

Speed of sensitized photographic materials —

Part 4: Specification for daylight and incandescent tungsten illuminants for sensitometry

[ISO title: Photography — Illuminants for sensitometry —
Specifications for daylight and incandescent tungsten]

UDC 771.534.5:771.44:[628.9.041.678 + 628.92]

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Cinematography and Photography Standards Committee (CPM/-) to Technical Committee CPM/10 upon which the following bodies were represented:

- British Institute of Non-destructive Testing
- British Kinematograph, Sound and Television Society
- British Photographic Association
- College of Radiographers
- Institute of Physics
- Ministry of Defence
- Photogrammetric Society

This British Standard, having been prepared under the direction of the Cinematography and Photography Standards Committee, was published under the authority of the Board of BSI and comes into effect on 29 August 1986

© BSI 09-1999

First published July 1972
First revision February 1979
Second revision August 1986

The following BSI references relate to the work on this standard:
Committee reference CPM/10
Draft for comment 83/36092 DC

ISBN 0 580 15292 8

Amendments issued since publication

Amd. No.	Date of issue	Comments

Contents

	Page
Committees responsible	Inside front cover
National foreword	ii
0 Introduction	1
1 Scope and field of application	1
2 References	1
3 Definitions	1
4 ISO sensitometric illuminants	2
5 Spectral distribution index (ISO/SDI)	3
6 Tolerances	3
Annex A Example sources	8
Annex B Exposure calculations	10
Annex C Average colour film sensitivities	11
Figure — Trilinear graph	4
Table 1 — Relative spectral power distribution, S_λ , of ISO sensitometric daylight illuminant	5
Table 2 — Relative spectral power distribution, S_λ , of ISO sensitometric studio tungsten illuminant	6
Table 3 — Relative spectral power distribution, S_λ , of ISO sensitometric photoflood illuminant	7
Table 4 — Calculation of the ISO spectral distribution index for a candidate sensitometric daylight illuminant	9
Table 5 — Average colour film relative spectral sensitivity $\bar{s}(\lambda)$	11
Publications referred to	Inside back cover

National foreword

This revision of this Part of BS 1380 has been prepared under the direction of the Cinematography and Photography Standards Committee. It is identical with ISO 7589:1984 *“Photography — Illuminants for sensitometry — Specifications for daylight and incandescent tungsten”*, published by the International Organization for Standardization (ISO).

BS 1380-4:1979 was published as three separate Sections, which were identical to three separate ISO standards which have been withdrawn. This revision of BS 1380-4 supersedes BS 1380-4.1, BS 1380-4.2 and BS 1380-4.3 which are withdrawn.

The changes made in the revision of this Part of BS 1380 are explained in clause 0.

Terminology and conventions. The text of the International Standard has been approved as suitable for publication as a British Standard without deviation. Some terminology and certain conventions are not identical with those used in British Standards; attention is drawn especially to the following.

The comma has been used as a decimal marker. In British Standards it is current practice to use a full point on the baseline as the decimal marker.

Wherever the words “International Standard” appear, referring to this standard, they should be read as “Part of BS 1380”.

Cross-references. There are no equivalent British Standards to ISO 3028 and ISO 6728 which are referred to in clause 2. However as they are mentioned in the text for information only this does not adversely affect the validity of the standard.

CIE Publication No. 15 and No. 17, referred to in the text, are published by the International Commission on Illumination (Commission Internationale de L’Eclairage) and are also mentioned for information only.

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, pages 1 to 12, an inside back cover 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.

0 Introduction

Colour and black-and-white camera films are most commonly designed for use with three light sources — daylight, studio tungsten (type B), and photoflood (type A). This International Standard specifies three corresponding illuminants for sensitometry, since most meaningful results are obtained when exposing conditions match those of actual film use. Two other important photographic light sources — electronic flashtube and blue photoflash lamps — give light of a colour that approximates daylight so the sensitometric daylight illuminant serves for films used with them as well. Other aspects of sensitometric exposure and testing form the subjects of International Standards more closely related to specific classes of sensitized products.

This International Standard constitutes a revision of ISO 2239:1972, ISO 2241:1972 and ISO 2242:1972.

It differs in the following respects:

- a) a new spectral power distribution, designated studio tungsten, is used to represent illumination supplied by lamps operated at 3 200 K. This is based on spectroradiometric measurements taken in several professional photographic studios. It recognizes the fact that lamp ageing, reflectors, diffusers, and general studio conditions reduce the effective distribution temperature from 3 200 to about 3 050 K. This does not mean there is a change in the lamps themselves or in the balance of type B colour films;
- b) the spectral transmittance values have been changed to coincide with those of the ISO standard camera lens (see ISO 6728). For this reason, transmittance values are slightly lower in the blue and red portions of the spectrum compared to those previously used;
- c) a new criterion has been adopted for judging the acceptability of illuminants for sensitometry, which generally are lamp-filter combinations. Unlike the old criterion which gave equal weighting to all wavelength regions, the new criterion emphasizes the spectral bands to which typical colour films are most sensitive. The result is significantly greater flexibility in finding lamp-filter combinations that provide the aim spectral power distributions required.

The illuminants described in this International Standard are used in ISO 3028 and other International Standards which describe methods for determining the speed of various types of sensitized products exposed in cameras.

1 Scope and field of application

This International Standard specifies the spectral characteristics of illuminants for sensitometry appropriate for evaluating camera films used for pictorial photography in natural daylight, studio tungsten, and photoflood, including colour and black-and-white films, both reversal and negative types. It also describes a method for evaluating the acceptability of illuminants for sensitometry and specifies tolerances.

2 References

ISO 3028, *Photography — Camera flash sources — Determination of ISO spectral distribution index (ISO/SDI)*.

ISO 6728, *Photography — Camera lenses — Determination of ISO colour contribution index (ISO/CCI)*.

CIE Publication No. 15 (E-1.3.1), *Colorimetry, Official Recommendations of the International Commission on Illumination*.

CIE Publication No. 17 (E-1-1), *International Lighting Vocabulary*.

3 Definitions

For the purpose of this International Standard, the following definitions apply.

3.1 source

a physical emitter of energy such as a lamp or the sun and sky

3.2 illuminant

light having a specific spectral power distribution not necessarily provided directly by a source and not necessarily realizable by a source

3.3 relative spectral power distribution

a description of the spectral character of radiation by the relative spectral distribution of some radiometric quantity (radiant flux, radiant intensity)

3.4 distribution temperature

the thermodynamic temperature of the full radiator for which the ordinates of the spectral distribution curve of its radiance are proportional, in the visible region, to those of the distribution curve of the radiation considered

3.5

photographic daylight

the relative spectral power distribution of typical daylight having a correlated colour temperature of 5 500 K. This describes the combination of skylight and sunlight when the sun is about 40° above the horizon with a clear atmosphere, and is designated as D_{55}

3.6

spectral distribution index; SDI

a three number designation which describes the degree to which a light source is expected to change the overall colour of a photograph relative to that obtained with a specified illuminant

4 ISO sensitometric illuminants

The colour quality of a photographic illuminant is a description of the relative spectral power distribution used to illuminate the subject matter photographed. This would be the same as that incident on the camera lens from a non-selective neutral absorber. This International Standard is concerned with the quality of radiation incident on the film (not the camera) after it has been modulated by the ISO standard camera lens (see ISO 6728). This is representative of lenses found in medium and high priced cameras used for reversal colour films which are the most critically sensitive to spectral conditions.

The relative spectral power distributions of the three ISO sensitometric illuminants described in this International Standard are normally obtained by operating a lamp at a specified condition and modulating the flux with selectively absorbing filters of suitable spectral transmittance. It should be emphasized that this International Standard specifies the spectral distribution of power incident on the exposure plane at 10 nm intervals, i.e. the spectral power emitted by a source and its modulation by all elements in the sensitometer that affect the spectral quality, for example filters, mirrors, and step tablet.

4.1 ISO sensitometric daylight illuminant

This is suitable for the sensitometry of “daylight balanced” colour films and is also normally used for black-and-white camera films. These films are designed to be exposed in photographic daylight (see 3.5), or with flash. The spectral power distribution used to represent photographic daylight was taken from the data of Judd *et al*¹⁾ who give typical spectral irradiance data for five different conditions of daylight (skylight, and sunlight plus skylight). Data corresponding to a correlated colour temperature of 5 500 K were selected as the most appropriate for photography and designated as D_{55} . This is the prevailing condition in temperate zones during the daylight hours recommended for colour photography.

The ISO sensitometric daylight illuminant, is defined as the product of the spectral power distribution of photographic daylight (D_{55}) and the spectral transmittance of the International Standard camera lens $\bar{\tau}(\lambda)$. The aim values, S_{λ} , for the relative spectral power distribution for this illuminant are given in Table 1. An illuminant complying with these values within the tolerances specified in clause 6 may be designated “ISO sensitometric daylight illuminant”.

4.2 ISO sensitometric studio tungsten illuminant

This is suitable for the sensitometry of type B colour films which are normally exposed with lamps described as 3 200 K lamps. However, the effect of lamp age, reflectors, and diffusers is to reduce the average effective distribution temperature to about 3 050 K. The spectral power distribution used to represent studio tungsten was obtained by spectroradiometric measurements in several photographic studios. The aim values, S_{λ} , for the relative spectral power distribution for this source after modulation by the ISO standard lens are given in Table 2. An illuminant complying with these values within the tolerances specified in clause 6 may be designated “ISO sensitometric studio tungsten illuminant”.

¹⁾ JUDD, D.B., MACADAM, D.L., WYSZECKI, G. Spectral distribution of typical daylight as a function of correlated color temperature. *Journal of the Optical Society of America*. 54 (8) 1964:1031–1040.