

---

---

**Photography — Film-based cameras —  
Automatic controls of exposure**

*Photographie — Appareils de prise de vues à film — Commandes  
automatiques de l'exposition*

**iTeh STANDARD PREVIEW**  
**(standards.iteh.ai)**

[ISO 2721:2013](https://standards.iteh.ai/catalog/standards/sist/9d2bdfc1-d397-45b8-8d7c-0bf19e27a6ed/iso-2721-2013)

<https://standards.iteh.ai/catalog/standards/sist/9d2bdfc1-d397-45b8-8d7c-0bf19e27a6ed/iso-2721-2013>



**iTeh STANDARD PREVIEW**  
**(standards.iteh.ai)**

ISO 2721:2013

<https://standards.iteh.ai/catalog/standards/sist/9d2bdfc1-d397-45b8-8d7c-0bf19e27a6ed/iso-2721-2013>



**COPYRIGHT PROTECTED DOCUMENT**

© ISO 2013

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office  
Case postale 56 • CH-1211 Geneva 20  
Tel. + 41 22 749 01 11  
Fax + 41 22 749 09 47  
E-mail [copyright@iso.org](mailto:copyright@iso.org)  
Web [www.iso.org](http://www.iso.org)

Published in Switzerland

# Contents

	Page
Foreword .....	iv
Introduction .....	v
<b>1 Scope</b> .....	<b>1</b>
<b>2 Normative references</b> .....	<b>1</b>
<b>3 Terms and definitions</b> .....	<b>1</b>
<b>4 Specific requirements</b> .....	<b>2</b>
4.1 Scales .....	2
4.2 Out-of-range indication .....	2
4.3 The sensors of exposure controls .....	2
<b>5 Calibration of the exposure controls</b> .....	<b>3</b>
5.1 Method of calibration .....	3
5.2 Light source for calibration .....	3
5.3 General test conditions .....	3
5.4 Exposure in the focal plane .....	4
<b>6 Acceptance angles of the photoelectric system</b> .....	<b>4</b>
6.1 Specific acceptance angle .....	4
6.2 Oblique acceptance angles .....	4
<b>Annex A (normative) Measurement of light exposure in the focal plane and calibration of measuring instrument</b> .....	<b>5</b>
<b>Annex B (normative) Size of measuring area</b> .....	<b>8</b>
<b>Annex C (normative) Performance test</b> .....	<b>9</b>
<b>Bibliography</b> .....	<b>11</b>

## 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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. 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.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 2721 was prepared by Technical Committee ISO/TC 42, *Photography*.

This second edition cancels and replaces the first edition (ISO 2721:1982), of which it constitutes a minor revision with the following changes:

- a) The title has been updated from "Cameras" to "Film-based cameras".
- b) The scope has been updated to include the clarification, "This standard is not applicable to digital cameras."

[ISO 2721:2013](https://standards.iteh.ai/catalog/standards/sist/9d2bdfc1-d397-45b8-8d7c-0bf19e27a6ed/iso-2721-2013)

<https://standards.iteh.ai/catalog/standards/sist/9d2bdfc1-d397-45b8-8d7c-0bf19e27a6ed/iso-2721-2013>

## Introduction

This International Standard gives the nominal exposure at the focal plane and its tolerance, which are to be taken as reference values in designing and testing automatic film-based cameras.

“Correct” exposure may vary from one photographer to another due to personal preferences and/or type of photograph. For this reason, no “standard” value for the exposure at the focal plane can be given. However, a “normal” focal plane exposure for a film of a particular speed and an average scene can be determined by allocating representative values to the relevant exposure parameters.

The nominal exposure at the focal plane  $H = \frac{H_0}{S}$  or  $H = \frac{H_0}{10^{(S^0 - 1)/10}}$  given in this International Standard

is determined on the above assumption. Long experience has proved that the above value is adequate for most automatic cameras in most situations.

Since with some cameras the use of a different focal plane exposure gives better results when taking pictures outdoors, the nominal focal plane exposure is only to be considered as a reference value. The tolerance  $\pm 1$  step ( $\pm 1$  Ev) is also a reference value. Experience has proved that this tolerance is satisfactory in most cases. However, a much tighter tolerance, such as  $\pm 1/3$  step, is often required by advanced photographers for film such as colour reversal film having limited exposure latitude.

On the other hand, if colour reversal films are not likely to be used in certain kinds of cameras, as in the case of cameras using 110 size colour negative films, even an exposure deviation of + 3 steps or – 1 step is acceptable for such cameras.

Therefore, when testing and/or evaluating an automatic camera according to the methods specified in this International Standard, the above-mentioned points must be taken into consideration. A photographic check of the correct exposure is recommended.

ISO 2721:2013

<https://standards.iteh.ai/catalog/standards/sist/9d2bdfc1-d397-45b8-8d7c-0bf19e27a6ed/iso-2721-2013>

**iTeh STANDARD PREVIEW**  
**(standards.iteh.ai)**

ISO 2721:2013

<https://standards.iteh.ai/catalog/standards/sist/9d2bdfc1-d397-45b8-8d7c-0bf19e27a6ed/iso-2721-2013>

# Photography — Film-based cameras — Automatic controls of exposure

## 1 Scope

This International Standard specifies the exposure at the focal plane of film-based cameras for values of two exposure parameters, i.e. field luminance and film speed, and also describes methods of evaluating other photometric characteristics, such as the acceptance angles of the photoelectric system.

This International Standard applies to automatic exposure control systems which are built into film-based cameras or coupled with them to regulate the exposure in the focal plane as a function of the several exposure parameters. The mechanism can control either the focal-plane illuminance or the exposure-time interval or both. Pointer (or needle) matching systems are included in this International Standard even though they are not fully automatic. This standard is not applicable to digital cameras.

## 2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60068-2-6, *Environmental testing — Part 2-6: Tests — Test Fc: Vibration (sinusoidal)*

IEC 60068-2-27, *Environmental testing — Part 2-27: Tests — Test Ea and guidance: Shock*

<https://standards.iteh.ai/catalog/standards/sist/9d2bdfc1-d397-45b8-8d7c-0bf19e27a6ed/iso-2721-2013>

## 3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

### 3.1

#### exposure in the focal plane

denoted by  $H^1$ ) and defined by the equation

$$H = \frac{1}{A} \int_{At_1}^{t_2} \int E(r,t) dt dr$$

where

$A$  is the prescribed area for the exposure measurement;

$t_1$  is the time at which the exposure time begins;

$t_2$  is the time at which the exposure finishes;

$E(r,t)$  is the illuminance in the focal plane at a point (coordinate  $r$ ) in the prescribed area at an instant  $t$  during the exposure time.

1) International Lighting Vocabulary. Publication CIE 17,1970: light exposure  $H$ . In this International Standard,  $H$  is referred to as “exposure”.

### 3.2 automatic setting of camera exposure

action of the automatic exposure control intended to maintain substantially constant exposure at the focal plane for a preset film speed for all values of field luminance within the exposure capabilities of the camera

Note 1 to entry: The film speed setting may be made manually or may be automatically sensed from the film or its container.

Note 2 to entry: Operation of the control may require the operator's participation in adjusting an indicator to a fiducial point or condition for set-point recognition, but should not require him to read light value indications and transfer the information to another mechanism having similar fiducial markings.

### 3.3 exposure capability of camera

difference between the maximum exposure value for which the camera can provide nominal focal-plane exposure and the minimum exposure value for which the camera can provide nominal focal-plane exposure, both for the film speed ISO 100/21°

Note 1 to entry: When describing the exposure capability of a camera, the film speed should be indicated.

## 4 Specific requirements

### 4.1 Scales

If the camera has scales for f-number, exposure time, exposure value, or film speed, the numerical values according to ISO 2720 shall be applied.

### 4.2 Out-of-range indication

For cameras designed to use colour reversal films, automatic indication, for example by an optical signal in the viewfinder, should be displayed when the field luminance exceeds the exposure capability of the camera by more than 1  $E_V$  (1 exposure value = 1 step) in either over-exposure or under-exposure. This indication need only be provided if the exposure capability of the camera does not cover subject luminance below 4 cd/m<sup>2</sup> and above 4096 cd/m<sup>2</sup>. Tests are made with a uniform source.

In addition, a long exposure signal should be provided to indicate when the field luminance is such as to result in an exposure longer than approximately 1/30 s. This signal need not be provided if the camera cannot give an exposure longer than 1/30 s without the photographer being aware of it.

### 4.3 The sensors of exposure controls

#### 4.3.1 Spectral sensitivity

The spectral sensitivity of the system response in the camera shall manifest no discontinuities within the visible spectrum (380 nm to 780 nm).

#### 4.3.2 Spectral sensitivity tests

For cameras designed to be used in daylight, tungsten light, and with other artificial sources, the ratio of the responses of the light sensors including optical systems to field luminances of distribution temperature 2856 K compared with those at 4700 K shall be  $1,0_{-0,21}^{+0,26}$  (corresponding to  $\pm 1/3 E_V$ ). Not more than 10 % of the total response of the light sensors, including optical systems, should be due to wavelengths longer than 700 nm when the sensors are exposed to a light source of equal energy at all wavelengths. Not more than 10 % of the total response of the sensors should be due to wavelengths shorter than 380 nm when tested in the same manner.



## 5 Calibration of the exposure controls

### 5.1 Method of calibration

In this International Standard, the word calibration means the adjustment of the exposure control mechanism so that the measured focal-plane exposure is within the limits described in this International Standard.

The exposure controls of the camera shall be calibrated by actual measurement of the exposure in the focal plane. The exposure shall be measured within a circular area in the focal plane, which is concentric with the lens axis, and of diameter equal to three-quarters of the shorter side of the nominal picture format of the camera. A circular area, whose diameter is smaller than three-quarters of the shorter side of the nominal picture format, may be used for medium and large format cameras.

The exposure is measured by placing a device in the focal plane having a circular aperture of the diameter described above, located in the exact plane of focus of the lens, when the latter is adjusted to focus at a distance of 5 m or more. If a smaller aperture is used, the influence of the size of the measuring area shall be taken into account as in the example of [Annex B](#).

The sensor used for calibration shall have, for cameras having sensors as described in [4.3.2](#), a photopic response in accord with the spectral luminous efficiency for the CIE standard photometric observer  $V(\lambda)$  (see International Lighting Vocabulary, CIE Publication No. 17, 1970) or a correlatable spectral sensitivity.

The sensor shall be large enough to receive all of the flux transmitted by the circular aperture of the measuring device.

For methods of measuring the exposure in the focal plane, see [Annex A](#).

### 5.2 Light source for calibration

The light source used for calibration of the exposure control shall approximate a uniformly diffusing (Lambertian) surface source that subtends a field angle at least 25 % larger in diameter than the photometric field of the exposure control and of the measuring device in the focal plane. The source shall provide a continuous spectrum throughout the visible range, and shall be uniform in luminance within  $\pm 4$  %. The distribution temperature shall be  $(4\,700 \pm 200)$  K. The spectral radiance shall not vary by more than  $\begin{matrix} +0,26 \\ -0,21 \end{matrix}$  % from that of a full radiator of 4 700 K at wavelengths from 420 to 1 050 nm.

The luminance of the source at an angle of  $60^\circ$  from the optical axis shall be at least 85 % of that on the optical axis; each measurement being made in an area around the same point of the source.

The range of luminance of the calibration source should be adjustable over the range of the exposure capability of the camera plus the over-range indication increments if applicable.

### 5.3 General test conditions

The camera shall be calibrated with the optical axis horizontal or in the position of normal use if designed for special purposes.

The ambient temperature shall be  $(23 \pm 3)$  °C and relative humidity of  $(65 \pm 20)$  %.

Stray light, such as reflections from the camera, shall be eliminated.

If adjustment of the camera parts is required to obtain the exposure setting, the set point should be approached from both directions to determine the “hysteresis” or lost motion in the mechanism. Readings may be taken for both conditions and the average value used in computing the calibration accuracy. The amount of the “hysteresis” shall also be stated.

When the field luminance is changed, a time interval of at least 3 s may be allowed before the exposure setting is made or measured.