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Graphic technology — Process control for the production of halftone colour separations, proof and production prints —

Part 7: Proofing processes working directly from digital data

Technologie graphique — Contrôle des processus de confection de sélections couleurs tramées, d'épreuves et de tirages —

Partie 7: Processus d'épreuve travaillant directement à partir de données numériques

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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 on 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 the following URL: www.iso.org/iso/foreword.html.

The committee responsible for this document is ISO/TC 130, *Graphic technology*.

This third edition cancels and replaces the second edition (ISO 12647-7:2013), which has been technically revised with the following changes:

— a number of anomalies identified by industry experts have been addressed;

— substrate selection and measurement specification has been modified to reflect industry practice;

— approximately equivalent CIEDE2000 colour difference values have been added;

— basic support for spot inks has been added;

— wording has been updated to reflect current terminology and industry thinking.

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

Introduction

ISO 12647-1 serves to provide definitions, the general principles, the general order, the material to be covered in ISO 12647-2 to ISO 12647-8, the definition of the data, the measurement conditions, and the reporting style.

This document relates to the subject of digital proofing and establishes proofing requirements for the most demanding part of the printing and publishing market.

This document specifies aim values (or sets of aim values) and tolerances for the primary parameters specified in ISO 12647-1 for digital proof printing. Primary parameters that define a printing condition include screening parameters (where applicable), the colours of the solids, the colour of the print substrate, colours of intermediate tint values and the tone curve. This document also specifies test methods for those properties of digital proof prints and their substrates that are considered relevant for stable and reliable proofing conditions, and thus for a certification procedure.

The graphic technology industry makes extensive use of proofing to predict the rendering of digital data files by a wide variety of high-definition, high-quality off-press printing processes and applications. Each prediction is based on a characterization data set that defines a particular printing condition.

Typically, the specified printing condition is defined through an International Color Consortium (ICC) profile or the associated characterization data set, both of which relate source data and colorimetric values of the printed colour. Such data may be derived from printing conditions conforming to the pertinent process standard of the ISO 12647 series by industry trade groups or individuals.

The purpose of a proof print is to simulate the visual characteristics of the finished production print product as closely as possible. In order to visually match a particular printing condition, proofing processes require a set of parameters to be specified that are not necessarily identical to those put forward in ISO 12647-1 or another part of ISO 12647. This is caused by differences in colourant spectra or phenomena such as gloss, light scatter (within the print substrate or the colourant), and transparency. In such cases, it is also found that spectrocolorimetry takes precedence over densitometry.

Another problem area is the matching of a double-sided production print on a lightweight printing substrate, such as often used in heat-set web and publication gravure printing, to a digital proof on a nearly opaque substrate. If the proof was produced using a colour management profile based on measurements with white backing, there will be an unavoidable visual and measurable difference between the proof on the one hand and the production print placed on black on the other hand. A black backing is required for double-sided production printing on non-opaque prints, as specified in the pertinent parts of ISO 12647. The possible occurrence of such differences needs to be well communicated, in advance, to all parties concerned.

Historically, there has been no consistency in the way that either the characterization data or the criteria and limits for a satisfactory match have been provided. This has led to significant redundancy and inconsistencies in the evaluation of proofing systems for different, but similar, applications, and a cost and time burden on the industry. This document therefore attempts to provide guidance in this area by providing specifications and associated testing procedures.

Annex A summarizes the requirements for the digital proof prints listed in the main body of this document; these are weighted with respect to their relevance in three typical situations:

— requirements with which a proof print, made for a particular printing condition, must comply if it is to be referenced in a contract between the printer and the provider of the digital data (Certified Proof Creation);

— requirements with which a vendor's proofing system, comprising hardware and software, must comply if it is to be considered capable of reliably producing digital contract proofs for a particular printing condition (Certified Proofing System);

— requirements with which a proof print made for a particular printing condition must comply when tested in the field using only a control wedge (Certified Field Proof).

ISO 12647-8 defines requirements for validation prints. Because data are exchanged electronically and visualizations of those data are produced at multiple sites, there is a market need for defined requirements for validation prints to promote a degree of consistency throughout the workflow. Validation prints are intended to be used at early stages of the print production workflow, particularly at the document design stage and have less stringent requirements, particularly on colour fidelity, to allow their production on less elaborate and less costly devices than are required for contract proofs.

Validation prints are not intended to replace “contract proofs” as specified in this document for predicting colour on production printing devices. It is expected that the modifications of the requirements for both contract proofs and 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 halftone colour separations, proof and production prints —

Part 7:
Proofing processes working directly from digital data

1 Scope

This document specifies requirements for systems that are used to produce hard-copy digital proof prints intended to simulate a printing condition defined by a set of characterization data. Recommendations are provided with regard to appropriate test methods associated with these requirements.

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

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

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

3 Terms and definitions

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

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

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

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

3.1
chromatic primaries
cyan, magenta and yellow process inks

3.2
CIELAB chromaticness difference
ΔC_h
difference between two colours of approximately the same lightness projected onto a constant lightness plane in the CIELAB colour space

Note 1 to entry: This is calculated as $\Delta C_h = \sqrt{(\mathrm{CIE}a_1 - \mathrm{CIE}a_2)^2 + (\mathrm{CIE}b_1 - \mathrm{CIE}b_2)^2}$.

3.3
digital proof
soft-copy proof or hard-copy proof produced directly from digital data, on a display or a substrate, respectively

3.4
digital proof print
digital hard-copy proof
digital proof (3.3) produced as a reflection copy on a *proofing substrate* (3.5)

3.5
proofing substrate
printing substrate used for hard-copy proofing processes

3.6
halftone proof
proof print made using the same screening technology (generally centre-weighted halftone dots) as the intended production printing

Note 1 to entry: This is done to attempt to produce (and therefore check for the existence of) the same screening artefacts, such as rosettes, moiré, or aliasing patterns, as expected in the corresponding production print. One possibility is to base proofing on the bitmap produced on the production plate or film setter.

3.7
primaries
set of process inks: cyan, magenta, yellow and black

3.8
print stabilization period
time elapsed since the production of a proof print until a stable colour is achieved

Note 1 to entry: This property is to be specified by the manufacturer.

3.9
spot colour inks
inks which are not part of the set of process inks

Note 1 to entry: Spot colour inks are often used when printing brand colours.

4 Requirements

4.1 Colour difference measurements

In previous revisions of this document, CIELAB 1976 colour difference measurements (ΔE^*_{ab}) were used as detailed in ISO 13655 for normative colour difference measurements.

Conformance with this document requires the reporting of all colour differences as CIEDE2000 (ΔE_{00}).

NOTE The relationship of ΔE^*_{ab} to ΔE_{00} varies throughout the colour space and there is no simple correlation between the two metrics. Users are advised that some proofs that are in conformance with ISO 12647-7:2013 may not be in conformance with this document and that some proofs that are in conformance with this document may not be in conformance with ISO 12647-7:2013.

4.2 Data files, simulation of screens

4.2.1 Data delivery

Digital proofing systems should accept digital data delivered as PDF/X data files as defined in ISO 15930 (all parts) or TIFF/IT files as defined in ISO 12639. Where TIFF/IT files are used, colour information shall be included using tag 34675 or tag 34029 as defined in ISO 12639.

PDF/X requires that the intended printing condition be indicated. Where the intended printing condition is included in the registry of characterizations maintained by the International Color Consortium (ICC) and the digital data are cyan-magenta-yellow-black (CMYK), the name used in the ICC registry is usually used for identification in lieu of including an ICC output profile. If the intended printing condition is not included in said registry, PDF/X requires that an ICC output profile be included. If the data are other than CMYK, the data are required to be defined colorimetrically using an ICC input profile or another mechanism and an ICC CMYK output profile is required to be included; the rendering intent to be used with the output profile is required to be communicated.

4.2.2 Screen frequency

Halftone proofs should have the same screen frequencies (screen rulings) as the production press print to be simulated within a tolerance of ±3/cm.

4.2.3 Screen angle

Halftone proofs should have the same screen angles (with a tolerance of ±3°) as the production print to be simulated.

4.2.4 Dot shape

Halftone proofs should have the same general dot shape as the production print to be simulated.

4.2.5 Halftone proofs screening

Where halftone proofs are used and the screen frequency, screen angle or dot shape are different from that of the production press to be simulated, these differences shall be reported.

4.3 Proof print

4.3.1 General

When evaluating and communicating proofing substrate properties, the list of required criteria for communication described in ISO 15397 should be followed.

4.3.2 Proofing substrate colour and gloss

In an ideal situation, the digital proofing substrate should be the same as the substrate to be used for production printing. As this ideal situation is seldom possible, the digital proofing substrate shall fulfil all of the following criteria.

a) The gloss level of both the printing substrate and proofing substrates shall be estimated as one of matte, semi-matte or glossy either by the substrate manufacturer or by measuring as described in 5.5. Matte proofing substrates shall not be used to make proofs for glossy printing substrates and glossy proofing substrates shall not be used to make proofs for matte printing substrates.

b) The white point of the unprinted proofing 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 proofing substrate should have a CIEL* value that is higher than the substrate of the printing condition to be simulated.

c) The proofing substrate should belong to the same fluorescence classification as the production paper. Fluorescence classification in four levels of faint, low, moderate, and high shall be made using the testing procedures described in ISO 15397:2014, 5.12.

NOTE Fluorescence as defined in ISO 15397 is calculated by measuring D65 brightness evaluated as per ISO 2470-2 with UV included (UV) and UV excluded (UV_{ex}) and taking the ratio UV/UV_{ex} (see ISO 15397 for details). Usual categories for fluorescence are faint, low, moderate and high. In practice, it is often useful to add an OBA free category in which case the faint category is split into OBA free and faint. The categories and ranges for each are shown in Table 1.

Table 1 — Fluorescence categories and ranges

Category name	Range
OBA free	0 ≤ OBA free ≤ 1
Faint	1 < faint ≤ 4
Low	4 < low ≤ 8
Moderate	8 < moderate ≤ 14
High	14 < high ≤ 25

4.3.3 Colouration of printed parts

The measurement conditions shall be as specified in 5.4; the digital control strip specified in 5.2 and an ISO 12642-2 compliant chart shall be used.

The CIELAB colour coordinates of the process colour solids shall agree with the pertinent aim values of the printing condition to be simulated as given by the data (see 4.2.1), within 3,0 ΔE_{00} units. The CIELAB metric hue difference for CMY shall not exceed 2,5.

The variability of the colouration across the proof print format is limited by the provision that the colours of nine measurement locations evenly spaced on the test objects (see 5.3.4), which have been printed without prior modification in view of the printing condition, shall have the following:

— a standard deviation of less than 0,5 each for values of L^*, a^*, and b^*;

— a maximum of 2,0 ΔE_{00} units between the average value and any one point.

The CIELAB colour coordinates of the control patches, defined in 5.2 or ISO 12642-2, shall agree with the pertinent aim values of the printing condition to be simulated as given by the data (see 4.2.1) within the tolerances specified in Table 2.

If the proofing conditions are such that the simulation of the production printing substrate requires overprinting of the proofing substrate, the maximum colour difference between the overprinted proofing substrate and the production printing substrate shall be less than or equal to 3,0 ΔE_{00} units.

Table 2 — Additional tolerances for control patches

Control patch description	Tolerance
All patches specified in 5.2 except spot colour ink patches	Maximum $\Delta E_{00} \leq 5{,}0$ Average $\Delta E_{00} \leq 2{,}5$
A CMY overprint scale roughly replicating the neutral scale for an average printing condition comprising a minimum of five patches spaced approximately uniform intervals across the tone scale	Maximum $\Delta C_h \leq 3{,}5$ Average $\Delta C_h \leq 2{,}0$
All patches of ISO 12642-2	Average $\Delta E_{00} \leq 2{,}5$ 95th percentile $\Delta E_{00} \leq 5{,}0$
All spot colour ink solid patches specified in 5.2	Maximum $\Delta E_{00} \leq 2{,}5$
NOTE 1 The tolerances pertain to the deviation of the proof values from the values of the characterization data of the printing condition to be simulated. The specification of ΔE_{00} tolerances lower than 2,5 is presently not practical due to poor inter-model agreement; however, when the same instrument is being used to make both sets of measurements, it is recommended that the tolerances be halved. If the final proof print is subjected to surface finishing, the final colours might deviate significantly from those of the unfinished print. In this case, a new proofer or simulation profile or other adjustments are required. Spot colour ink solid patches should be clearly identified by the CIELAB colour of the solid spot ink on the print substrate. There is no standard way to communicate the intended colour of a tint of a spot ink and so communication of spot ink tint aim values and tolerances shall be determined by a separate agreement between participants, for example by means of a physical reference sample. NOTE 2 Previous versions of this document used the metric ΔH which is very unstable for differences close to the neutral axis and so this has been replaced by chromaticness difference ΔC_h which provides a more reliable measure.	

4.3.4 Gamut

The 226 outer gamut patches of ISO 12642-2 shall be proof printed. The average colour difference between actual and aim values for those patches shall not exceed 2,5 ΔE_{00} units. See Annex C for the list of outer gamut patches of ISO 12642-2.

Where multiple printing conditions are supported by a proof printer, this test may be applied to ensure that the proof printer colour gamut is sufficiently large to allow all printing conditions to be supported effectively.

Solid and a representative set of tints, including at least a 50 % tint where a definition is available, of all spot colours to be simulated shall be proof printed. The maximum colour difference between actual and aim values for those patches shall not exceed 2,5 ΔE_{00} units.

NOTE ISO 17972-4 defines an exchange format (CxF/X-4) for spectral measurement data of inks to provide a means to characterize spot colour inks to allow reliable printing and proofing of products that have been designed using these inks.

Spot colours which cannot be simulated by the proofing system, such as when they are out of gamut or where special inks are used, shall be identified and proofs should be accompanied by a physical sample of the required colour.

4.3.5 Permanence of proofing substrate and printed parts

Four copies of a test form shall be prepared on the proofing substrate which contains unprinted parts and patches of printed primaries and secondaries both as solids and as midtones. Combinations of all of the process colours used by the proofing system shall be included in this set which may include more than four colourants.

The four copies of the test form shall be stored for a print stabilization period of at least 24 h in the dark under standard atmosphere according to ISO 187 (at 23 °C ± 1 °C and a relative humidity of 50 % ± 2 % RH).

The CIELAB colour values of the proofing substrate and the printed patches shall be measured according to ISO 13655 M1.

Each of the four copies of the test form shall be subjected to one of the following storage conditions:

a) 24 h at 25 °C ± 1 °C and at a relative humidity of 25 % ± 2 % in the dark;

b) 24 h at 40 °C ± 1 °C and a relative humidity of 80 % ± 2 % in the dark;

c) 1 week at 40 °C ± 1 °C and at a relative humidity of 10 % ± 2 % in the dark;

d) light fastness exposure using a window glass filtered xenon lamp with a level of exposure of the test form corresponding to a light fastness rating of 3 using the blue wool test as described in ISO 12040. Fading of blue wool reference 3 (Acid blue 83) should be used to check the dose.

For each of these treatments, for the substrate and for all patches of the test form, the maximum colour difference between colour values of the patches before and after the treatment shall not exceed 2,5 ΔE_{00} units and should not exceed 2,0 ΔE_{00} units. For matte substrates (see 4.3.2 and 5.5), these tolerances shall be relaxed to 4,0 ΔE_{00}.

Prints with rough surfaces are generally more susceptible to fading but in some cases having a proof with a surface that is similar to that of the production print is more important than having a light fast proof and so these tolerances shall be reduced to allow the use of proofs with mechanically rough surfaces.

The reader should be aware that production printing substrates and inks are usually less stable than typical inkjet-based proofing substrates and inks, see Reference [12]. It is therefore recommended to apply this permanence test to proofs on production printing substrates if the lifetime of such proofs is of any concern.

NOTE It is anticipated that window glass application as described in ISO 105-B02, e.g. optical filters, be fitted to minimize short-wavelength light (less than 310 nm).

4.3.6 Repeatability of proof printing

The variability of the proof print primary and secondary colour solids and primary colour midtone patches from one day to the following shall not exceed a colour difference of 2,0 ΔE_{00} units. Patches should be measured by the same instrument and at the same position on the sheet after the vendor-specified warming-up period and, if necessary, recalibration.

4.3.7 Colourant rub resistance

Using the test apparatus and method specified in Annex B, the time required by printed solids to reach mechanical stability against a rubbing action should not exceed 30 min or the print stabilization period, whichever is longer. This test shall be performed for each combination of materials and operating conditions that the proofing system supports.

NOTE A period of 30 min was chosen because this is believed to represent the expectation of the average user. Where the colour (as distinct from the rub resistance of the colourant) takes longer to stabilize, this requirement can be relaxed.

4.3.8 Ink set gloss

The gloss of solid tone colours should be visually similar to that of the production print to be simulated. The ink set gloss may be specified if deemed necessary; the method specified in 5.5 shall be used.

NOTE If the gloss of the proof print is substantially changed by the applied colourants, a surface-finishing step might improve the situation. See 4.3.2.

4.3.9 Tone value reproduction limits

Tints intermediate between the (simulated) substrate white and solid shall transfer onto the proof in a consistent and uniform manner over a tone value range that includes at least the tone reproduction limits of the printing condition to be simulated; see the part of ISO 12647 that describes process control for the type of printing to be simulated.

NOTE It is good prepress practice that no image parts rely on tone values outside of the tone value reproduction limits of the production printing process.

4.3.10 Reproduction of vignettes

The test objects specified in 5.3.2 shall show no easily visible steps within the tone value reproduction limits (see 4.3.9) if viewed under ISO viewing condition P1 in accordance with ISO 3664.

4.3.11 Image register and resolving power

The maximum deviation between the image centres of any two printed colours shall not be larger than 0,05 mm. The resolving power of the proof print shall be such that C, M, K positive, non-serif, type of 2-point size, reverse (negative) of 8-point size, and 2-point reverse line are legibly reproduced; the test object specified in 5.3.3 shall be used.

The above requirements shall not apply to rough or mechanically unstable substrates such as newsprint or to cases where the tolerances for production printing registration are substantially greater than 0,05 mm.

NOTE 1 This condition usually corresponds to an output addressability of at least 100 pixels per centimetre.

NOTE 2 This condition includes the effects of colourant migration, if at all present.

4.3.12 Margin information

The following information shall be provided and every digital proof should include the following information as a human-readable commentary line:

— conformance level (“Digital proof according to ISO 12647-7:—”);

— file name;

— digital proofing system designation;

— substrate material type;

— the printing condition simulated;

— time and date of production;

— measurement condition: M0, M1, or M2.

NOTE 1 The intent of including the printing condition is to identify this clearly to a user. The conventions used to indicate printing conditions vary but a good way to do this would be to identify the name of a characterization data set, for example using its name as registered on the ICC registry or using the filename or profile description tag of an ICC profile that represents the printing condition.

It should also include

— colourant types,

— colour management profile(s) used,

— raster image processor (RIP) name and version,

— scaling (if applied),

— type of coating (if applied or simulated),

— time and date of last calibration,

— details of any special data preparation, and

— type of paper/structure simulation such as noise or patterning (if applied).

When making a proof from a PDF/X document, the margin information shall include the file name and the date and time of the last modification and should include the document ID. When the document ID is included, this shall be printed as two hex strings and the last five digits of each string should be highlighted in some way in order to assist identification.

NOTE 2 In some cases of recalibration, it is useful to re-profile the proofer.

5 Test methods

5.1 Viewing conditions

Viewing of prints shall be in accordance with ISO 3664 P1 or P2 viewing condition.

5.2 Control strip

A CMYK digital control strip representing the printing condition to be simulated shall be printed on every proof. The control elements identified in the list below should be included while keeping the total number of patches within reasonable limits. To provide compatibility with characterization data, as many control patches as possible should be selected from ink value combinations of ISO 12642-2. Control patches shall be selected such that the following control patch types are covered:

a) solid tones of the chromatic primaries and their secondaries C,M,Y,R,G, and B (6 patches);

b) mid- and shadow tones of the chromatic primaries and their secondaries C,M,Y,R,G, and B (12 patches);

c) black (K) tone scale with a minimum of six steps that includes the solid;

d) a set of patches with CMY values chosen to match the colour of the patches defined in c) as closely as possible;

e) selection of critical tertiary colours such as flesh tones, brown, aubergine, violet (e.g. 15 patches);

f) simulated print substrate colour of the production printing condition (1 patch);

g) solid tones of all spot colour inks used in the document.

NOTE 1 There are two practical definitions for grey which are sometimes contradictory: (i) a colour having the same a^* and b^* CIELAB values as the print substrate; (ii) a colour having the same a^* and b^* CIELAB values as a halftone tint of similar L^* value printed with black ink. The latter definition is believed to be useful in the midtone and upwards whereas the former is believed to work best with highlight tones.

NOTE 2 Grey balance patches composed of suitable CMY mixtures serve a useful purpose for quick visual checks of whether the CMY tone values have changed, for example from one proof print to the next. A single grey balance condition is usually not sufficient to ensure an achromatic colour for all print substrates and printing inks that are used for a given printing condition. In addition, it usually depends on the particular black composition used.

The *L** scale of the black is usually considerably greater than the three colour scale and care should be taken to ensure that the patches described in c) and d) above are suitably spaced.

5.3 Additional test objects

5.3.1 Resolution

For the visual determination of the resolving power of the proofing process, the resolution charts S2 and S3 defined in ISO 12640-1 shall be used.

5.3.2 Primary and secondary process colours

For checks of the primary and secondary process colours (C, M, Y, K, M+Y, C+Y, C+M, and C+M+Y), a test form comprising vignette targets such as the test image S6 of ISO 12640-1 should be used. The length of the vignettes should be such that they are just below the length where less than smooth behaviour is visible for normal production printing.

5.3.3 Resolving power

For checks on the resolving power, a test form comprising positive and reverse type of a non-serif Latin font with text sizes of 2, 3, 4, 5, 6, 7, and 8 points and reverse lines with widths of 2, 3, and 4 points should be printed both parallel and normal to the edge of the print (diagonal lines are not required). Three sets of positive text should be printed using 100 % cyan, 100 % magenta and 100 % black. Reverse printing should use 100 % black-only background with white knock-out. The same regular body text font should be used for all cases and all instances of 2-point text should be legible and all instances of 2-point lines should be visible.

NOTE This is simulation of the intended printing condition and press colourants are likely to be simulated by a colorimetric emulation involving multiple colourants on the target device.

5.3.4 Uniformity

For checks on uniformity, create three prints, each with an even tint area that fills the printable format of the proof printer, using the following tone value combinations:

a) C: 65 %, M: 50 %, Y: 50 %, K: 50 %;

b) C: 40 %, M: 30 %, Y: 30 %, K: 30 %;

c) C: 20 %, M: 15 %, Y: 15 %, K: 15 %.

NOTE The most popular format for proof printing is A3+.

5.4 Colour measurement

Colour measurements shall be made using an instrument (such as a spectrophotometer from which colorimetric values can be calculated) that is capable of repeatedly producing measured values well within the tolerances specified in this document. The measurement condition of the instrument should be set to use the CIE Illuminant D50 and the 2° standard observer. The CIELAB colour coordinates *L**, *a**, *b** shall be calculated as detailed in ISO 13655. Characterization data representing a particular measurement condition (M0, M1, or M2) shall be verified using an instrument configured to use this same measurement condition.

Black or white backing shall be selected based on the opacity of the proofing substrate. Black and white backing shall be in accordance with ISO 13655.

All colour measurements and computed colour differences shall be reported, accompanied by an associated total uncertainty (using the coverage factor k = 1 as defined in ISO 15790). In addition, it should include an estimate of the variation between different measurement instruments. The value may be extracted from the manufacturer's specification or from a certificate of calibration from the manufacturer.

All colour measurements shall be rounded with the same precision as the defined tolerance value.

NOTE A colour difference of $\Delta E_{00} = 5{,}4$ is rounded to 5 if the tolerance is defined as $\Delta E_{00} \leq 5$ and will be in conformance. The same colour difference is not in conformance when the tolerance is stipulated as $\Delta E_{00} \leq 5{,}0$.

5.5 Measurement of gloss

The gloss of the substrate or ink set single ink solid areas should be measured with an incidence angle of 75° as specified in ISO 8254-1 or 60° as specified in ISO 2813 and shall be classified into categories of "matte", "semi-matte" or "glossy" as follows:

a) 75° (see ISO 8254-1): Matte: <20 GU, Semi-matte: 20 GU to 60 GU, Glossy: >60 GU;

b) 60° (see ISO 2813): Matte: <5 GU, Semi-matte: 5 GU to 20 GU, Glossy: >20 GU.

NOTE The correspondence between the categories a) and b) is based on Reference [11].

Other gloss measurement methods specified in ISO 15397 may be used as long as it can be demonstrated that the substrate categories that result from such a measurement are approximately equivalent to those specified in a) or b).

5.6 Visual appraisal of proof-press-print matches

See Annex D for a typical set of guidelines used for visual evaluations.

NOTE Although the industry is struggling to develop metrologically based techniques for the evaluation of the quality of proof-to-print matches, unfortunately, most industry trade groups still rely on visual comparisons. It is recognized that these evaluations are highly dependent on both the subject matter chosen and on the observers participating.

Annex A
(normative)

Technical requirements for proofing conformity

A.1 Certified proof (field certification)

Digital proofs may be considered to be "field certified" for a chosen printing condition in conformance with this document if the proof print conforms to the requirements listed in A.1.1 for the chosen printing condition.

A.1.1 All proofs

All proofs shall conform to the following requirements of Clause 4:

— colouration of printed parts (see 4.3.3), except the light fastness, the 24 h colour fading tests and the patches from the ISO 12642 charts;

— margin information (see 4.3.12).

A.2 Certified contract proofs

A.2.1 General provisions

Production sites for digital proofs may be considered capable of delivering certified contract proofs for a chosen printing condition in conformance with this document if it can be reliably demonstrated that the proof prints conform to the requirements listed in A.2.2 or A.2.3 for the chosen printing condition.

A.2.2 All proofs

All proofs shall conform to the following requirements of Clause 4:

— proofing substrate colour and gloss (see 4.3.2), conformance to Table 1 is the only requirement;

— colouration of printed parts (see 4.3.3), except the light fastness and 24 h colour fading tests;

— gamut (see 4.3.4);

— reproduction of vignettes (see 4.3.10);

— image register and resolving power (see 4.3.11);

— margin information (see 4.3.12).

A.2.3 Halftone proofs

Halftone proofs shall conform to all requirements of A.2.2 and the following requirements of Clause 4:

— screen frequency (see 4.2.2);

— screen angle (see 4.2.3);

— dot shape (see 4.2.4).

A.3 Production systems capable of delivering certified contract proofs

A.3.1 General provisions

Production systems for digital proofing provided by vendors may be considered capable of delivering certified contract proofs for a given printing condition in conformance with this document if it can be reliably demonstrated that the proofing system, comprising hardware and workflow components, if tested under the environmental conditions specified by the vendor, conforms to the requirements listed in A.3.2 or A.3.3 for said printing condition. In addition, the system shall be capable of accepting and processing data files conforming to 4.2.1.

Where proofing systems are intended to support proofing of spot inks, a representative set of spot colours should be included in the assessment.

A.3.2 All proofs

All proofs shall conform to the following requirements of Clause 4:

— proofing substrate colour and gloss (see 4.3.2), conformance to Table 1 is the only requirement;

— colouration of printed parts (see 4.3.3), except the light fastness and 24 h colour fading tests;

— repeatability of proof printing (see 4.3.6);

— colourant rub resistance (see 4.3.7);

— tone value reproduction limits(see 4.3.9);

— reproduction of vignettes (see 4.3.10);

— image register and resolving power (see 4.3.11);

— margin information (see 4.3.12) which should be added by the same marking engine that created the proof.

A.3.3 Halftone proofs

Halftone proofs shall conform to all requirements of A.3.2 and the following additional requirements of Clause 4:

— screen frequency (see 4.2.2);

— screen angle (see 4.2.3);

— halftone dot shape (see 4.2.4).

A.4 Tables of aim values and tolerances

Tables A.1 and A.2 are provided as a guide to implementers of this document. Full details of each requirement are provided in the section indicated.

Table A.1 — Technical requirements for contract proofs

Requirement	Tolerance	Reference	Additional constraints
Maximum proof to production print difference for substrate	3,0 ΔE_{00}	4.3.2 4.3.3	Only applies if the proof substrate is overprinted. Gloss and fluorescence levels should be similar between proof and print.
Maximum proof to printing condition difference for process colour solids	3,0 ΔE_{00}	4.3.3	CIELAB metric hue difference shall not exceed 2,5.
Maximum variation across the sheet (9 patch grey charts)	2,0 ΔE_{00}	4.3.3	Standard deviation of less than 0,5 for each of L^*, a^*, and b^*.
Maximum proof to printing condition difference for all patches in 5.2 except spot colour inks	5,0 ΔE_{00}	4.3.3 Table 2	—
Average proof to printing condition difference for all patches in 5.2 except spot colour inks	2,5 ΔE_{00}	4.3.3 Table 2	—
Maximum for CMY neutral scale	3,5 ΔC_h	4.3.3 Table 2	—
Average for CMY neutral scale	2,0 ΔC_h	4.3.3 Table 2	—
Average proof to printing condition difference for all patches of ISO 12642-2	2,5 ΔE_{00}	4.3.3 Table 2	—
95 % percentile of proof to printing condition difference for all patches of ISO 12642-2	5,0 ΔE_{00}	4.3.3 Table 2	—
Maximum proof to printing condition difference for spot colour ink solid patches of 5.2	2,5 ΔE_{00}	4.3.3 Table 2	—
Average proof to printing condition difference for outer gamut patches of ISO 12642-2	2,5 ΔE_{00}	4.3.4	—
Maximum error for spot colour solids and 50 % tints	2,5 ΔE_{00}	4.3.4	—
Maximum change in substrate and chromatic (CMYRGB) solids and midtones following permanence tests (shall)	2,5 ΔE_{00}	4.3.5	For matte substrates 4,0 ΔE_{00}
Maximum change in substrate and chromatic (CMYRGB) solids and midtones following permanence tests (should)	2,0 ΔE_{00}	4.3.5	For matte substrates 4,0 ΔE_{00}
Maximum variation of primary and secondary solids and midtones from day to day	2,0 ΔE_{00}	4.3.6	—

Table A.2 — Technical requirements for certified field proofs

Requirement	Tolerance	Reference	Additional constraints
Maximum proof to production print difference for substrate	3,0 ΔE_{00}	4.3.2 4.3.3	Only applies if the proof substrate is overprinted Gloss and fluorescence levels should be similar between proof and print
Maximum proof to printing condition difference for process colour solids	3,0 ΔE_{00}	4.3.3	CIELAB metric hue difference shall not exceed 2,5
Maximum proof to printing condition difference for all patches in 5.2 except spot colour inks	5,0 ΔE_{00}	4.3.3 Table 2	—
Average proof to printing condition difference for all patches in 5.2 except spot colour inks	2,5 ΔE_{00}	4.3.3 Table 2	—
Maximum proof to printing condition difference for spot colour ink solid patches of 5.2	2,5 ΔE_{00}	4.3.3 Table 2	—

Annex B
(normative)

Rub resistance of the proof colourant

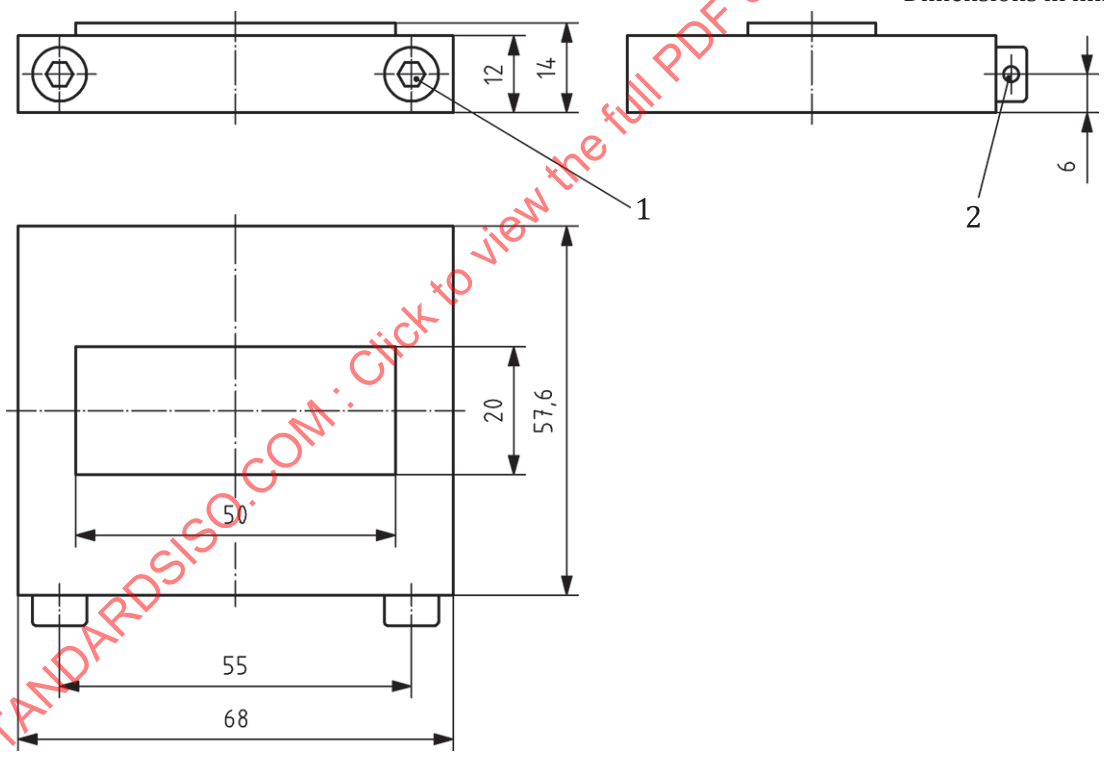
B.1 Apparatus

B.1.1 Slab

For the procedure, a stainless steel slab is used, having dimensions according to Figure B.1, with a mass of approximately 400 g, a protruding wipe area of 10 cm^2, and hence a ratio of mass per area of 0,4 N/cm^2. A pull string is attachable to the front of the slab by means of two screws whose heads have a hole (see key 1 of Figure B.1).

NOTE This procedure is modelled after method A of DIN 53131-2[9].

Dimensions in millimetres



Key

1 screw M5

2 hole, of 2 mm to 3 mm in diameter, for fastening of pull string

Figure B.1 — Slab

B.1.2 Rubber mat

Rubber mat with the following properties:

— thickness: 2 mm;

— length: 340 mm;

— width: 250 mm;

— shore-A hardness: 65 A;

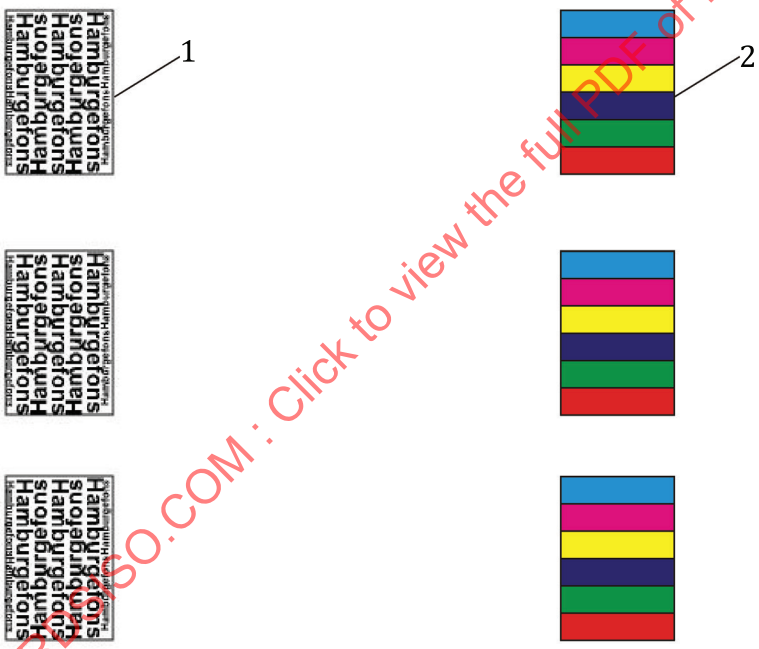
— smooth matte surface.

B.2 Proofing system

The results of this test only pertain to the particular combination of proofing system, hardware, firmware, driver setting and software, and the particular proofing substrate and colourant material used.

B.3 Printed test area

Prepare a test form with six printed rectangular test areas having an approximate size of 25 mm by 36 mm. Fill three rectangles with black ink type and the rest each with six strips of C100, M100, Y100, C100+M100, C100+Y100, and M100+Y100, each strip parallel to the shorter side of the rectangles. See Figure B.2 for an example layout.



Key

1 text sample area

2 colour sample area

Figure B.2 — Example layout for printed test objects

B.4 Rub test

B.4.1 Climatic conditions

Strictly observe the temperature and relative humidity ranges specified by the vendor. Place all materials and test devices in that environment at least 24 h prior to the test.

B.4.2 Preparation of the slab

Fasten a piece of unprinted proofing substrate of the type to be tested, 40 mm by 80 mm, to the front part of the slab such that it extends rearwards over the protruding part of the slab. Orient the normal printing side of the proofing paper away from the slab so that this surface will come in contact with the printed test area.

B.4.3 Test

Attach a 40 cm pull string to the screws of the slab (key 1 in Figure B.1) so that the slab may be pulled to slide over the table surface. Place the rubber mat on a flat table. Firmly attach the proof print (with its six rectangular test objects; see Figure B.2) to the rubber mat, printed side up.

Place the prepared slab on the proof print behind a rectangular printed object, with the protruding part facing the proof print. Orient the slab such that longer sides of the protruding part of the slab and those of the printed test area are parallel. At a speed of approximately 5 cm/s, pull the slab fully across the chosen test area in the direction perpendicular to its longer side. Do not apply vertical forces to the slab. While pulling the slab, keep the string parallel to the table surface. Inspect the substrate attached to the bottom of the slab. If it is marked by transferred colourant, replace it with a fresh piece of proofing substrate. Repeat the rubbing pulls for the remaining five test areas.

B.4.4 Evaluation

Visually scrutinize the printed test areas and the adjacent unprinted parts for traces of the rubbing action. Visually examine the proofing substrate that was attached to the slab for traces of transferred colourant. For the striped test areas, note which colourant is affected most by the rubbing.

B.4.5 Mechanical stabilization period of colourant

Determine the colourant mechanical stabilization period as follows. Make a series of tests according to B.4.3, starting immediately after the proof print fully emerges from the proofing system. Repeat at least three times, at evenly spaced intervals of approximately 10 min. The time elapsed after printing until the point when no visual traces of the rubbing action can be seen is the colourant mechanical stabilization period.

B.5 Test report

The test report shall include the following information:

a) a reference to this document, i.e. ISO 12647-7;

b) the proofing substrate (vendor, type, article number);

c) the colourant (vendor, type, article number);

d) the proof printer (vendor, type, article number);

e) the printer driver and setting (vendor, type, version);

f) the application program (vendor, type, version);

g) the raster image processor (RIP) (type and version);

h) the operating system (vendor, type, version);

i) the test conditions and any deviations from this document that might have influenced the results;

j) a scan or photograph of the test form accompanied by notes from the evaluator (see B.4.4);

k) the date and name of person carrying out the test.

Annex C
(normative)

Outer gamut patches

Table C.1 contains a selected subset of outer gamut patches of ISO 12642-2. The outer gamut patch set is also a subset of the patches defined in ISO 12642-2. The first column of Table C.1 gives the order number used in ISO 12642-2. The remaining columns give the data tone values of the patches.

NOTE In some cases, systems use 8-bit values in which case some of the values in this table may not be precisely achieved.

Table C.1 — 226 outer gamut patches of ISO 12642-2

No.	C	M	Y	K
1	0	0	0	0
2	0	10	0	0
3	0	20	0	0
4	0	30	0	0
5	0	40	0	0
7	0	70	0	0
9	0	100	0	0
10	10	0	0	0
11	10	10	0	0
12	10	20	0	0
14	10	40	0	0
16	10	70	0	0
18	10	100	0	0
19	20	0	0	0
20	20	10	0	0
21	20	20	0	0
23	20	40	0	0
25	20	70	0	0
27	20	100	0	0
28	30	0	0	0
37	40	0	0	0
38	40	10	0	0
39	40	20	0	0
41	40	40	0	0
43	40	70	0	0
45	40	100	0	0
55	70	0	0	0
56	70	10	0	0
57	70	20	0	0
59	70	40	0	0
61	70	70	0	0
63	70	100	0	0
73	100	0	0	0
74	100	10	0	0
75	100	20	0	0
77	100	40	0	0
79	100	70	0	0
81	100	100	0	0
82	0	0	10	0
83	0	10	10	0
84	0	20	10	0
86	0	40	10	0
88	0	70	10	0
90	0	100	10	0
91	10	0	10	0
100	20	0	10	0
118	40	0	10	0
136	70	0	10	0
154	100	0	10	0
163	0	0	20	0
164	0	10	20	0
165	0	20	20	0
167	0	40	20	0
169	0	70	20	0
171	0	100	20	0
172	10	0	20	0
181	20	0	20	0
199	40	0	20	0
217	70	0	20	0
235	100	0	20	0
244	0	0	30	0
325	0	0	40	0
326	0	10	40	0
327	0	20	40	0
329	0	40	40	0
331	0	70	40	0
333	0	100	40	0
334	10	0	40	0
343	20	0	40	0
361	40	0	40	0
379	70	0	40	0
397	100	0	40	0