INTERNATIONAL STANDARD

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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

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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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

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

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 document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 12647-8 was prepared by Technical Committee ISO/TC 130, *Graphic technology.*

ISO 12647 consists of the following parts, under the general title *Graphic technology — Process control for the production of half-tone colour separations, proof and production prints*:

— *Part 1: Parameters and measurement methods*

— *Part 2: Offset lithographic processes*

— *Part 3: Coldset offset lithography on newsprint*

— *Part 4: Publication gravure printing*

— *Part 5: Screen printing*

— *Part 6: Flexographic printing*

— *Part 7: Proofing processes working directly from digital data*

— *Part 8: Validation print processes working directly from digital data*

Introduction

This part of ISO 12647 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 the 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 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 work flow 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 documented in this part of ISO 12647.

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.

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 — The electronic file of 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 part of ISO 12647 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 part of ISO 12647.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the reference document (including any amendments) applies.

ISO 3664:2009, *Graphic technology and photography — Viewing conditions*

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

ISO 12639, *Graphic technology — Prepress digital data exchange — Tag image file format for image technology (TIFF/IT)*

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

ISO 12640-1:1997, *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 13655:2009, *Graphic technology — Spectral measurement and colorimetric computation of graphic arts images*

3 Terms and definitions

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

3.1
validation print substrate
printing substrate used for validation print processes

NOTE A validation print substrate is usually characterized by its light fastness or permanence properties, with only essential requirements dictated by the printing process.

3.2
ICC
International Color Consortium

3.3
print stabilization period
time after which the colour does not change anymore

NOTE It is necessary that this property of the validation print system be specified by the manufacturer.

3.4
digital contract proof
digital print of high colour accuracy, useable as reliable visual colour reference for printing, and as a part of a commercial agreement as defined in ISO 12647-7

3.5
validation print
print produced directly from digital data early in the production chain meeting the requirements of this part of ISO 12647 representative of the concept for the final product

NOTE A validation print can have reduced accuracy compared to contract proof.

3.6
production print substrate
intended substrate to be used for production printing

3.7
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

3.8
TIFF/IT
Tagged Image File Format for Image Technology
format for exchanging raster-based data in accordance with ISO 12639

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 ISO 15930 (all parts) or TIFF/IT files in accordance with ISO 12639. 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. Where TIFF/IT files are used, colour information shall be included using tag *34675* or tag *34029*.

4.2 Validation print

4.2.1 Validation print substrate colour and gloss

The choice of the substrate used for the creation of a validation print is based on a combination of the user's knowledge of the intended production printing substrate and the capabilities of the equipment used to create the validation print. In cases where the production print substrate is not used for the validation print or is unknown, then the substrate used for the validation print shall be white on both the front and the back and shall not have any print on the back that influences the resulting measurements.

In applications where the substrate that will be used for the production print is known and the equipment used to create the validation print is compatible with that substrate, the unmarked production print substrate shall be used to create the validation print.

In applications where the substrate used for the production print is known, but is not compatible with the equipment being used to create the validation print, a substrate shall be selected whose colour, measured in accordance with ISO 13655:2009 M0 with white backing, simulates the unprinted substrate within a CIELAB 1976 colour difference of 3.0 computed in accordance with ISO 13655. This simulation should be determined using ISO 13655:2009 M1 with white backing, when available. This simulation of substrate colour may be accomplished using uniform coloration of the unprinted area during creation of the validation print. In addition, the gloss of the validation print substrate should be that of the production print substrate within 15 gloss units as measured according to 5.6. The validation print and production print substrates should ideally have similar levels of OBA (optical brightening agents) present and exhibit the same amount of fluorescence under an M1 illumination source.

NOTE 1 This does not imply that under other measurement conditions the simulation will be the same. The paper industry provides methods that do not conform to ISO 13655 M0 or M1 for estimating the similarity of OBA levels but not image colour between production print and validation print.

This part of ISO 12647 addresses situations that can occur very early in the creative process where the intended printing production substrate is not known. In such situations, a substrate shall be selected whose colour simulates the production substrate colour, as obtained from the characterization data set being used to create the validation print. The tolerance on the simulation shall be a CIELAB colour difference of 3 units. The measurement conditions targeted shall be those specified for the characterization data set being used. This simulation of substrate colour may be accomplished using uniform coloration of the unprinted area during creation of the validation print. In such a case, the unprinted areas of the substrate shall be removed in order to assure adaptation to the correct white point. The gloss of the substrate shall be selected to simulate the general type of printing expected based on the reference values of Table 1.

NOTE 2 In cases where the colour of the substrate being used to create the validation print differs from the substrate colour in the characterization data set by more than a CIELAB colour difference of 3 and uniform coloration of the unprinted area during creation of the validation print is not possible, the characterization data set can be adjusted to simulate the substrate colour using the tristimulus correction technique detailed in ISO 13655. It is recommended that all parties agree to any such change.

Table 1 — Nominal gloss of various substrate types

Substrate type	Nominal gloss[a]
Unit	1
Glossy white (e.g. glossy paper coated paper, grade 1)	> 60
Semi-matte white (e.g. coated paper, grade 3 coated paper, grade 5 super-calendared paper)	20 to 60
Matte white (e.g. uncoated paper, liner board, improved newsprint, newsprint)	< 20
[a] Measurement according to 5.6.	

Where the intended production print substrate is not used to create the validation print, the colour of the simulated substrate, including any uniform coloration of the unprinted area, shall not vary by more than 2,5 CIELAB colour difference units when successively subjected to the following conditions in a dark environment:

a) for 24 h at 25 °C and at a relative humidity of 25 %;

b) 24 h at 40 °C and a relative humidity of 80 %;

c) one week at 40 °C and at a relative humidity of 10 %.

In addition, its light-fastness rating as determined according to ISO 12040 shall not be less than 3.

NOTE 3 This is intended to exceed the upper level of exposure for any validation print, and any production print substrate with significant levels of optical brightening agents is likely to fail this test. While validation prints made with the production print substrate are exempt from this test, it is the responsibility of the user to weigh the options of simulating the fluorescence of the validation print substrate, as noted above, to the production substrate against the requirement for colour permanence indicated by this test.

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^*;

b) maximum CIELAB colour difference of 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.

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 2.

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 2 — Tolerances for reproduction of all patches in the validation print described in Clause 5 by comparison to the values of the characterization data of the printing condition being simulated

Unit: 1

Patch in validation print form	Tolerance	
All patches described in 5.2	Maximum: Average:	$\Delta E^*_{ab} \leq 8$ $\Delta E^*_{ab} \leq 3$
Patches described in 5.2 a) (C,M,Y,R,G,B)	Maximum:	$\lvert \Delta H^*_{ab} \rvert \leq 4$[a]
Patches described in 5.2 c)	Average:	$\Delta C_h \leq 2{,}5$[b]
Selected surface gamut patches as listed in Annex B (taken from ISO 12642-2)	Average:	$\Delta E^*_{ab} \leq 4$
All patches described in ISO 12642-2	Average: 95 % percentile:	$\Delta E^*_{ab} \leq 3$ $\Delta E^*_{ab} \leq 6$

[a] Due to the sign character of ΔH, the absolute values are used.

[b] ΔC_h is the CIELAB chromaticness difference between two colours of approximately the same lightness projected onto a constant lightness plane in the CIELAB colour space. This is calculated the same way as ΔE_c, stipulated in ISO 12646.

NOTE 2 These tolerances apply only to conformance of validation printing systems. They can also be used to determine if sites are capable of producing validation prints. They are inappropriate as tolerances for validation prints in daily use at production sites due to the increased production costs required to maintain the equipment in this optimum state. Experience indicates that a factor of approximately 1,5 times these tolerances is a reasonable starting point for setting daily validation print production tolerances modified by individual user requirements.

NOTE 3 ISO/TC 130 has determined that DE2000 tolerances are now preferable to CIELAB tolerances, but exact conversion factors are not available for this edition of this part of ISO 12647.

4.2.3 Short- and long-term repeatability

Three validation prints containing at least the primary and secondary colour solids, and primary colour mid-tones shall be produced. There shall be a 1 h 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 warm-up period. The maximum CIELAB colour difference between any two of the three samples of each colour shall not exceed the values shown in Table 3.

Table 3 — Repeatability of primary and secondary colour solids and primary colour mid-tones (CIELAB 1976 colour differences)

Unit: 1

Type	Solids	Mid-tones (40 % to 50 %)
Validation print	2,5	3,0