SLOVENSKI STANDARD
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Fotografija - Elektronske bliskavice - Določanje svetlobne zmogljivosti

Photography - Electronic flash equipment - Determination of light output and performance

Photographie - Flash électronique - Détermination de l'émission lumineuse et des performances

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МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ

Photography — Electronic flash equipment — Determination of light output and performance

Photographie — Flash électronique — Détermination de l'émission lumineuse et des performances

Reference number
ISO 2827 : 1988 (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 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 2827 was prepared by Technical Committee ISO/TC 42, *Photography*.

This second edition cancels and replaces the first edition (ISO 2827 : 1973), 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 — Electronic flash equipment — Determination of light output and performance

1 Scope and field of application

This International Standard specifies methods of measurement and sets standards of performance for light output, angle of coverage, ready indication, recycle time and number of flashes for electronic flash equipment of the single flash type, which is primarily intended to provide illumination for photography with cameras in which the contacts that control the flash are closed when the shutter of the camera is fully or nearly fully open.

2 References

ISO 1229, *Photography — Expendable photoflash lamps — Determination of the light output.*

ISO 1230, *Photography — Determination of flash guide numbers.*

ISO 3028, *Photography — Camera flash illuminants — Determination of ISO spectral distribution index (ISO/SDI).*

ISO 5763, *Photography — Electronic flash equipment — Automatic control of exposure.*

3 Definitions

For the purposes of this International Standard, the definitions given in ISO 1230 and the following definitions apply.

3.1 flash : Pulse radiation of intense light having inconstant flux, used for photographic purpose.

3.2 electronic flash tube : A light-transmitting envelope having electrodes and containing a gas through which the energy from a storage capacitor is discharged, thereby producing a flash of light.

The spectral energy distribution of this light depends on the type of gas and other design factors.

3.3 electronic flash equipment : An electronic flash tube, usually mounted in a suitable reflector, and the appropriate apparatus for activating and controlling the electronic flash tube.

3.4 automatic flash equipment : Equipment that varies the intensity or duration or both of a flash in such manner as to achieve the necessary exposure of the film independent of the object distance from the flash equipment within given limits (see ISO 5763).

3.5 half angle of coverage : The angle between the axis of the reflector and the direction where the luminous intensity falls to one half of the value in the axis.

On symmetrically designed reflectors the **angle of coverage** is equal to twice the half angle of coverage. For flash equipment producing a pattern which deviates significantly from a circle, a rectangle within which the luminous intensity does not vary by more than ± 50 % from the value on the axis may be specified by two angles in horizontal and vertical directions of the rectangle. For large flash sources, for example studio flash sources, where the dimensions are not smaller than 2 m, the method of specifying angle of coverage is not applicable.

3.6 light output (for bare flash tubes) : The light output measured in two mutually perpendicular equatorial lines around the bare tubes. The cross-line of the planes through the equatorial lines shall be parallel to the optical axis of the lens of the camera.

3.7 beam light output : The time integral of the luminous intensity of flash equipment in the direction specified by the axis of the reflector, expressed in candela seconds.

3.8 stored energy (E_n) : The energy stored in the main capacitor expressed in joules (watt seconds) and determined by the following formula

$$E_n = \frac{CU^2}{2}$$

where

C is the capacitance of the combined main capacitor in farads;

U is the peak voltage in volts (see 3.14).

3.9 effective flash duration ($t_{0,5}$) : The time interval from the instant the flash reaches one-half of its peak intensity to the instant it decays to the same value.

3.10 total flash duration ($t_{0,1}$) : The time interval from the instant the flash reaches 10 % of its peak intensity to the instant it decays to the same value.

3.11 Guide Number (GN) : See ISO 1230. For flash equipment to which the inverse-square law applies, the guide number is a constant for a given film speed. Guide numbers do not apply to flash equipment or working conditions where the inverse-square law does not apply, which is the case when the area or size of the light source is large with respect to the distance between source and object. This condition may exist for very large studio type sources (umbrellas) or in extreme close-up photography. Guide numbers also do not apply to automatic electronic flash equipment when used in the automatic exposure mode. For studio type equipment to which the inverse-square law does not apply the light output shall be measured at a fixed distance of 2 m and calculated into the corresponding camera lens *f*-number based on a given film speed.

3.12 number of flashes per battery (pertaining to equipment capable of operation from primary type batteries which are not rechargeable) : Capacity of the equipment in terms of the total successive flashes, obtainable over a prescribed duty cycle, to an end point.

The end point is reached when the ready indicator will no longer appear within a 60 s time period.

NOTE — On equipment capable of changing the energy per flash by use of, for example, a power selector or exposure control system, the operating conditions of the equipment should be fully specified and the number of flashes given for each mode (see clause 6).

3.13 number of flashes per charge (pertaining to equipment operating from secondary type battery supplies capable of complete recharge after each disabling energy depletion)

See 3.12. Additional conditions should be specified such as the initial battery conditioning, the battery charging time and the input power requirements for the charger unit.

3.14 peak voltage : The maximum voltage at the energy storage capacitor during a charging cycle when the increase during a 10 s interval is less than 1 %.

Following the procedure outlined in 7.1, the voltage readings are taken at the same time as beam light output is measured.

3.15 regulated voltage (storage capacitor) : Voltage controlled by a regulating system.

For equipment with voltage regulating systems operating in its controlling mode, the peak voltage is the minimum voltage to which the regulating system permits the voltage to build during a charge cycle.

3.16 ready indication : A means, usually visible, of indicating that the equipment is ready to flash.

3.17 recycle time : The period between release of the flash and subsequent ready indication.

3.18 spectral energy distribution : See ISO 3028. The spectral energy distribution of the flash radiation should match that of "photographic daylight D_{55}" as close as possible in order to achieve a good colour rendition with colour films designated for primary use for daylight illumination.

Spectral energy distribution is expressed as a three number ISO spectral distribution index as described in ISO 3028 (see A.6.1).

4 Test conditions

4.1 Test arrangement for beam light output and angle of coverage

The lamp head of the electronic flash equipment shall be held in a suitable fixture. The fixture shall permit rotation of the lamp head 90° each side, pivoting about the centre of the reflector aperture, or, if no reflector is used, about the centre of the bare flash tube with the tube oriented in the position it is normally used with the camera.

The fixture shall be calibrated in degrees with an error not exceeding 0,5 ° and shall hold the flash equipment so that the front cover of the reflector can be correctly adjusted to face the detector of a flash exposure meter. Measurements shall be made in dark, non-reflective surroundings. Other measuring apparatus may be used which permit measurement to the specified tolerances.

4.2 Measuring distances

4.2.1 Distance from flash source to light meter sensor

For measurement of the beam light in the manual mode the light meter sensor shall be placed at a distance approximately 2 m in front of the cover of the flash head.

4.2.2 Distance for angle of coverage test

The light output measurements for determination of angle of coverage of the flash illumination shall be made at a distance approximately 2 m in front of the cover of the flash head.

4.3 Test apparatus for beam output and flash duration

A flash exposure meter measuring incident light from the flash equipment may be used to determine beam light output.

For determination of the time integral parameters, suitable electronic integration equipment or mechanical integration of the time intensity curve (such as a photograph of an oscilloscope trace) may be employed. The time intensity curve may also be used to determine the flash duration.

These instruments shall meet the following conditions :

— accuracy : ± 7 % of indicated reading (± 1/10 E_v);

— spectral response of sensor : shall approximate the luminosity curve of the CIE Standard Observer (photopic response) so that the error by measuring a light source with a colour temperature between 3 500 K and 7 000 K does not exceed ± 5 %. See clause A.1 of the annex.

— flash duration : shall be capable of measuring time intervals as short as 10 µs (see A.2);

— general : the instrument shall be linear within the above limits and be able to measure the high intensities and short durations encountered in this work;

— sensor size : the sensor shall have a maximum diameter of 50 mm.

4.4 Details and precautions

Additional details and precautions for the test are given in clauses A.2 to A.5 of the annex.

5 Conditioning of flash equipment

5.1 General conditions

For each test the equipment under test shall be fully charged and in an operable condition with the storage capacitor formed as specified by the manufacturer. This usually involves operating the equipment for a specified period of time or flashes.

The test shall be conducted at 23 ± 3 °C.

5.2 Primary batteries

Primary batteries shall be fresh and representative of the type specified by the manufacturer of the flash equipment.

5.3 Rechargeable batteries

Rechargeable batteries shall be charged prior to the test in accordance with the instructions furnished with the equipment. Measurements shall be started no sooner than 1 h after recharge of the equipment.

5.4 Line power operation

Flash equipment or chargers intended for operation on alternating current shall be tested at the ac mains voltage specified on the equipment, or the mean of the voltage range, if specified.

6 Selection of operating mode

6.1 Selection of operating mode — Non-automatic flash equipment

The primary data for recycle time, number of flashes and beam light output shall be given for full power, manual operation. Additional data, if applicable, shall be given for half power, quarter power, etc., modes.

6.2 Selection of operating mode — Automatic flash equipment

Automatic flash equipment usually permits selection of the operating mode, manual or automatic.

In the automatic mode some equipment permits a range selection of different *f*-numbers for a given film speed.

Recycle time, number of flashes and beam light output for equipment in which the depth of capacitor discharge is affected by the automatic exposure system shall be stated in three ways, (see ISO 5763)

a) full power and manual mode;

b) automatic mode at the distance from the standard test object specified in ISO 5763;

c) automatic mode at the closest working distance from the standard test object. This distance shall be indicated and shall be the closest one the manufacturer claims still gives proper exposure.

If the amount of exposure can be additionally controlled, the setting shall be specified.

Clause A.6 of the annex displays a suggested listing of data.

7 Method of measurement

7.1 Time integral of luminous intensity (beam light output)

The equipment shall be switched on and left on during the test in its full power and manual mode.

Prior to measuring the beam light output the equipment shall be flashed five times.

Every flash shall be released after 60 s.

The time integral of luminous intensity shall then be determined from the following three successive flashes released in intervals of 60 s. The average of the three flashes is the total energy measured divided by three.

7.2 Angle of coverage

To determine the angle of coverage the flash head shall be rotated about the mutually perpendicular and diagonal reflector axis as described in 4.1 and measurements of light output made at 0°, 2,5°, and at increments of 5°. An alternative method may be used, for example with the detectors located on a spherical surface of 2 m radius from the centre of the reflector aperture. For analytical display, these measurements may be plotted on a graph to show the light output versus angle of rotation. The measured angles of coverage shall describe a circle or rectangle, in which the luminous intensity shall vary by not more than 50 % of the value in the axis.

7.3 Recycle time

The equipment shall be switched on and left on at full power and in manual mode. It shall be flashed at the moment of each ready indication. The three intervals between the sixth and the seventh, the seventh and the eighth, the eighth and the ninth flashes shall be measured.

The claimed recycle time is the average of the measured time intervals, in seconds.

Recycle times for any additional operating modes and stated test distances may be determined using the same discharge schedule.

NOTE — For flash equipment, for which in certain operating modes ready indication is never extinguished, recycle times according to this International Standard (3.17) are not defined and therefore cannot be measured using the method specified in 7.3.

7.4 Ready indication

The light output shall be measured under the following conditions :

- when ready indication appears;
- when testing beam light output (see 7.1).

The differences shall be expressed in exposure values (E_v) from nominal beam light output.

7.5 Number of flashes per battery or per charge

7.5.1 Conditioning

The equipment under test shall be in the condition specified in clause 5.

Rechargeable batteries shall have undergone five complete charge-discharge cycles with the depth of discharge being almost equivalent to the end point defined in 3.12.

The batteries shall be recharged for the time specified by the manufacturer.

7.5.2 Discharge schedule for primary batteries (high and low voltage non-rechargeable type)

One flash shall be made every 60 s.

The test shall be run until the ready indicator does not appear within the 60 s period.

7.5.3 Discharge schedule for rechargeable battery

One flash shall be made every 60 s.

The test shall be run until the ready indicator does not appear within the 60 s period.

8 Performance

For equipment using a battery the performance of the equipment is dependent upon the condition and/or type of battery; these factors affect the following parameters :

a) measurement of the light output;

b) recycle time;

c) number of flashes per battery or per charge.

Consequently the type and manufacturer of battery used for performance measurements shall be recorded.

8.1 Beam light output/guide number

The measured guide number shall be within $\pm$ 0,5 E_v of the claimed guide number ($^{+18,9\ \%}_{-15,9\ \%}$ in the guide number value).

If the measured guide number is within this tolerance the claimed guide number may be referred to as an "ISO guide number (ISO/GN)" in accordance with ISO 1230. Because instant picture cameras and some colour reversal films with limited exposure latitude require a tolerance of only $\pm$ 1/3 E_v $\left(\begin{matrix}+26,0\ \% \\ -20,6\ \%\end{matrix}\right)$, an additional photographic check with flash equipment for the appropriate exposure may be necessary when using the above mentioned systems.

Any indication of guide numbers shall be accompanied by the angle of coverage of light of the system.

8.2 Angle of coverage

The measured angles of coverage of light shall be equal to or greater than the corresponding angles of the camera lens/film system for which the flash equipment is to be used. No conspicuous dark or bright spots shall be allowed in the claimed picture area.

8.3 Ready indication

Whenever ready indication appears the measured guide number shall not deviate more than 1 E_v from the claimed guide number (– 29,3 % in the guide number value). Under these conditions the ready indication may be called a "Standard ready indication".

For units with regulated voltage for the storage capacitor the ready indication may be set to about 100 % of the stored energy. If the measured guide number varies by not more than 0,1 E_v ($^{+3,5\ \%}_{-3,4\ \%}$ in the guide number value) whenever the ready indication is on, the ready indication may be called "100 % ready indication".

8.4 Recycle times

The measured recycle time shall be not greater than 1,3 times the claimed recycle time. Under these conditions the recycle time may be called "Standard recycle time".

For units with "100 % ready indication" the recycle time may be called "100 % recycle time".

8.5 Number of flashes

The measured number of flashes shall be not less than 0,8 times the claimed number of flashes.

Annex

Additional data

(This annex does not form part of the standard.)

A.1 Photopic response

Photopic response of the sensor is chosen as it is implied by the choice of photometric units.

A.2 Light meter requirements

In measuring photometric parameters of the electronic flash equipment very high light intensities are encountered; the illumination on the light meter sensor may reach peaks of several 10^6 lx.

Precautions have to be taken to ensure that the sensors are not overloaded. The use of stable, calibrated neutral density filters may aid in reducing the illuminance levels to within the linear range of the sensors, and will also facilitate the calibration of sensors against incandescent standard lamps. The sensor and associated electronics shall be capable of high frequency response in order to follow accurately and measure the fast rise and fall times of illuminance. As these times are usually expressed in microseconds equipment with a better frequency response than 1 MHz shall be used.

A.3 Precautions during testing

Due precautions should be taken to ensure that meter readings are not influenced by specular or light-coloured surfaces in the test environment. This precaution also applies to the flash equipment sensor, when testing automatic flash equipment equipped with sensors. Objects near the flash equipment lamp head may reflect enough light to the automatic sensor to seriously affect its operation. Surfaces with specular reflection, including the light meter sensor head, may adversely affect sensors in automatic flash equipment. A larger room with low-reflecting walls (less than 5 % reflectance) is recommended. The test arrangement should be such that no objects are interposed between the flash equipment lamp head and the light meter sensor.

A.4 Spectral energy distribution of the flash radiation

Spectral energy distribution is affected by the loading of the flash tube, flash duration and characteristics of flash tube, reflector and accessories. When specifying the ISO spectral distribution index the test conditions shall be specified. A variation in spectral distribution index may also be specified for different operating conditions.

A.5 Energy and voltage measurements

Electrolytic capacitors typically used in electronic flash equipment are affected by non-use. The forming procedure recommended by the electronic flash equipment manufacturer should be followed prior to making measurements of capacity. The energy storage capacity of the equipment should not be calculated from the nominal or labelled values of the capacitors since these components can vary widely in normal commercial practice. In order to determine the actual capacitance it is necessary to make measurements with an accurate capacitance bridge in the range of the values being measured. Capacitance measurements shall be made at 100 or 120 Hz.

The measurement of capacitor voltage shall be made without a significant electrical load on the circuit. A voltmeter with an input impedance of 1 MΩ or more (10 MΩ is desirable) will meet this requirement.

As the period between the release of the flash and the following indication of readiness for flash release may be very short, an automatic release of the flashes and a photoelectric time measurement is recommended. Recording of events on a strip chart recorder has been found very useful.

A.6 Suggested display of data for flash equipment (assumed values)

A.6.1 Manual operation

ISO guide number (ISO/GN) :	32 m (100 ft)
Angle of coverage of light :	60° (diagonal)
Spectral quality :	ISO/SDI 2/0/1