



SLOVENSKI STANDARD SIST-TS ISO/TS 10128:2010

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Grafična tehnologija - Metode za prilagajanje barvne reprodukcije na tiskarskem sistemu, da ustreza želenim karakterističnim vrednostim

Graphic technology - Methods of adjustment of the colour reproduction of a printing system to match a set of characterization data

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Technologie graphique - Méthodes d'ajustage de la reproduction de couleurs d'un système d'impression pour correspondre à un ensemble de données de caractérisation

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ICS:

37.100.10 Reprodukcijska oprema Reproduction equipment

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TECHNICAL SPECIFICATION

ISO/TS 10128

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Graphic technology — Methods of adjustment of the colour reproduction of a printing system to match a set of characterization data

*Technologie graphique — Méthodes d'ajustage de la reproduction de
couleurs d'un système d'impression pour correspondre à un ensemble
de données de caractérisation*

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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.

In other circumstances, particularly when there is an urgent market requirement for such documents, a technical committee may decide to publish other types of normative document:

- an ISO Publicly Available Specification (ISO/PAS) represents an agreement between technical experts in an ISO working group and is accepted for publication if it is approved by more than 50 % of the members of the parent committee casting a vote;
- an ISO Technical Specification (ISO/TS) represents an agreement between the members of a technical committee and is accepted for publication if it is approved by 2/3 of the members of the committee casting a vote.

An ISO/PAS or ISO/TS is reviewed after three years in order to decide whether it will be confirmed for a further three years, revised to become an International Standard, or withdrawn. If the ISO/PAS or ISO/TS is confirmed, it is reviewed again after a further three years, at which time it must either be transformed into an International Standard or be withdrawn.

ISO/TS 10128 was prepared by Technical Committee ISO/TC 130, *Graphic technology*.

Introduction

As the printing and publishing world has embraced the use of digital data and the preparation of printing plates directly from digital data (often referred to as computer to plate or CTP), it has struggled to find ways to take better advantage of the electronic data manipulation opportunities offered. When traditional half-tone film was the medium of exchange of final material and the input to the printing plate and press operation, the primary methodology available to the printer to match industry aims and standards was to force the press, ink and paper to be as close as possible to the references upon which the printing standards were based. Today, with digital data input, it is recognized that modification of that digital data can be used to compensate (adjust) for some of the differences in press, ink and paper between various printing sites and between the actual conditions at a specific site and the reference or standard printing condition.

As part of the introduction of digital technology, the printing industries (and its standards activities) have begun to establish reference characterization data corresponding to various printing specifications and conditions. Characterization data is generally defined as the relationship between the CMYK digital input values (in the data file exchanged) and the measured colorimetric values for the colour printed in response to these values.

Discussions within Technical Committee ISO/TC 130 have identified three general methods by which compensation for differences in printing conditions can be accomplished. Two of these make use of individual one-dimensional transforms (i.e. plate curves) for each printing channel, but differ in the method by which these transforms are determined. These are referred to as matching of tone value curves and use of near-neutral scales. The third method makes use of multi-dimensional transforms such as International Color Consortium (ICC) device-link profiles.

The features and general methodology for use of these adjustment techniques is the subject of this Technical Specification. The goal is to provide a common understanding of these procedures across the industry, to allow consistency between implementations, and to facilitate communication of the adjustments used/desired in particular workflows.

It is important to recognize that these are not competitive solutions, but each have different strengths and weaknesses in individual workflow applications. It is the choice of the individual print facility and/or the involved trade associations to decide how to best apply these capabilities, made possible through the use of digital data.

The basic assumption behind the use of characterization data and these correction techniques is that a printing process can be repeatedly restored to a prior printing condition and that condition can be maintained both within a run and between runs. A variety of process control methods can be used to achieve this repeatability. Solid ink reflectance density and tone value increase based on the specific materials involved, and tied back to the conditions established during characterization are common process control tools that are used in addition to the data adjustment techniques described in this document. These adjustment techniques work together with process control to achieve the printing quality desired.

The International Organization for Standardization (ISO) draws attention to the fact that it is claimed that compliance with this document may involve the use of a patent concerning recalibrating a multi-colour imaging system given in 4.3.

ISO takes no position concerning the evidence, validity and scope of this patent right.

The holder of this patent right has assured ISO that he/she is willing to negotiate licences free of charge with applicants throughout the world. In this respect, the statement of the holder of this patent right is registered with ISO. Information may be obtained from:

Intellectual Property Standards and Transactions
Eastman Kodak Company
343 State Street, Rochester, NY 14650, USA

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Graphic technology — Methods of adjustment of the colour reproduction of a printing system to match a set of characterization data

1 Scope

This Technical Specification specifies three methods for the adjustment of the digital content data that is input to a printing system to achieve consistency in the printed results among a number of presses printing to the same general aim conditions. These three methods are generally identified as

- a) the matching of tone value curves,
- b) the use of near-neutral scales, and
- c) the use of CMYK to CMYK multi-dimensional transforms.

The procedures for establishing the aim condition for the necessary transfer curves, the procedures for determining the individual transfer curves, and a comparison of the applicability of these three methods are included.

These adjustment procedures are applicable to printing systems that use CMYK colourants but are not restricted to those that use traditional ink on paper printing but can involve other marking technologies such as those used for proofing and/or digital printing.

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 referenced document (including any amendments) applies.

ISO 12642-1, *Graphic technology — Input data for characterization of 4-colour process printing — Part 1: Initial data set*

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 15076-1, *Image technology colour management — Architecture, profile format and data structure — Part 1: Based on ICC.1:2004-10*

3 Terms and definitions

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

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3.1 adjustment of a printing system with digital data
systematic modification of the content data received, to enable the results printed on a specific device to match the appearance of the same content data as would have been printed on a reference device

3.2 digital printing
printing directly from digital data when there is no intermediate image carrier, or when the image carrier is refreshed for each impression, and thus each impression can be different in content if desired

3.3 grey balance
set of tone values for cyan, magenta and yellow that are expected to appear as an achromatic grey under specified viewing conditions when printed using the specified printing conditions

NOTE 1 Adapted from ISO 12647-1.

NOTE 2 The user can choose between the following two practical definitions and one theoretical definition of grey, depending upon the particular context:

- a) practical definitions:
- 1) a colour having the same CIELAB a^* and b^* values as the print substrate;
 - 2) a colour that has the same CIELAB a^* and b^* values as a half-tone tint of similar L^* value printed with black ink;
- b) theoretical definition: the colorimetric definition of grey is when the CIELAB a^* and b^* values both equal 0.

3.4 tone value
 A
proportional printing value encoded in a data file and interpreted as defined in the file format specification

NOTE 1 Most files store these data as 8-bit integer values, i.e. 0 to 255. The tone value, A , expressed as a percentage of a pixel, is typically computed from the equation

$$A = 100 \times \left(\frac{V_p - V_0}{V_{100} - V_0} \right)$$

where

- V_p is the integer value of the pixel in the file;
- V_0 is the integer value corresponding to a tone value of 0 %;
- V_{100} is the integer value corresponding to a tone value of 100 %.

NOTE 2 Adapted from ISO 12647-1.

3.5 tone value increase
 ΔA
difference between the tone value in the digital data file and the tone value on the printed sheet

NOTE Adapted from ISO 12647-1.

4 Procedures

4.1 General

4.1.1 Overview

Printing standards, in general, specify the ink and paper to be used and the process control parameters in colorimetric terms. When the inks are well characterized, densitometric aims may also be included for reference. The ISO 2846 series of International Standards provides the mechanism to specify the colour and transparency of the ink. Specification of paper is not well defined and is generally limited to an identification of colour, translucency or grammage, and a reference to industry grades or classifications.

The outer gamut of the printable colour volume is primarily defined by the combination of the colour of the paper, the colour of solids of the primary inks and of the overprinted solids of two primary inks, and the colour of the overprinted solids of three primary inks in combination with the black ink. These are included in the printing conditions defined in the ISO 12647 series of International Standards and are also typically included in other printing specifications along with reference aims for densitometric data and tone value increase. Characterization data associated with such printing standards is usually prepared from print test data or data from earlier tests. In either case, it is typically modified and smoothed so as to match the specified values for the aim parameters and to represent smooth transitions within the colour volume.

In some situations, a printing system can be adjusted to match a reference by adjusting tone value increase to match the reference. The principal assumptions are

- a) if the primary and secondary colour solids are correct, the outer printing gamut is correct,
- b) if the tone curves for the individual single colour scales match those of the reference printing condition, then the internal overprint data will also match the reference, and
- c) within limits, differences in the tone value increase between presses (or between a press and the reference printing condition) can be compensated for by a series of single channel changes in the input tone values.

It is, of course, assumed that the paper and ink comply with the specifications for the printing standard being matched within reasonable tolerances.

The first two methods described in this Technical Specification use such single channel changes and differ only in the procedure used to determine the individual channel corrections.

The third method assumes that there is sufficient interaction between channels that a series of single channel corrections are not sufficient. It makes use of an ICC device-link transform (or other mechanism which maps the device-dependent printing data of one system into the device-dependent printing data of another system) which essentially is a predefined four-dimensional transform. The reason that an ICC device-link is used instead of classic ICC colour management is that the transforms included in a device-link profile can be tuned to preserve the black channel (single colour black stays as a single colour). Classic ICC colour management converts the CMYK data back into profile connection space (PCS) data and then re-computes the individual colour separations to create a new set of CMYK data.

All three methods depend on the use of the specified paper and ink, and on achieving the correct colorimetric values of the process colour solids and two-colour overprint solids.

Although the descriptions that follow refer to the “press to be used for actual printing”, it is recognized that often process control within an organization is sufficiently managed or that presses belonging to a single “family” (e.g. same brand or similar models) are sufficiently similar that the same set of corrections can be applied in a broader sense than simply to a single press. Furthermore, although the term press is used throughout this document to refer to the intended printing device, these procedures may be used with proofing devices or with digital printing devices operated in traditional half-tone, continuous tone, or non-traditional imaging modes.