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МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ

Photography — Colour negative films for still photography — Determination of ISO speed

Photographie — Films négatifs couleur pour prise de vue — Détermination de la sensibilité ISO

Reference number
ISO 5800 : 1987 (E)

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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 5800 was prepared by Technical Committee ISO/TC 42, *Photography*.

This second edition cancels and replaces the first edition (ISO 5800 : 1979), of which it constitutes a technical revision.

Users should note that all International Standards undergo revision from time to time and that any reference made herein to any other International Standard implies its latest edition, unless otherwise stated.

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Photography — Colour negative films for still photography — Determination of ISO speed

0 Introduction

Satisfactory prints can generally be obtained from colour negative films over a significant range of exposure provided that suitable adjustments are made in the printing operation. The underexposure latitude is approximately one camera exposure value unit (camera stop or E_v) when film speed is determined using this International Standard. Overexposure latitude of a colour negative film can be as large as 3 E_v. In other words, if a colour negative film has a speed of ISO 100, it may give satisfactory results if it is exposed anywhere from ISO 12 to ISO 200.

Photographers, on the average, tend to underexpose film, particularly in simple cameras,[1] as a result of their desire to record events under cloudy conditions or in the shade. Some camera-cartridge systems are designed to take advantage of the overexposure latitude of colour negative films to improve results when pictures are taken under these circumstances. This is accomplished by overexposing the film under sunlight conditions to increase the underexposure latitude of the system. For example, a 126-size cartridge containing film with an ISO speed of 100 may be coded for ISO 64 speed.

This International Standard is a revision of ISO 5800 : 1979 to update the format of presentation and to reference new ISO standards which more precisely describe illuminants and densitometry specified for use. No differences in speed values should result from the changes made to the International Standard.

1 Scope and field of application

This International Standard specifies the method for determining the ISO speed of colour negative camera films for pictorial still photography. It is assumed that the colour negatives obtained with these films will be used to make reflection-type colour prints primarily but may also be used to make colour transparencies. The speeds obtained by application of this International Standard are intended for practical use with exposure meters, exposure calculators, and exposure tables.

This International Standard does not apply to colour negative films for motion-picture and aerial photography or for making intermediate negatives.

2 References

ISO 5, *Photography — Density measurements —*

Part 1: Terms, symbols and notations.

Part 2: Geometric conditions for transmission density.

Part 3: Spectral conditions.

ISO 554, *Standard atmospheres for conditioning and/or testing — Specifications.*

ISO 2720, *Photography — General purpose photographic exposure meters (photoelectric type) — Guide to product specification.*

ISO 2721, *Photography — Cameras — Automatic controls of exposure.*

ISO 7589, *Photography — Illuminants for sensitometry — Specifications for daylight and incandescent tungsten.*

3 Definitions

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

3.1 speed: A quantitative measure of the response of the photographic material to luminous energy for the specified conditions of exposure, processing, density measurement, and analysis.

3.2 exposure (H): The time integral of illuminance on the film, measured in lux seconds, and designated by the symbol H.

Exposure is often expressed in $\log_{10} H$ units.

3.3 exposure value unit: A unit used for an exposure change by a factor of 2 or change of 0,30 $\log_{10} H$ units. To be in compliance with ISO 2720, this will be denoted as 1 E_v.

Changing exposure may be accomplished by changing exposure time, illumination level, or filters over the lens.

1) Such as those with one shutter speed and two aperture stops.

4 Sampling and storage

In determining the ISO speed of a product, it is important that the samples evaluated yield the average results obtained by users. This will require evaluating several different batches periodically under the conditions specified in this International Standard. Prior to evaluation, the samples shall be stored according to the manufacturers' recommendations for a length of time to simulate the average age at which the product is normally used. Several independent evaluations shall be made to ensure correct calibration of equipment and processes involved in determining film speed. The basic objective in selecting and storing samples as described above is to ensure that film characteristics are representative of those obtained by a photographer at the time of use.

5 Method of test

5.1 Principle

Samples are exposed and processed as specified below. Density measurements are obtained from the resultant images to produce a sensitometric curve from which values are taken and used to determine ISO speed.

5.2 Safelights

To eliminate the possibility of safelight illumination affecting the sensitometric results, all films shall be handled in complete darkness to avoid exposing the emulsion to unintentional radiation during sample preparation, exposing and processing.

5.3 Exposure

5.3.1 Sample condition

During exposure, the samples shall be at a temperature of 23 ± 2 °C and in equilibrium with a relative humidity of (50 ± 5) %.

5.3.2 Type of sensitometer

The sensitometer shall be a non-intermittent, illuminance-scale type.

5.3.3 Radiant energy quality

The appropriate illuminant for the particular film type being exposed shall conform to the specification given in ISO 7589. ISO speed may be determined using ISO sensitometric daylight, studio tungsten, or photoflood illuminants. Since the speed of film/process combinations will depend on the type of illuminant used for determining ISO speed, the illuminant should be specified in the instructions.

5.3.3.1 Filters

ISO speed shall be specified for use without a filter in front of the camera lens. If film is used with a colour filter in front of the camera lens, an "equivalent" speed number can be used to determine the exposure of the film with the filter. ISO speed does not apply to the filtered condition.

5.3.4 Modulation

The total range of spectral diffuse transmission density with respect to the film plane of each area of the light modulator throughout the wavelength interval from 400 to 700 nm shall not exceed 5 % of the average density obtained over the same interval or 0,03 density, whichever is greater. In the interval from 360 to 400 nm, 10 % of this same average density, or 0,06 density, whichever is greater, is acceptable.

If stepped increments are used, the logarithm to the base 10 of the exposure increment shall not be greater than 0,20. The width and length of a single step shall be adequate to obtain a uniform density within the reading aperture specified for densitometry.

If a continuous variable modulator is used, the logarithm to the base 10 of the change in exposure with distance along the test strip shall be uniform and not greater than 0,04 per millimetre.

5.3.5 Exposure time

The exposure time shall correspond with the usage practice for the particular film tested. Since the speed of film may be dependent on the exposure time because of reciprocity law failure, the exposure time used for determining the ISO speed should be specified when quoting values.

5.4 Processing

5.4.1 Conditioning of samples

In the time interval between exposure and processing, the samples shall be kept at 23 ± 2 °C and a relative humidity of (50 ± 5) %. The processing shall be completed in not less than 5 days and not more than 10 days after exposure for general-purpose films, and not less than 4 h and not more than 7 days for professional films.

5.4.2 Processing specifications

No processing specifications are described in this International Standard in recognition of the wide range of chemicals and equipment used. ISO speeds provided by film manufacturers generally apply to the films when they are processed in accordance with their recommendations to produce the photographic characteristics specified for the process. Process information shall be available from film manufacturers or others who quote ISO speed. This shall specify the chemicals, time, temperature, agitation equipment, and procedure used for each of the processing steps and any additional information required to obtain the sensitometric results described.

The values for speed obtained using various processing procedures may differ significantly. Although different speeds for a particular film may be achieved by varying the process, other sensitometric and physical changes may also accompany the speed changes.

5.5 Densitometry

ISO standard Status M diffuse transmission densities of the processed images shall be measured using a densitometer complying with the geometric conditions specified in ISO 5-2 and the spectral conditions specified in ISO 5-3.

These conditions are designated:

D_T (90° *opal*; S_H: ⩽ 10°; M)

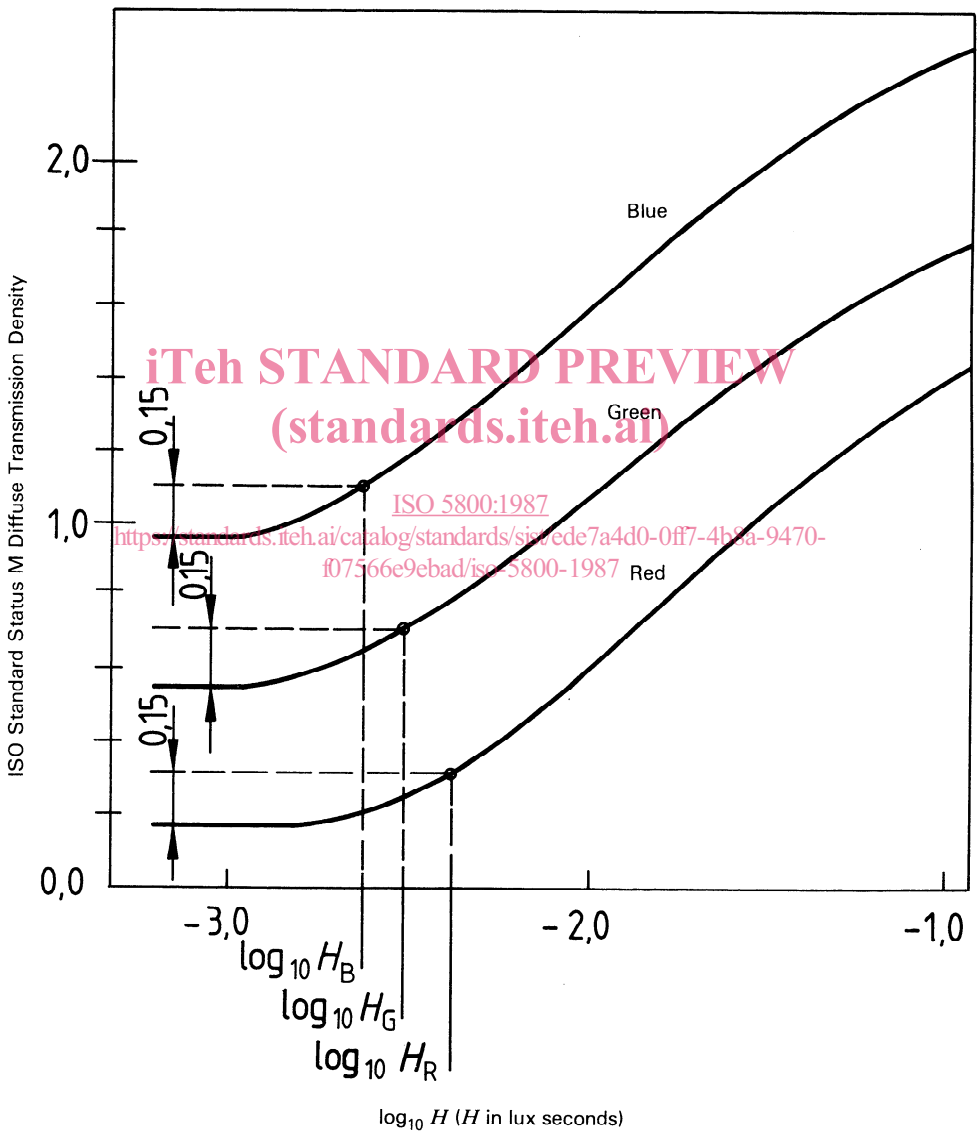
or D_T (⩽ 10°; S_H: 90° *opal*; M).

A minimum aperture area of 7 mm^2 should be used to minimize the effect of image non-uniformity. Readings shall be at least 1 mm from the edges of the exposures.

5.6 Evaluation

5.6.1 Sensitometric curve

The ISO standard red, green, and blue Status M diffuse transmission density values are plotted against the logarithm to the base 10 of the corresponding exposure (H) expressed in lux seconds, to obtain three sensitometric curves similar to those illustrated in the figure.



In the figure above, the red is the slowest and the formula becomes:

$$\log_{10} H_m = \frac{\log_{10} H_G + \log_{10} H_R}{2}$$

Figure — Method for determining speed

5.6.2 Minimum densities

The red, green, and blue minimum densities shall be determined from an unexposed sample of the same film processed simultaneously with the film exposed for determining the sensitometric curve.

5.6.3 Determination of H_m

Speed is calculated from the exposures required to produce red, green, and blue densities that are 0,15 above the corresponding minimum density values for each of the three curves. The exposure, H_m, is computed by the use of the formula:

$$H_m = \sqrt{H_{Green} \times H_{Slowest\ layer}}$$

or

$$\log_{10} H_m = \frac{\log_{10} H_{Green} + \log_{10} H_{Slowest\ layer}}{2}$$

The exposure, H_m, represents the sensitometric parameter from which speed is computed.

If the green layer is also the slowest, H_m will equal H_{Green}.

6 Product classification

6.1 ISO speed scale

The speed scales given in the table are derived from the formulae:

$$\text{Arithmetic speed: } S = \frac{\sqrt{2}}{H_m}$$

$$\text{Logarithmic speed: } S° = 1 + 10 \log_{10} \frac{\sqrt{2}}{H_m}$$

"ISO" speed shall be obtained directly from $\log_{10} H_m$ by use of the table which shows the rounding method to be used.

6.2 ISO speed of a product

The ISO speed of a product (as distinguished from that of a specific sample) shall be based on the arithmetic average of the logarithms of exposures, $\log_{10} H_m$, determined from various batches of the product when selected, stored, and tested as specified as above. The ISO speed of a product with proper rounding is then determined from the average value of $\log_{10} H_m$, by use of the table.

Since ISO speed is dependent on exposure and processing conditions, these should be indicated when quoting ISO speed values.

Table — ISO speed scales

$\log_{10} H_m$		ISO speed	
from	to	arithmetic	logarithmic
−3,40	−3,31	3 200	36°
−3,30	−3,21	2 500	35°
−3,20	−3,11	2 000	34°
−3,10	−3,01	1 600	33°
−3,00	−2,91	1 250	32°
−2,90	−2,81	1 000	31°
−2,80	−2,71	800	30°
−2,70	−2,61	640	29°
−2,60	−2,51	500	28°
−2,50	−2,41	400	27°
−2,40	−2,31	320	26°
−2,30	−2,21	250	25°
−2,20	−2,11	200	24°
−2,10	−2,01	160	23°
−2,00	−1,91	125	22°
−1,90	−1,81	100	21°
−1,80	−1,71	80	20°
−1,70	−1,61	64	19°
−1,60	−1,51	50	18°
−1,50	−1,41	40	17°
−1,40	−1,31	32	16°
−1,30	−1,21	25	15°
−1,20	−1,11	20	14°
−1,10	−1,01	16	13°
−1,00	−0,91	12	12°
−0,90	−0,81	10	11°
−0,80	−0,71	8	10°
−0,70	−0,61	6	9°
−0,60	−0,51	5	8°
−0,50	−0,41	4	7°

6.3 Accuracy

The calibration of the equipment and processes involved in determining film speed shall be adequate to ensure that the error in $\log_{10} H_m$ is less than 0,05.

7 Product marking and labelling

Speed of a product determined by the method described in this International Standard and expressed on the scales of the table may be designated ISO speed and denoted in the form of ISO 100, ISO 21°, or ISO 100/21°. However, since the speed is dependent on the illuminant, exposure time, and process used, these conditions should be clearly indicated, whenever possible, when quoting values.

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