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Graphic technology — Printing from digital data across multiple technologies

Part 1: Principles

Technologie graphique — Impression à partir de données numériques via des technologies multiples —

Partie 1: Principes

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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~~www.iso.org/directives).

ISO draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). ISO takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO had not received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at ~~www.iso.org/patents~~.www.iso.org/patents. ISO shall not be held responsible for identifying any or all such patent rights.

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

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

This document was prepared by Technical Committee ISO/TC 130, *Graphic* ~~Technology, WG 3, Process control and related metrology~~*technology*.

This ~~second edition cancels and replaces the~~ first edition ~~(~~of ISO/PAS 15339-1~~)~~, cancels and replaces ISO/PAS 15339-1, which has been technically revised.

The main changes are as follows:

— ~~—~~the normative references have been updated;

— former subclause 5.4.2 on tolerances has been deleted;

— former Annex B, Tolerancing schema, has been deleted and subsequent annex has been relabelled;

— published as an International Standard.

A list of all parts in the ISO 15339 series can be found on the ISO website.

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

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Introduction

This document is based on the premise that in the printing and publishing industries, electronic data are the intermediary for content storage and exchange throughout production including file preparation, job assembly, proofing, and process colour printing. It further assumes that data preparation can be largely process independent and that choice of the printing process or processes to be used for final production will be based primarily on run length requirements and substrates to be used. There are various tools in place to both define the relationship of digital data to printed colour for specific instances of printing and to manipulate data such that similar results can be obtained between and among different printing processes (see ISO/TS 10128). These specific instances of printing are typically described by colour characterization data.

When producing printed colour reproductions, it is important that the organizations responsible for material preparation, colour separation, proofing, and printing all working to a common set of parameters that uniquely define the intended visual characteristics of the final printed product. Such an agreement enables the correct production of suitable input data and subsequent production of proofs from these data. The purpose of a proof is to simulate the visual characteristics of the finished print product as closely as possible prior to production printing.

There is a unique relationship between ink, substrate, and printing process that limits the maximum chroma of the solids of the printing colorants and therefore limits the range of colours (colour gamut) that can be achieved for particular combinations. While special inks can be used, the commonly available ink pigments are used across all traditional ink processes. While toner and ink-jet systems have different colorant constraints than traditional ink processes, they tend to mimic traditional ink process aims and they will be treated as a variation of traditional ink processes. The achievable chroma range (gamuts) of ink-on-paper characterized reference printing conditions can generally be bracketed between cold-set printing on newsprint on the small end and by printing on gloss coated stocks (by a variety of processes) on the large end. Between these limits there is significant overlap of process/substrate combinations. The number of intermediate characterized reference printing conditions that are logical to define between smallest and largest is in part a function of the tolerances to which printing is expected to conform to the intended characterized reference printing condition. However, the intermediate characterized reference printing conditions also need to represent common widely used printing.

A colour characterization data set is required for each characterized reference printing condition specified. Because the intent of this document is that the data sets provided can be used as the reference for any printing process, they might not be aligned with the typical TVI and trapping associated with any specific printing process. The values selected need to represent in effect virtual printing on a virtual printing system.

It is important to realize that digital data can be encoded as already separated CMYK or can consist of un-separated data (typically in an RGB colour space) with supplementary information (ICC colour profiles, etc.) defining the colour intended on the printed sheet. Such unseparated data plus the associated supplementary data are sometimes referred to as "virtual CMYK" data. All data are encoded according to one of the PDF/X specifications (see the ISO 15930 series) to allow the necessary metadata which identifies the intended characterized reference printing condition to be included.

The colour of the printing substrate is a critical component of the colour appearance of a printed image (it behaves like a 5th colour). For halftone images, the colour of the substrate contributes mostly in the area not covered by ink. ISO 15339 is based on the assumption that the colour characterization data can be adjusted (fine-tuned) for the range of normal substrate colours expected and that different characterized reference printing conditions are not required for moderate differences in substrate colour.

Modern characterization data and profile evaluation tools allow identification of the colour of the solids, the colour and tone values of the single colour scales, and the CMY values associated with the neutral (achromatic) tone scale. Using the values derived from the colour characterization data for one printing process when

printing on a printing process with substantially different characteristics, is the recommended input for process control aims used to conform to a particular characterized reference printing condition.

~~Annex B~~Annex B provides a description of the process independent workflow that is the basis for the concepts embodied in ISO 15339.

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Graphic technology — Printing from digital data across multiple technologies

Part 1: Principles

1 Scope

This document establishes principles for the use of colour characterization data as the definition of the intended relationship between input data and printed colour for file preparation, job assembly, proofing, and graphic arts production printing. It specifies the procedure used to adjust colour characterization data for the normally expected range of substrate colour.

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 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 15930 (all parts), Graphic technology — Prepress digital data exchange using PDF

3 Terms and definitions

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

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

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

— IEC Electropedia: available at ~~https://www.electropedia.org/~~https://www.electropedia.org/

3.1
colour characterization data
tabulation of data that represents the relationship between device code values (e.g. CMYK) and the colour (CIELAB) produced or intended to be produced on the printed sheet

~~NOTE~~ Note 1 to entry: Where such a set of colour characterization data are used as a reference, it is referred to as a characterized reference printing condition (CRPC).

3.2
colour profile
set of transforms, encoded according to the rules of ISO 15076-1, that convert data between (to and from) device space and profile connection space

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Note 1 to entry: The transforms contained within a colour profile can include manipulation of gamut compression/expansion, tone reproduction, colour separation, black generation, printing limitations (e.g., total area coverage), etc.

3.3
colour gamut
region of CIELAB colour space containing all printable colours

Note 1 to entry: For comparison purposes, the CIELAB values of the primaries and secondaries along with the substrate are often an adequate, if sparse, definition of a colour gamut. The surface values of the measurements of a target such as that included in ISO 12642-2 can provide a more complete definition.

3.4
characterized reference printing condition
CRPC
identified printing condition ~~(3.4)~~(3.4) and associated *colour characterization data* ~~(3.1)~~(3.1) intended for use with multiple printing processes

3.5
process independent
independent of the printing process (offset, flexography, gravure, digital, etc.), to be used for production of printed material

3.6
identified printing condition
printing condition documented in a national or international standard or industry publication in a way that allows it to be replicated by an industry practitioner

4 Requirements

4.1 Principles and assumptions

One of the key principles upon which this document is based is that colour content data can be adjusted such that any printing processes capable of achieving a specified colour gamut can produce the within-gamut image colours specified by the appropriate reference colour characterization data. This allows printing aims to be process independent.

A second principle is that process control aims and tools should be based on (extracted from) the reference colour characterization data selected and not based on a priori assumptions. Many of the parameters used in process control such as tone value increase, grey balance, etc. are contained within, or can be derived from, the colour characterization data chosen as a reference. Local site tools can also be used for initial setup processes where these are based on the known differences between the colour characterization data aims and the colour characterization of the actual printing system being used. The aim values extracted from characterisation data should match or be aligned with the aim values specified in the appropriate part of ISO 12647 when printing using the process from which the characterisation data was derived. Where this is not the case, the process control principles and tolerances should still be used.

NOTE 1 The ISO 12647 series specifies process control aims and requirements. When aim values extracted from characterisation data meet the requirements of the applicable part of ISO 12647, conformance with both standards is possible.

Where similar characteristics, such as tone reproduction, are desired between different characterized reference printing conditions (different colour gamuts), these shall be built into the colour characterization data associated with these characterized reference printing conditions. Characterized reference printing conditions, and their associated colour characterization data, can be thought of as a virtual printing system

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