
International Standard



7187

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Photography — Direct positive colour print camera materials — Determination of ISO speed

Photographie — Surfaces sensibles pour appareils photographiques donnant directement une épreuve positive en couleur — Détermination de la sensibilité ISO

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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 developing International Standards is carried out through ISO technical committees. Every member body interested in a subject for which a technical committee has been authorized 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.

International Standard ISO 7187 was developed by Technical Committee ISO/TC 42, *Photography*, and was circulated to the member bodies in November 1982.

It has been approved by the member bodies of the following countries :

Australia	France	South Africa, Rep. of
Canada	Italy	United Kingdom
China	Japan	USA
Czechoslovakia	Mexico	
Egypt, Arab Rep. of	Netherlands	

No member body expressed disapproval of the document.

Photography — Direct positive colour print camera materials — Determination of ISO speed

0 Introduction

The increased use of in-camera processed colour print materials, often referred to as "instant print", and the introduction of equipment to permit their use in general cameras makes it desirable to establish a standard method for determining the speed of this type of product. This International Standard applies to any directly viewed reflection colour print material made by camera exposure of the original scene onto a photosensitive material and subsequent diffusion transfer of a dye image within the same material or to a second receiver material. It also applies to any material similarly exposed, but later processed outside of the camera by a process other than diffusion transfer of the dyed image. It does not apply to copying or duplicating

For diffusion transfer materials, the speed and colour of prints depend on the ambient temperature during diffusion. Usually, speed problems as well as serious colour mismatches will occur in prints made at temperatures beyond those recommended by the manufacturer. The conditions of direct viewing of reflection prints are specified in ISO 3664.

The sensitometric method specified in this International Standard gives ISO speeds that are in close agreement with film speeds obtained by making practical camera exposures. These speeds follow the $f/16$ daylight rule; that is, the ISO speed is the reciprocal of the exposure time in seconds which gives the best quality print when the camera aperture is set at $f/16$ in direct sunlight for an average scene with a solar altitude between 35° and 50° .

When these ISO speeds are used in conjunction with exposure meters conforming to ISO 2720, resultant pictures will be of best quality. For an average scene, the optimum exposure will be approximately midway between the least exposure and the greatest exposure producing satisfactory prints at normal viewing luminance levels. The exposure latitude for satisfactory prints is approximately half-camera stop for underexposure and half-camera stop for overexposure.

1 Scope and field of application

This International Standard specifies the method for determining the ISO speed of direct positive colour print camera materials when used in a camera for pictorial photography. It

also applies to diffusion transfer and conventional colour print materials directly exposed in cameras and processed in or out of the camera.

This International Standard does not apply to materials used for copying or duplicating applications.

2 References

ISO 5, *Photography — Density measurements*

Part 3: *Spectral conditions.*¹⁾

Part 4: *Geometric conditions for reflection density.*

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

ISO 3664, *Photography — Illumination conditions for viewing colour transparencies and their reproductions.*

ISO 7589, *Photography — Illuminants for sensitometry — Specifications for daylight and incandescent tungsten.*²⁾

3 Definitions

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

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

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

3.2 speed: A quantitative measure of the response of the photographic material to radiant energy for the specified conditions of exposure, processing, and image measurement.

1) At present at the stage of draft. (Revision of ISO 5-1974.)

2) At present at the stage of draft. (Revision of ISO 2239-1972, ISO 2241-1972 and ISO 2242-1972.)

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 manufacturer's 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 the proper calibration of equipment and processes. The basic objective in selecting and storing samples as described above is to ensure the product 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 in the manner specified below. Density measurements are obtained from the resultant image 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 sensitized materials shall be handled in complete darkness during 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 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 illuminant for the particular product type being exposed shall conform to the appropriate illuminant specified in ISO 7589.

5.3.3.1 Filters

ISO speed shall be specified for use without a filter in front of the camera lens. If a product 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 product 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 modulation 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 exposure increment shall not be greater than $0,15 \log_{10} H$. The width and length of a single step shall be adequate to obtain a uniform density devoid of adjacency effect within the minimum 3 mm reading aperture specified for densitometry.

If a continuously variable modulator is used, the change in exposure with distance along the test strip shall be uniform and not be greater than $0,04 \log_{10} H$ per millimetre.

An area of the product shall be given sufficient exposure to produce the minimum density possible.

5.3.5 Exposure time

Exposure time shall be between 5 and $1/1\ 000$ s, typical of the usage practice for the sensitized material tested. Typical exposure times are $1/1\ 000$ s to $1/25$ s for a daylight type print material and $1/100$ s to 5 s for exposure with tungsten illumination. Since the speed of the sensitized material may be dependent on the exposure time because of reciprocity law failure, the exposure time used in determining the ISO speed should be specified in use instructions.

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 %.

For products designed for in-camera processing, the processing shall be initiated within 2 min after exposure.

For products requiring conventional processing in separate equipment, processing should be initiated within 2 h after exposure.

5.4.2 Processing specifications

The temperature for processing products designed for in-camera processing shall be $23 \pm 0,5$ °C.

The temperature for processing products designed for conventional processing using separate equipment shall be that recommended by the manufacturers.

No additional processing specifications are described in this International Standard in recognition of the wide range of chemicals and equipment used. ISO speed provided by sensitized product manufacturers generally applies to the product when it is processed in accordance with their recommendations to produce the photographic characteristics specified for the process. Process information shall be available from the manu-

facturers or others who quote ISO speed values. This shall specify the chemicals, times, temperatures, 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 product may be achieved by varying the process, the user should be aware that other sensitometric and physical changes may also accompany the speed changes.

5.5 Densitometry

ISO standard visual reflection density of the processed images shall be measured using a densitometer complying with the geometric requirements specified in ISO 5/4 and the spectral requirements specified in ISO 5/3. A minimum aperture of 3 mm diameter shall be used. Readings shall be at least 1 mm from the edges of the exposures.

Density measurements shall be made 24 ± 4 h after processing. During this interval, the samples shall be stored at 23 ± 2 °C and a relative humidity of 50 ± 5 %.

5.6 Evaluation

5.6.1 Sensitometric curve

The ISO Standard visual reflection density values are plotted against the logarithm to the base 10 of the corresponding exposures (H) expressed in lux seconds, to obtain a sensitometric curve similar to that illustrated in the figure.

5.6.2 Minimum density

The minimum density shall be determined from a sample of the material adequately exposed to produce the minimum density possible and processed simultaneously with the sample exposed for determining the sensitometric curve.

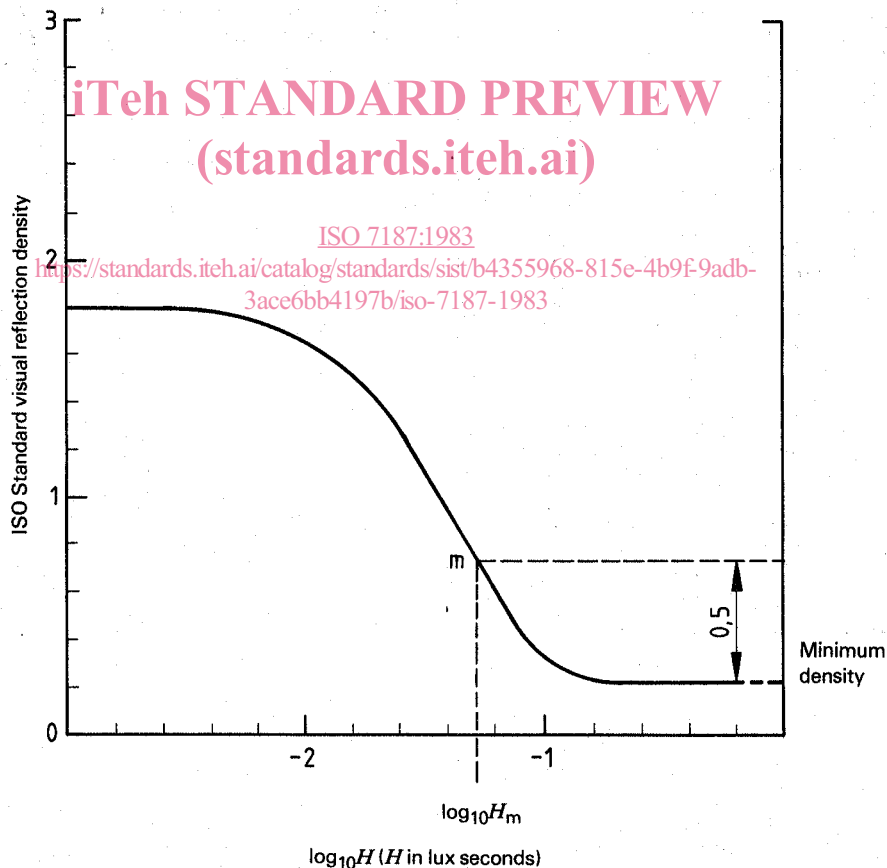


Figure — Determination of ISO speed

6 Product classification

6.1 ISO speed scale

The speed scale given in the table is derived from the formula:

$$\text{Speed} = \frac{9}{H_m}$$

where H_m is the exposure in lux seconds required to produce a density of 0,50 above minimum density.

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

Table — ISO Speed Scale

$\log_{10}H_m$		ISO speed
from	to	
-2,60	-2,51	3 200
-2,50	-2,41	2 500
-2,40	-2,31	2 000
-2,30	-2,21	1 600
-2,20	-2,11	1 250
-2,10	-2,01	1 000
-2,00	-1,91	800
-1,90	-1,81	640
-1,80	-1,71	500
-1,70	-1,61	400
-1,60	-1,51	320
-1,50	-1,41	250
-1,40	-1,31	200
-1,30	-1,21	160
-1,20	-1,11	125
-1,10	-1,01	100
-1,00	-0,91	80
-0,90	-0,81	64
-0,80	-0,71	50
-0,70	-0,61	40
-0,60	-0,51	32
-0,50	-0,41	25
-0,40	-0,31	20
-0,30	-0,21	16
-0,20	-0,11	12
-0,10	-0,01	10
0,00	0,09	8
0,10	0,19	6
0,20	0,29	5
0,30	0,39	4

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 numerical average of $\log_{10}H_m$ values determined from several batches of the product when selected, stored, and tested as specified 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.

6.3 Accuracy

The calibration of the equipment and processes involved in determining product speed shall be adequate to ensure 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 scale of the table may be designated ISO speed and denoted in the form "ISO 100".

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

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