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Photography — Photographic reflection prints —

Part 1: Evaluation methods of image quality

Photographie — Tirages photographiques par réflexion —

Partie 1: Méthodes d'évaluation de la qualité de l'image

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Contents

Page

Foreword ..... **iv**
Introduction ..... **v**
1 Scope **1**
2 Normative references **1**
3 Terms and definitions **1**
3.1 Terms 1
3.2 Abbreviations 3
4 Overview of the photographic print image quality **3**
4.1 General 3
4.2 Density and colour 4
4.3 Uniformity 4
4.4 Tone 4
4.5 Detail reproduction 4
4.6 Glossiness 4
4.7 Others 4
5 Density **5**
6 Colour **5**
7 Uniformity **7**
7.1 General 7
7.2 Micro uniformity 8
7.2.1 Granularity 8
7.2.2 Graininess 8
7.3 Semi-micro uniformity 10
7.4 Macro uniformity 10
8 Tone **12**
8.1 Tone reproduction 12
8.2 Capacity for tone reproduction 12
9 Detail reproduction **13**
9.1 General 13
9.2 Resolution measured with patterns of fine lines 13
9.3 Resolution measured with contrast-resolution test target 15
10 Glossiness **16**
10.1 General 16
10.2 Specular gloss 16
10.3 Sharpness of reflected light (Image clarity and distinctness of image) 17
Bibliography **20**

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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).

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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*.

A list of all parts in the ISO 20791 series can be found on the ISO website.

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Introduction

Image quality of photographic prints is not based on any single feature but instead involves several factors. There are so-called “five major properties” for representing photographic image quality, and each one is essential: (1) density; (2) colour; (3) uniformity; (4) tone and (5) detail reproduction. Glossiness represents another important factor. It affects the observer’s perception since it relates to the light specularly reflected from prints. Though the specularly reflected light contains no information from the printed image, it affects the observer’s perception. Furthermore, sharpness of the shape of reflected light sources also affects the perception.

Several standards for image quality measurement have been documented by ISO/TC 42. Standards intended for analogue prints fail to properly address the effect of half tone dots, which required to produce inkjet and electrophotographic prints.

In recent years, the field of imaging science and technology has witnessed the investigation of measurement methods for digital prints. In addition, standards have been developed by ISO/IEC JTC 1/SC 28 and ISO/TC 130. Some of these standards cannot be applied broadly to photographic prints because they focus on a specific technical or industrial field. However, the rest of these standards handle common aspects and can be applied to photographic prints with or without modifying the standard. This document provides information about the measurement methods for image quality that are applicable to photographic prints, including digital prints produced using a range of printing technologies.

ISO/TC 42 plans to develop test targets for image quality measurements on small size photographic prints. This document provides methods which can be applied for the measurements.

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Photography — Photographic reflection prints —

Part 1: Evaluation methods of image quality

1 Scope

This document provides information and examples of measurement methods for evaluating the image quality of digital photographic reflection prints, including prints produced by ink jet, thermal dye transfer, electrophotography and silver halide (chromogenic) technologies. These measurement methods are intended especially to be applicable to small prints with a size of available picture area ranging from 35 mm × 45 mm to 360 mm × 450 mm, a popular and basic application of photographic print technology.

NOTE The definition of "digital print" here is print made 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.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions 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/

3.1 Terms

3.1.1
reflectance factor
ratio of the reflected flux as measured to the reflected flux under the same geometrical and spectral conditions for an ideal 100 % diffuse reflecting surface

[SOURCE: ISO/IEC 24790:2017, 3.30]

3.1.2
spots per inch
spi
spots per 25,4 mm

[SOURCE: ISO/IEC 24790:2017, 3.34]

3.1.3
visual transfer function
VTF
function used to represent human visual characteristics when dividing the system into parts and evaluating it as a superposition of transfer functions in the spatial frequency domain

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3.1.4
mura
non-uniformity in the image that should be of uniform density or uniform colour

Note 1 to entry: Mura defects are larger than graininess or mottle, and it generally has ambiguous boundaries.

3.1.5
addressability
number of uniquely identifiable printable spot positions per unit distance

[SOURCE: ISO/IEC 29112:2018, 3.1.1]

3.1.6
area modulation
method of expressing gradation by changing the size or the frequency of dots

3.1.7
density modulation
method of expressing gradation by changing the density of pixels

3.1.8
contrast transfer function
CTF
ratio of the image contrast to the object contrast of a square-wave pattern as a function of spatial frequency

[SOURCE: ISO/TR 19319:2013, 2.2, modified — Notes 1 and 2 to entry were deleted.]

3.1.9
modulation transfer function
MTF
spatial frequency response
SFR
ratio, as a function of spatial frequency, of the measured modulation response in a print produced by a printing system, to the stimulus modulation presented to that printing system

[SOURCE: ISO/IEC 29112:2018, 3.1.16]

3.1.10
line spread function
LSF
normalized spatial signal distribution in the linearized output of an imaging system resulting from imaging a theoretical infinitely thin line

[SOURCE: ISO 12231:2012, 3.94, modified — Note 1 entry was deleted.]

3.1.11
specular gloss
gloss observed or measured at the specular angle

[SOURCE: ISO 8254-1:2009, 3.8]

3.1.12
image clarity
degree of sharpness of an image reflected by a specimen or transmitted through a specimen

[SOURCE: ISO 17221:2014, 3.1, modified — Note 1 to entry was deleted.]

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3.2 Abbreviations

R	red
G	green
B	blue
V	visual
CIE	International Commission on Illumination
CIELAB	CIE 1976 ($L^*a^*b^*$) colour space
dpi	dots per inch
spi	spots per inch
cy/mm	cycle per millimetre
DOI	distinctness of image

4 Overview of the photographic print image quality

4.1 General

It is commonly understood that there are five major properties for representing the image quality of photographic prints, and each one is essential in representing the overall image quality. Each property can be further classified into several sub-properties. Table 1 presents these categorised properties and some related examples of measurements.

Table 1 — Overview of properties and measurement methods

Property	Sub-property	Related measurement methods
(1) Density	a) Optical density	— Optical density R, G, B and V values for white, grey, black and each colour step
(2) Colour	a) Chromaticity	— Colorimetric value in colour space
	b) Colour gamut	— Coverage in colour space (area, volume)
(3) Uniformity	a) Micro uniformity	— Granularity and graininess (tens to hundreds of micrometres)
	b) Semi-micro uniformity	— Mottle (hundreds to thousands of micrometres)
	c) Macro uniformity	— Non-uniformity in print area, such as mura, banding and shading (thousands of micrometres to the whole printing area)
(4) Tone	a) Tone reproduction	— A characteristic of a printing system how colour or density is modulated by the change in the intensity of input image signal to the system.
	b) Capacity for tone reproduction	— Number of tonal steps
(5) Detail reproduction	a) Detail reproduction	— Contrast transfer function (CTF) property and several “spatial resolution” values

The following aspects should be included when evaluating and measuring digital photographic print image quality, in comparison to that of traditional analogue photographic prints.

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