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Imaging materials — Reflection colour photographic prints — Test print construction and measurement

Matériaux pour l'image — Réflexion des impressions photographiques en couleurs — Mesurage et construction d'une impression d'essai

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

This document was prepared by Technical Committee ISO/TC 42, *Photography*.

This third edition cancels and replaces the second edition (ISO 18944:2014), which has been technically revised.

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

— the document structure has been simplified in order to be better understood by users;

— definitions for measurement condition, colour attributes measured and calculations of colour changes have been included.

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Introduction

This document is one of a family of International Standards on the physical properties, stability and permanence of imaging materials.

This document provides constraints on factors pertaining to target print preparation and resulting target print measurement which can cause a confounding test-process-induced variation in measured colour values and densities.

The requirements in this document are intended to be used with test methods that produce test data to be shared publicly, with the aim that test results can be duplicated in an alternate test facility.

Topics addressed include:

— digital file preparation;

— digital test file usage;

— target print uniformity;

— printing system configuration and control;

— test print conditioning;

— measurement timing and measurement conditions;

— sRGB encoded patch value for test targets and the corresponding patch selection process;

— densitometric and colorimetric calculations for colour changes.

Test target design and test print preparation are important elements in the characterization of image stability of prints, namely changes in colour attributes such as discoloration of $D_{\min}$ as well as lightness, hue and chroma changes in colour and neutral patches.

A test target realizes a specific sampling of colours from colour space that is representative for characterization of image stability in the envisaged use case. Other important elements in that characterization process are the definition of colour attributes the changes of which are evaluated and the construction of a metric as well as the choice of the statistical assessment of data analysis, such as choice of average, median or maximum changes of either individual colours or all colours. Unless a psychovisual correlation with observer judgments have been implemented, measured changes have *ad hoc* character.

In this document, the definition and the calculation of changes in colour attributes of colour and neutral patches are expressed in terms of densitometry, whereas discoloration of $D_{\min}$ is characterized colorimetrically. Changes in colour attributes evaluated with the target and definition of colour attributes in this document are intended to feed an end point system that can be used in image life specification under development in the series of print life specification standards. Previously, the definitions of colour attributes were included in the various test methods which are now consolidated into this document.

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Imaging materials — Reflection colour photographic prints — Test print construction and measurement

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

1 Scope

This document specifies requirements and recommendations for the digital test file content, printer setups and printing procedures that are used to generate target prints for test method standards and specifications for image stability in the context of reflection colour photographic prints.

Furthermore, this document defines measurement procedures of the test patches as well as how changes of colour attributes are calculated in the course of a given image stability test.

Definition of the statistical procedure for data reduction and the translation of those changes into psychophysical end point levels does not belong to the scope of this document, but results obtained with the methods defined in this document can feed into the appropriate statistical evaluation and end point systems of a print life specification defined in other documents.

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 5-3, *Photography and graphic technology — Density measurements — Part 3: Spectral conditions*

ISO 5-4, *Photography and graphic technology — Density measurements — Part 4: Geometric conditions for reflection density*

ISO 11664-4, *Colorimetry — Part 4: CIE 1976 L*a*b* Colour space*

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

ISO 18913, *Imaging materials — Permanence — Vocabulary*

ISO 18941, *Imaging materials — Colour reflection prints — Test method for ozone gas fading stability*

IEC 61966-2-1, *Multimedia systems and equipment — Colour measurement and management — Part 2-1: Colour management — Default RGB colour space — sRGB*

3 Terms, definitions and symbols

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 18913 and the following apply.

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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3.1.1
printing system
system to generate reflection colour photographic prints, including printing colorants, printing equipment hardware and software, and typically the print media

3.1.2
RGB printer
printer configured to accept digital files with RGB printer-independent encoded colours and apply a conversion to obtain printer colourant code values

3.2 Symbols

Symbol	Definition
D_{min}	optical density of the unprinted substrate
D_{max}	maximum optical density aim chosen for the test

4 Requirements

This document specifies constraints on factors pertaining to target print preparation and resulting target print measurement which can cause confounding test-process-induced variation of measured colour values and densities. The requirements of this document shall be applied in image stability test methods that are used to characterize changes of a print material due to a specific failure mode, or to make life expectancy claims, such as time-based print lifetime claims, either comparative or absolute, in accordance with the applicable International Standard(s) for specification of print life.

The analysis of colour changes in the course of image stability testing requires the following.

a) A definition of how test colours are sampled in colour space in a way representative for the use case. This results in a specific design of a test target as given in this document.

b) A definition of how colour changes are determined, which represents a specific colour distance metrics. In this document, changes in colour and neutral patches are measured densitometrically and discoloration of D_{min} is characterized with colorimetry.

c) A definition of the statistics that is applied to translate the calculated colour changes into end point levels, e.g. average, media or maximum colour change for a selection of starting density values over all colours or per colour. The statistics are not defined in this document but are given by appropriate specifications of print life or characterizations of single failure mode.

d) A correlation of end point levels to visual perception. The necessary establishment of (potentially different) tolerance sets for each colour is an important limitation. Such end point levels system is not defined in this document but is given by an appropriate specification of print life.

5 Digital file preparation

5.1 Digital test file usage situations

For general testing purposes, users of this document are free to choose whatever target patches and starting densities they feel are appropriate for their testing needs. Applicable International Standard(s) for specification of print life is likely to require the use of specific targets and starting densities.

The digital test file is designed to assess the stability of images printed in end-user-typical fashion. The test file in this case is encoded in standard sRGB, as defined in IEC 61966-2-1.

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