The gloss level of both the printing substrate and validation print substrate should be estimated as one of matte, semi-matte or gloss either by the substrate manufacturer or by measuring as described in 5.6. Matte substrates should not be used to make validation prints for gloss printing substrates and gloss substrates should not be used to make validation prints for matte printing substrates.

b) The white point of the unprinted validation print substrate shall allow a colorimetric match of the substrate of the intended printing condition to be simulated with a colour difference of less than or equal to 3,0 ΔE_{00} units when measured according to ISO 13655.

   To assure a white point match, the validation print substrate should have a CIE L* value that is higher than the substrate of the printing condition to be simulated.

c) The validation print substrate should belong to the same fluorescence classification as the production substrate. Fluorescence classification in four levels of faint, low, moderate, and high shall be made in accordance with the testing procedures described in ISO 15397:2014, 5.12. Additional information is provided in Annex D.

4.2.2 Coloration of printed parts

4.2.2.1 Validation print system within-sheet uniformity

The variability of the coloration across the validation print format shall be verified by printing each of the three test forms described in 5.4. Each test form shall be measured at nine locations on each sheet as follows. Divide the printed area into thirds both horizontally and vertically and measure at the centre of each area. All selected locations across the printed test area for each test tint, after the stabilization period, shall have the following:

a) standard deviation less than or equal to 1,5 for CIE L*, a* and b*;

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b) maximum ΔE_{00} colour difference less than or equal to 2 units between the average of the 9 readings and any one reading.

NOTE The requirements specified in a) and b) are not statistically consistent but have been observed to be achievable in a well-controlled digital printing system.

The uniformity shall also be measured by using the "Macro-Uniformity-Score" method defined in ISO/TS 18621-21, also known as M-Score. Three tone value combinations specified in 5.4 shall be evaluated as the uniformly tinted area. The "Macro-Uniformity-Score" shall be greater than or equal to 50 and should be greater than or equal to 60.

4.2.2.2 Colour simulation requirements for validation prints

The CIELAB colour coordinates of the patches of the ISO 12642-2 target and the validation print control strip defined in 5.2 shall agree with the aim values of the printing condition being simulated as given by the data (see 4.1) within the appropriate tolerances specified in Table 1.

NOTE 1 The colorimetric aim values for all patches are included in, or can be derived from, the colorimetric values of the reference characterization data set.

Table 1 — Tolerances for reproduction of all patches in the validation print[a] by comparison to the values of the characterization data of the printing condition being simulated

Unit: 1

Patch in validation print form	Tolerance
Substrate	$\Delta E_{00} \leq 3{,}0$
All patches described in 5.2 (without the boundary patches)	95th percentile: $\Delta E_{00} \leq 5{,}0$ Average: $\Delta E_{00} \leq 2{,}5$
Patches described in 5.2 c	Average: $\Delta C_h \leq 2{,}5$ Maximum: $\Delta C_h \leq 4{,}0$
Selected surface gamut patches as listed in Annex C (taken from ISO 12642-2)	Average: $\Delta E_{00} \leq 3{,}0$
All patches described in ISO 12642-2[b]	Average: $\Delta E_{00} \leq 2{,}5$ 95th percentile: $\Delta E_{00} \leq 5{,}0$
Spot colours (solids)	$\Delta E_{00} \leq 3{,}5$

[a] Described in Clause 5.

[b] For multicolour reference printing conditions, only the patches in 5.2 shall be used.

These tolerances apply only to conformance of validation prints as defined in A.1 and A.2. They can also be used for validation prints made for a particular printing condition when tested in the field using only a control wedge. They might be inappropriate as tolerances for daily use at production sites due to the increased production costs required to maintain the equipment in this optimum state.

NOTE 2 It is expected that validation printing system can also reproduce solid spot colours, provided that a clear identification by the CIELAB colour or spectral definition such as ISO 17972-4 (CxF/X-4).

NOTE 3 Only when spot colour availability is declared, the declared spot colours are evaluated.

4.2.3 Short- and long-term repeatability

Three validation prints containing at least the primary and CMY secondary colour solids, and primary colour mid-tones shall be produced. There shall be a 1 hour time difference between the production of the first and second print and a one day time difference between the first and third validation print. Recalibration before production of each print is permitted. For each print, measurements shall be made on the first print produced after the vendor-specified stabilization period. The maximum CIEDE2000

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