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Graphic technology — Printing from digital data across multiple technologies — Part 1: Principles

SECRETARIAT
NPES THE ASSOCIATION FOR SUPPLIERS OF PRINTING, PUBLISHING AND CONVERTING TECHNOLOGIES

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AMERICAN NATIONAL STANDARDS INSTITUTE, INC.

CGATS

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Foreword

This standard defines the principles associated with the use of color characterization data to define process color printing. Such data represents the expected relationship between input CMYK electronic data and the printed color on the final product. It 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.

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Introduction

CGATS 21 is based on the premise that in the printing and publishing industry, electronic data is the intermediary for content storage and exchange throughout production including copy preparation, job assembly, proofing, and process color 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. Each of the major printing processes has unique limitations that will be covered in additional parts of CGATS 21. There are a variety of tools in place to both define the relationship of digital data to printed color for specific instances of printing and to manipulate data such that similar results can be obtained between and among different printing processes (ISO/TS 10128). These specific instances of printing are typically described by color characterization data, which is the relationship between CMYK input data and color measured on the printed sheet. Where such a set of color characterization data is used as a reference it is referred to as a characterized reference printing condition.

When producing printed color reproductions it is important that the organizations responsible for material preparation, color separation, proofing, and printing are 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 colors (color gamut) that can be achieved for particular combinations. While special inks can be used, the commonly available ink pigments seem to be 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 processes 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 (on 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 conditions and that was the determining factor for the selection of printing conditions listed in Part 2 of CGATS 21. In addition a characterized reference printing condition 7 is included to represent a possible exchange space for large gamut processes that exceed the color gamut of characterized reference printing condition 6 and therefore need a larger exchange gamut.

The data sets defined in CGATS 21-2 are those associated with the initial publication of CGATS 21. It is the intent of CGATS that if changes in, or additions to, these data sets are needed in the future they will be documented in added parts of CGATS 21 so that changes in the data sets are possible without loosing traceability to earlier data sets.

A color characterization data set is required for each characterized reference printing condition specified. Because these data sets can be used as the reference for any printing process, they will not be aligned with the typical TVI and trapping associated with any specific process. The values selected represent a compromise between all processes – 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 color space) with supplementary information (ICC color profiles, etc) defining the color it is intended to be on the printed sheet. Such un-separated data plus the associated supplementary data is sometimes referred to as "virtual CMYK" data. All data is to be encoded according to one of the PDF/X specifications (Parts of ISO 15930) or to allow the necessary metadata which identifies the intended characterized reference printing condition to be included.

The color of the printing substrate is a critical component of the color appearance of a printed image (it behaves like a 5th color). With the current widespread use of optical brightening agents (OBA) substrate color is defined in terms of its

apparent reflectance under D50 illumination (see ISO 3664). For halftone images the color of the substrate contributes mostly in the area not covered by ink. ISO 13655 provides a reasonably effective method to adjust tristimulus data of measured halftone areas for moderate changes in substrate color. This part of CGATS 21is based on the assumption that the color characterization data can be adjusted (fine tuned) for the range of normal substrate colors expected and that different characterized reference printing conditions are not required for moderate differences in substrate color.

Although density, tone value increase, gray balance, etc. are individually important tools for the printing and publishing industry, in this Standard they are assumed to be part of process control and not printing definition. They need to be considered in developing reference color characterization data sets and need to be used where applicable as part of local site ongoing process control.

Gray balance in particular is a useful tool for the control of a running press. Modern characterization data and profile evaluation tools allow identification of the CMY values associated with the neutral (achromatic) tone scale and the single color tone value scales for that color characterization data set. Using the values derived from the color characterization data, rather than any a priori values, is the recommended input for process control aims used to control a printing process intended to conform to a particular characterized reference printing condition.

Annex B provides a description of the process independent workflow that is the basis for the concepts embodied in CGATS 21.

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1 Scope and field of application

This part of CGATS 21 establishes principles for the use of color characterization data as the definition of the intended relationship between input data and printed color for copy preparation, job assembly, proofing, and graphic arts production printing. Additional Parts of CGATS 21 specify a limited number of characterized reference printing conditions that span the expected range of color gamuts used for the production of printed material from digital data, regardless of printing process used. The procedure to be used to adjust color characterization data for the normally expected range of substrate color Is specified.

2 Normative references

The following standards contain provisions that, through reference in this text, constitute provisions of this standard. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/TS 10128, *Graphic technology — Methods of adjustment of the colour reproduction of a printing system to match a set of characterization data*

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*

ISO 15076-1, *Image technology colour management — Architecture, profile format and data structure — Part 1: Based on ICC.1:2010*

CGATS/IDEAlliance TR 015, *Graphic technology — Graphic technology — Methodology for Establishing Printing Aims Based on a Shared Near-neutral Gray-scale*

CGATS TR 016, *Graphic technology — Printing Tolerance and Conformity Assessment*

CGATS 21-2, *Graphic technology — Printing from digital data across multiple technologies* — Part 2: *Characterized reference printing conditions 2013*

3 Terms and definitions

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

3.1
color characterization data
tabulation of data that represents the relationship between device code values (eg:CMYK) and the color (CIELAB) produced on the printed sheet by those values in a specific printing process