INTERNATIONAL STANDARD

ISO 2240

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Photography — Colour reversal camera films — Determination of ISO speed

Photographie — Films de prise de vue inversibles en couleur — Détermination de la sensibilité ISO

Reference number
ISO 2240:1994(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. 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 2240 was prepared by Technical Committee ISO/TC 42, *Photography*.

This second edition cancels and replaces the first edition (ISO 2240:1982), of which it constitutes a technical revision.

Annex A of this International Standard is for information only.

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Introduction

ISO speeds are intended to provide correct exposures with exposure meters conforming to ISO 2720, and, where applicable, automatic exposure controls for cameras conforming to ISO 2721; the resultant camera exposure will normally lead to colour transparencies or motion pictures of the best quality. For an average scene and average camera, the indicated camera exposure will be approximately midway between the least exposure and the greatest exposure required to produce transparencies and motion-picture films suitable for viewing at normal luminance levels.

For the purposes of this International Standard, the normal luminance of transparency illuminators is assumed to be that described in ISO 3664, with a ratio of direct-to-ambient luminance of about 40:1. The normal luminance of transparency projection screens is assumed to be about 137 cd/m^2.

Screen luminance of 8 mm Type R and 8 mm Type S (Super-8) motion-picture film projection is assumed to range from approximately 40 cd/m^2 (see ISO 2910) to 62 cd/m^2. Therefore, it may be desirable to increase exposure by 25 % above that obtained by using the speed derived by following the sensitometric procedure described in this International Standard. Many camera manufacturers design and calibrate their 8 mm Type R and 8 mm Type S motion-picture cameras with an adjustment which permits more exposure to compensate for the lower screen luminance of the usual projection conditions (see ISO 2721).

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Photography — Colour reversal camera films — Determination of ISO speed

1 Scope

This International Standard specifies the method for determining the ISO speed of colour reversal camera films producing continuous-tone pictorial images that are intended to be viewed on transparency illuminators or by projection as slides. It also applies to 8 mm and 16 mm motion-picture films used in non-professional applications.

This International Standard does not apply to professional motion-picture films regardless of their applications.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 5-2:1991, *Photography — Density measurements — Part 2: Geometric conditions for transmission density.*

ISO 5-3:—[1], *Photography — Density measurements — Part 3: Spectral conditions.*

ISO 7589:1984, *Photography — Illuminants for sensitometry — Specifications for daylight and incandescent tungsten.*

3 Definitions

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

3.1 exposure, H[2]: Time integral of illuminance on the film, measured in lux seconds.

NOTE 1 Exposure is often expressed in $\log_{10}H$ units.

3.2 speed: Quantitative measure of the response of the photographic material to radiant energy for the specified conditions of exposure, processing, density measurement and analysis.

3.3 minimum density: Minimum density value obtainable following the process used in the ISO speed determination.

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. To assure that all components of

1) To be published. (Revision of ISO 5-3:1984)

2) International Lighting Vocabulary, CIE Publ. No. 17.4, 1987, luminous exposure, H. In this International Standard, "luminous exposure" is simply referred to as "exposure".

variance are included in the sampling plan, it is recommended that procedures such as those outlined in ISO Standards Handbook 3 be used. The objective in selecting and storing samples as described above is to ensure the film characteristics are representative of those obtained by a photographer at the time of use.

5 Test method

5.1 Principle

Samples are exposed and processed in the manner 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 during sample preparation, exposing and processing.

5.3 Exposure

5.3.1 Sample condition

During exposure, the samples shall be equilibrated with air at a temperature of 23 °C ± 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 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, the illuminant should be specified in the instructions.

ISO speed shall be specified for use without a filter in front of the camera lens. If a 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 nm 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 nm to 400 nm, 10 % of this same average density, or 0,06 density, whichever is greater, is acceptable.

If a stepped increment modulation is 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 within the reading aperture specified for densitometry.

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

5.3.5 Exposure time

The exposure time shall be between 5 s and 1/1 000 s corresponding to the usage practice for the particular film tested. Since the speed of film is dependent on exposure time because of reciprocity law failure, the exposure time used for determining ISO speed should be specified in the instructions for use.

5.4 Processing

5.4.1 Conditioning of samples

In the time interval between exposure and processing, the samples shall be equilibrated with air at 23 °C ± 2 °C and a relative humidity of (50 ± 5) %. The processing shall be completed in not fewer than 5 days and not more than 10 days after exposure for general-purpose films, and not fewer 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 speed provided by film manufacturers generally applies to the film when it is 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, temperatures, agitation and procedure used for each of the processing steps and any