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Photography — Flash exposure meter — Requirements

Photographie — Exposimètre pour flash — Prescriptions

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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 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 10157 was prepared by Technical Committee ISO/TC 42, *Photography*.

Annex A of this International Standard is for information only.

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Photography — Flash exposure meter — Requirements

1 Scope

This International Standard applies to photoelectric flash exposure meters which measure the time integral of the luminance or of the illuminance of a photographic object (to be called thereafter "object") illuminated by a source of light for a brief illumination period[1] and indicate the time integral or a number corresponding to the time integral or the f-number required for the correct exposure of a photographic film with a given speed.

Continuous light, which is available in addition to the light emitted by the flash light source, is also evaluated.

NOTE 1 If the object is illuminated by electronic flash equipment with automatic exposure control, the measuring results of the flash exposure meter can deviate from the calibration values of the flash equipment.

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 2720:1974, *Photography — General purpose photographic exposure meters (photoelectric type) — Guide to product specification.*

IEC 68-2-6:1960, *Basic environmental testing procedures for electrical components and electronic equipment — Part 2: Tests — Test F: Vibration.*

IEC 348:1971, *Safety requirements for electronic measuring apparatus.*

3 Definitions

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

3.1 luminance coefficient, q: The luminance coefficient, q, is the ratio of the luminance, L, of the sample for a given observation direction to the illuminance, E, on the sample ($q = L/E$).

3.2 gate time: The gate time of the measuring circuit is the time in which the flash light meter is measuring.

3.3 storage time: The storage time is that time after the end of the gate time in which the indicated value changes by ± 7 % [corresponding to $\pm 1/10\ E_V$[2]].

3.4 acceptance angle: See definition in ISO 2720.

4 Scales

Relative aperture scale, exposure time scale and film speed scale are to be selected in accordance with ISO 2720.

5 General characteristic quantities of the flash exposure meter

5.1 Measuring range

It is recommended that the measuring range be indicated in candela seconds per square metre when measuring the time integral of luminance of the object and in lux seconds when measuring the time integral of illuminance of the object.

In addition, the aperture range and the luminous time (flash duration) range are to be indicated, in

1) Within the range of gate time specified by the manufacturer for the specific meter.

2) E_V = Exposure value.

which a measurement of flash light at an ISO 100/21° film speed is possible.

5.2 Gate time

During the gate time both the light of the flash light source and the light of the surroundings (continuous light) are to be measured. It is recommended that the times of the exposure time scale be used in accordance with ISO 2720. If there is only one fixed gate time, it must not be less than 0,007 81 s and is to be indicated. If the flash exposure meter does not, or does not completely, evaluate continuous light, this fact is also to be indicated.

5.3 Storage time

If the meter incorporates an automatic switching-off circuit, the storage time shall be long enough so that the meter indication can be read. The storage time shall be indicated on the exposure meter or in the instruction booklet.

5.4 Addition of individual measurements

If the measuring values of individual measurements are or can be added with the flash exposure meter, the deviation from the sum of four single flashes (provided there is a constant radiation from the flash light source) must not be greater than $1/5E_v$.

5.5 Acceptance angle

The acceptance angles are measured in accordance with ISO 2720.

5.6 Spectral response

The spectral response of the photoelectric receiver shall show no discontinuities within the visible spectrum (380 nm to 780 nm).

The ratio of the indications of the receiver, including optical elements, for a luminance of the distribution temperature of 4 700 K compared with that of the CIE standard illuminant C (representing daylight with a correlated colour temperature of 6 774 K), shall be $1\ ^{+0,26}_{-0,21}$ (corresponding to $\pm 1/3E_v$). Not more than 10 % of the total response of the receiver, including optical systems, should be due to wavelengths longer than 700 nm when the receiver is exposed to light sources of equal energy at all wavelengths. Not more than 10 % of the total response of the receiver should be due to wavelengths shorter than 380 nm when tested in the same manner.

NOTE 2 A light source with a distribution temperature of 4700 K is specified in ISO 2720. The CIE standard source C is specified in CIE Publication No.15.

6 Calibration

6.1 Measuring method

For calibration or for checking the calibration, known exposures are produced and compared with the indication of the flash exposure meter when measuring the light at the same place as the acceptance device of the flash exposure meter.

6.2 Light source

The calibration of flash exposure meters is to be checked with a light source of the correlated colour temperature of 5 500 K ± 200 K. It must be possible to set the duration of the light source, one-tenth of the time value, to between $0{,}8 \times 10^{-2}$ s and $1{,}0 \times 10^{-4}$ s.

6.3 Measuring the light which falls upon the object

(Measuring the object exposure.)

(Measuring the incident light.)

Calibration formula

$$H = \int E\,\mathrm{d}t = \frac{CA^2}{S}$$

or

$$H = \int E\,\mathrm{d}t = \frac{CA^2}{10^{(S^\circ - 1)/10}}$$

where

H is the exposure of the object, in lux seconds;

$\int E\,\mathrm{d}t$ is the time integral of illuminance, E, in lux;

A is the f-number;

S is the arithmetic ISO film speed;

S° is the logarithmic ISO film speed;

C is a constant which can be selected by the manufacturer in the range of 210 lx·s to 420 lx·s for the given type of exposure meter.

NOTE 3 The reflectance of the object, which is considered to be a uniform diffuser, is assumed to be 0,18.

If a reflected-light type flash exposure meter is to be designed, the calibration constant (C) can be determined by using the reflectance of the object.

7 Measuring accuracy

7.1 Error limits of the indication

The combined effect of calibration temperature, humidity, storage condition, exposure, vibration exposure, shock exposure, position, and flash duration shall not cause the indication to vary by more than $\pm 3/4E_v$ from the nominal value.

7.2 Flash duration and illuminance

Within the time range between 8×10^{-3} s and 10^{-4} s and the illuminance range between 5×10^2 lx and 2×10^6 lx, the meter shall give the same indication with a tolerance of $\pm 1/3E_v$ for the same amount of the time integral of illuminance.

8 Influence of external measuring conditions

8.1 Temperature range

The values indicated by the flash exposure meter, at temperatures of between 0 °C and 40 °C, combined with other effects, must not differ by more than the tolerance given in 7.1 from the values of the calibration formulae in 6.2 and 6.3.

8.2 Effect of humidity

The influence of the humidity is expressed as a modification of the exposure indication at 40 °C ± 5 °C and (90 ± 5) % relative humidity. Following the exposure to high humidity for 48 h and prior to taking measurements, the flash exposure meter shall be stored for 2 h at 23 °C ± 3 °C and (65 ± 20) % relative humidity. The modification of the climate must be carried out slowly so that the dew point is not reached.

9 Mechanical strength

Requirements and testing shall be in accordance with IEC 348.

9.1 Requirements

The apparatus shall have adequate mechanical strength. The components shall be reliably fastened and secured. The electrical connections shall be reliable. Internal wiring shall be installed in such a manner that its insulation cannot be damaged.

These requirements should be especially considered for apparatus containing sources of vibration or shock, and safety measures should be taken against influences on other assemblies.

Compliance is checked by inspection and by performing the following tests.

The tests described in 9.2 and 9.3 shall be performed on portable apparatus. For other apparatus, these tests are recommended but are optional.

The tests are based on the assumption that laboratory or industrial use of the apparatus causes no abnormal stress. These tests may not be sufficient for apparatus such as that used in vehicles.

9.2 Fall test

The apparatus shall be fixed in its position of normal use to a hardwood board and shall be dropped flatly three times on to a hardwood plate having a mass of at least three times the falling mass. The test set-up shall be in accordance with IEC 348:1971, figure 5, and the drop height shall be in accordance with table 1 of this International Standard.

Table 1 — Drop height

Falling mass kg	Drop height cm
Less than 10	5
10 to 50	3
More than 50	2

9.3 Vibration test

Apparatus shall be subjected to vibration endurance conditioning by frequency sweeping as specified in IEC 68-2-6.

The apparatus is fastened in its normal position of use to the vibration generator by means of straps around the enclosure. The direction of vibration is vertical, and the conditions are as follows:

Duration:	30 min
Amplitude (peak-to-peak):	0,35 mm
Sweep frequency range:	10 Hz — 55 Hz — 10 Hz
Sweep rate:	Approximately one octave per minute

9.4 Blow test

The apparatus is held firmly against a rigid support and shall be subjected to sets of three blows from a spring-operated impact hammer as shown in IEC 348:1971, figure 6. The hammer shall be applied to any external part that, when broken, is likely to expose live parts, including handles, levers, knobs, and the like, by pressing the hammer nose perpendicularly to the surface of that part.