

Implementation of
ISO 5-3:1995

Photography — Density measurements —

Part 3: Spectral conditions

ICS 37.040.20

NO COPYING WITHOUT BSI PERMISSION EXCEPT AS PERMITTED BY COPYRIGHT LAW



Document Sharing Hub

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by Technical Committee CPW/42, Photography, to Subcommittee CPW/42/-/3, Sensitometry, image measurement and viewing, upon which the following bodies were represented:

- British Film Institute
- British Institute of Professional Photography
- British Photographic Association
- Sira Limited

The following bodies were also represented in the drafting of the standard, through sub-committees and panels:

- Association of Teachers of Printing and Allied Subjects
- British Dental Association
- British Kinematograph, Sound and Television Society
- British Printing Industries Federation
- College of Radiographers
- Institute of Physics
- Institute of Practitioners in Advertising
- Lighting Industry Federation Ltd.
- Ministry of Defence
- Oil and Colour Chemists Association
- PICON
- Periodical Publishers Association Ltd.
- Photogrammetric Society
- Pira International
- Royal Photographic Society

This British Standard, having been prepared under the direction of the Consumer Products and Services Sector Board, was published under the authority of the Standards Board and comes into effect on 15 February 1996

© BSI 10-1999

The following BSI references relate to the work on this standard:
Committee reference CPW/42/-/3
Draft for comment 94/303017 DC

ISBN 0 580 25277 9

Amendments issued since publication

Amd. No.	Date	Comments

Contents

	Page
Committees responsible	Inside front cover
National foreword	ii
Foreword	iii
Text of ISO 5-3	1

National foreword

This British Standard reproduces verbatim ISO 5-3:1995 and implements it as the UK national standard. It supersedes BS 1384-3:1985.

This British Standard is published under the direction of the Consumer Products and Services Sector Board whose Technical Committee CPW/42/-/3 has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible international committee any enquiries on interpretation, or proposals for change, and keep UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

NOTE International and European Standards, as well as overseas standards, are available from Customer Services, BSI, 389 Chiswick High Road, London W4 4AL.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, the ISO title page, pages ii to iv, pages 1 to 18 and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

INTERNATIONAL STANDARD

ISO
5-3

Second edition
1995-11-15

Photography — Density measurements — Part 3: Spectral conditions

*Photographie — Mesurage des densités —
Partie 3: Conditions spectrales*



Reference number
ISO 5-3:1995(E)

Contents

	Page
Foreword	iii
Introduction	1
1 Scope	1
2 Normative references	2
3 Definitions	2
4 Density measurements	2
5 Spectral response	3
6 Spectral products	3
7 Notation	3
8 Types of density	3
8.1 ISO visual density	3
8.2 Printing density	3
8.3 ISO status A density	4
8.4 ISO status M density	4
8.5 ISO status T density	4
8.6 ISO status E density	7
8.7 ISO narrow-band density	7
8.8 ISO status I density	7
8.9 ISO type 3 density	12
9 Spectral tolerances	12
10 Absolute reference standard (white)	12
Annex A (informative) Calibration of densitometer	13
Annex B (informative) Spectral products for ISO density and relative spectral power distributions for influxes	13
Annex C (informative) Sideband rejection	18
Annex D (informative) Bibliography	18
Figure B.1 — Influx distributions and spectral products for visual density	14
Figure B.2 — Spectral products for type 1 and type 2 densities	15
Figure B.3 — Spectral products for status A and M densities	16
Figure B.4 — Spectral products for status T densities	17
Figure B.5 — Spectral products for status E and I densities	18
Table 1 — ISO densitometer influx spectra	5
Table 2 — $\log_{10}$ spectral products for ISO visual, type 1 and type 2 densities (Normalized to 5,000 peak)	6
Table 3 — Status A — $\log_{10}$ spectral products Π_A (Normalized to 5,000 peak)	8
Table 4 — Status M — $\log_{10}$ spectral products Π_M (Normalized to 5,000 peak)	9
Table 5 — Status T — $\log_{10}$ spectral products Π_T (Normalized to 5,000 peak)	10
Table 6 — Status E — $\log_{10}$ spectral products Π_T (Normalized to 5,000 peak)	11
Table C.1 — Deviations from actual density	18

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.

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.

International Standard ISO 5-3 was prepared by Technical Committee ISO/TC 42, *Photography*.

This second edition cancels and replaces the first edition (ISO 5-3:1984), which has been technically revised. It has also been expanded to include additional spectral types commonly used in consumer, professional, and graphic arts photographic applications. Status E and status I responses have been included in view of their relevance to graphic technology.

Annex A to Annex D of this part of ISO 5 are for information only.

Introduction

This part of ISO 5 is one of a series which specifies the spectral conditions for optical densitometry as practised in black-and-white and colour photographic applications.

To define a density value fully, it is necessary to specify both the geometric and spectral conditions of the measuring system. Geometric conditions are described in ISO 5-2 for transmission density, and in ISO 5-4 for reflection density. This part of ISO 5 specifies the spectral conditions for both transmission and reflection density measurements.

In the early years of densitometry, the spectral responses of instruments were specified only in terms of the colour filters used in the construction. Although it was seldom the case, it was assumed that the spectral responses of the photoreceivers and the illuminant spectral energy distributions as well as all intervening optical components were the same in all instruments. In more recent times densitometry standards have specified that the product of all these components must equal some given set of published "documentary" values. Such a specification allows flexibility to the manufacturer while providing for improved accuracy and precision. It also allows for standard reference materials to be manufactured and certified based on fundamental measurements.

In photographic image reproduction, optical density is a measure of the modulation of light or other radiant flux by a given area of the recording medium. The measurement of density may be of interest for various reasons. It may be necessary to assess the lightness or darkness of an image, to predict how a film or paper will perform in a printing operation, or to determine some measure of the amounts of colorants in the image for the purpose of controlling a colour process. If the visual effect is of interest, the spectral conditions of measurement must simulate some appropriate illumination and the spectral sensitivity of the eye. For printing operations, the spectral power distribution of the irradiator to be used in the printing operation and the spectral sensitivity of the print material must be simulated. In evaluating original material for colour separation, the illuminant, the spectral sensitivity of the separation medium, and the spectral transmittance of the tricolour separation filters must be simulated.

Certain types of density measurements are often made to generate sensitometric curves which are used to characterize the photographic properties of films and papers. Densities can also be used for tonereproduction analysis and to monitor various operations such as photoprocessing, lithography, gravure, screen printing processes, etc.

The specified spectral power distribution of the incident flux for transmission density measurements differs from that for reflection density measurements. For reflection density measurements, incandescent tungsten illumination of the type known as CIE (Commission internationale de l'éclairage) standard illuminant A, adopted by the International Commission on Illumination in 1931 is specified. Its use in densitometry is preferred because national standardizing laboratories are generally prepared to make spectrophotometric measurements and perform colorimetric computations of visual reflection factors on the basis of CIE standard illuminant A. This usage facilitates the procurement of physical standards for reflection densitometry. For transmission density measurements, the spectral distribution of the influx is CIE standard illuminant A, as modified by a typical heat-absorbing filter to protect the specimen and optical system from heat.

Many standards for reflection density specify the use of barium sulfate as the reference standard. However, pressed barium sulfate is fragile, variable from lot to lot of powder, variable from pressing to pressing, and the reflectance drifts appreciably in the first few days after pressing.

In 1969, the International Commission on Illumination (CIE) recommended that all reflectance factors and, by inference, the corresponding reflection densities be reported relative to a perfectly reflecting and perfectly diffusing material.

In day-to-day operation reflection densitometers are usually calibrated with standard reference materials available from a number of sources. These working standards are calibrated with respect to primary standards that are calibrated by absolute methods in national standards laboratories.

1 Scope

This part of ISO 5 specifies spectral conditions for the measurement of several types of densities used in photographic image reproduction. Photographic image reproduction as used throughout this part of ISO 5 encompasses the broad definition of photography as the art or process of producing images on a sensitized surface by the action of radiant energy.