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Graphic technology — Guidelines and recommendations for multicolour (CMYKOGV) print characterization

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Contents

Page

Foreword

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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).

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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.

This document was prepared by Technical Committee ISO/TC 130, *Graphic technology*.

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.

Introduction

Multicolour process packaging printing

Print technology and quality has improved in the past decades. Mechanical print characteristics perform at a higher level, as have customer expectations. For cyan, magenta, yellow, and black (CMYK), colour standardization has been adopted and customers expect a specific colour gamut and conformance to a characterization data set when printing with CMYK. The result of technology integration in all print processes has provided improvement in productivity and print quality. The research of Neugebauer (1937)[18], Murray (1936)[17], and Yule (1967)[22] presented a view of colour reproduction, which has evolved from imaging systems based on silver halide photography technology leading to today's digital pixel-by-pixel access to colour image data.

Print systems have also evolved from four-colour (CMYK) on four unit presses to CMYK plus additional colours as noted in research and recognized patents. Often called multicolour process printing (MCPP), additional terms used are Extended Colour Gamut (ECG) printing, Expanded Gamut Printing (EGP), Fixed-palette (FP) printing, N-colour printing, High-Fidelity (HiFi) printing. Examples of research include Kueppers (1989), Mills Davis/HiFi project (1991), Ostromoukhov[20], Boll[9], Mahy & De Baer[16], Bernasconi (1998), Herbert and DiBernardo (1998), Lo (1997), Viggiano and Hoagland[21], and Ingram and Simon[14]. In most of these references, additional colours were added to enhance image elements of the selected CMYK ink set. Viggiano and Hoagland provide methodology for colourant selection. Package printing often requires spot colours to be matched to aims within tolerances, with colour remaining consistent throughout the print run. This document describes insight concerning the selection of colourants to expand or enhance colour print gamut with orange, green, and violet (OGV) and recommended characterization procedures. The colourant selection may be restricted by the print process characteristics[12].

Previous efforts recommend adding an ink containing pigment Green, an ink containing Violet, and an ink containing an orange pigment. Due to ink curing systems, difficulty remains making a specific recommendation on a single orange pigment. Clemson University studies by Ingram and Simon[14], and Zeleznik[23] were able to recommend Colour Index International (C.I.)[10] pigment Orange-16 and C.I. pigment Orange-64. C.I. values are a common database reference for manufactured colour products, which can be communicated based upon a specific source. The recommended CMYKOGV pigment set provides increased colour gamut as seen in the colour gamut comparison as follows.

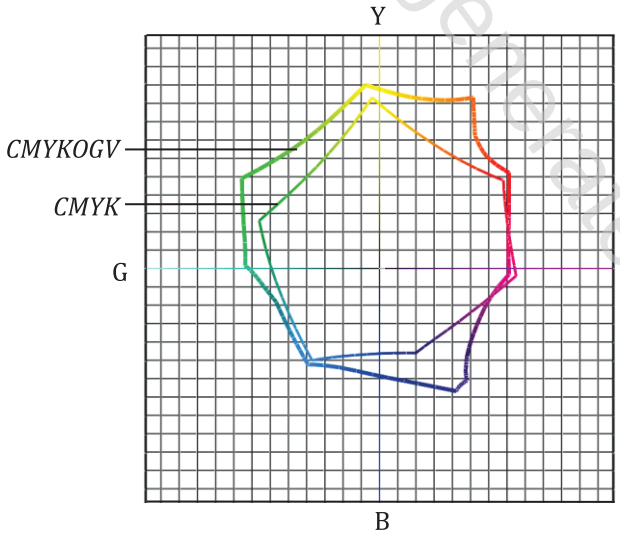

Figure 1 — CIELAB Colour Boundary Comparison of CMYK to CMYKOGV Hue Aims[15]

Use of a standardized multicolour printing target is required. Previous efforts have used an IT8.7/3 or IT8.7/4 colour characterization target. Four data sets are produced: 1. CMYK, 2. CMVK–complementary substituted ink, 3. CGYK–complementary substituted ink, and 4. OMYK–complementary substituted

ink. The measured spectral data sets were combined to produce a master CMYKOGV data set. A custom seven-colour characterization target may also be used. The colour data set is then analysed to calculate the colour gamut fit. Lastly, a technology capable of producing a compatible ICC n-colour profile is needed to complete a colour-managed workflow utilizing the CMYKOGV data.

Graphic technology — Guidelines and recommendations for multicolour (CMYKOGV) print characterization

1 Scope

This document provides guidelines and a procedure to generate a multicolour characterization dataset. Specifications for colour printing with CMYK + Orange, Green, and Violet are presented. Also, this document provides a recommendation on CMYKOGV ink pigment selections to produce an optimum colour gamut for specific printing processes or use cases. The recommended CMYKOGV ink pigment selections might not be suitable or available for all printing or digital processes or use cases. The procedure in this document is also applicable for CMYK plus any subset of O, G or V.

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 3664, *Graphic technology and photography — Viewing conditions*

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

ISO 17972-1, *Graphic technology — Colour data exchange format — Part 1: Relationship to CxF3 (CxF/X)*

ISO 28178, *Graphic technology — Exchange format for colour and process control data using XML or ASCII text*

ISO/TS 19303-1, *Graphic technology — Guidelines for schema writers — Part 1: Packaging printing*

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

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

3.1
calibration
comparison and adjustment between printing systems – one of known behaviour or correctness, made with a set of reference colours, and another printing system made to print in as similar a way as possible with the reference device

Note 1 to entry: The G7 methodology is one form of printing system calibration where the reference colours are 3-colour overprints made to match as closely as possible the optical properties of a series of black-only prints.

Note 2 to entry: ISO/PAS 15339-1 describes another process for calibration of a printing system to a Characterized Reference Printing Condition.

Note 3 to entry: Often, the first step alone in the above definition is perceived as being calibration.