

INTERNATIONAL STANDARD

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Second edition
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Photography — Determination of flash guide numbers

Photographie — Détermination des nombres-guides des appareils à éclairs

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Reference number
ISO 1230:1992(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 1230 was prepared by Technical Committee ISO/TC 42, *Photography*.

This second edition cancels and replaces the first edition (ISO 1230:1973), of which it constitutes a technical revision.

Annexes A, B and C of this International Standard are for information only.

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International Organization for Standardization
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Introduction

In general flash photography, where the flash light source is mounted on a camera, the product of the camera lens f -number and the distance from the flash light source to the subject is a constant with respect to the ISO speed of the film to be used. The illuminance of the subject varies with the distance according to the inverse-square law and, in order to obtain the same suitable exposure on film, the f -number should be adjusted according to the square root of the illuminance of the subject.

The constant is named "flash guide number" and is a very useful guide for flash photographers, because the guide number represents, in a sense, the power of illumination of the light source, for both flash lamps with and without integral reflectors and electronic flash equipment. The camera lens f -number setting can easily be calculated by dividing the guide number by the distance from the flash light source to the subject.

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Photography — Determination of flash guide numbers

1 Scope

This International Standard specifies the definition and determination of the ISO guide numbers of flash light sources for general photographic use, including expendable photoflash lamps with and without integral reflectors and electronic flash equipment. Definitions and measuring methods for the light output of photoflash lamps without integral reflectors are specified in ISO 1229. Definitions and measuring methods for the light output of electronic flash equipment are specified in ISO 2827.

NOTE 1 The same technique may be used for measurement of light output of photoflash lamps with integral reflectors.

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 1229:1989, *Photography — Expendable photoflash lamps — Determination of light output*.

ISO 2827:1988, *Photography — Electronic flash equipment — Determination of light output and performance*.

3 Definitions

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

3.1 reflector factor: The amplification of the luminous intensity taking the beam intensity in a solid angle $2 \times 5^\circ$ around the axis of the reflector of the

flash equipment compared to that from a bare lamp in a direction perpendicular to the axis of the lamp.

3.2 guide number (GN): The product of the camera lens f -number required for a suitable exposure on a film and the distance from the flash light source to the subject, in metres, with respect to the ISO speed of the film to be used.

3.3 ISO guide number (ISO/GN): The guide number, expressed in metres, for a film of speed ISO 100/21°, "X" synchronization, an exposure of 1/30 s and, in the case of an expendable photoflash lamp without integral reflector, a reflector factor of 5 (see clause 5).

4 Method for measuring reflector factor

4.1 Measurements of luminous intensity (in candelas) shall be carried out in a room with non-reflecting walls at a distance of at least 2 m or twelve times the reflector diameter, whichever value is the greater. For this purpose, normal photoflash lamps intended for equipment with reflectors shall be used.

4.2 Sufficient quantities of photoflash lamps shall be measured so as to ensure good average values; starting at the reflector axis, these measurements shall be carried out in all directions of interest so that the reflector factor may be calculated.

5 Reflector factors for flash lamp equipment

If the reflector factor of any equipment for expendable photoflash lamps otherwise complying with this International Standard differs materially from the value 5, a correction factor shall be published by the manufacturer of the equipment. This shall be marked on the equipment or included as part of the standard instructions supplied with it, enabling the ISO guide number of the photoflash lamp to be transformed to a guide number for the combination of lamp and flash equipment.

6 Formulae for calculating ISO guide number (ISO/GN)

6.1 ISO guide numbers in metres shall be obtained from the following formulae:¹⁾²⁾

— for photoflash lamps (without integral reflectors):

$$\text{ISO/GN} = \sqrt{0,21 Q}$$

— for electronic flash equipment or photoflash lamps (with integral reflectors)

$$\text{ISO/GN} = \sqrt{0,52 \int I dt}$$

where

Q is the light output of a photoflash lamp (without integral reflector) in lumen seconds (see ISO 1229);

$\int I dt$ is the time integral of the luminous intensity of electronic flash equipment or photoflash lamps (with integral reflectors) in candela seconds (see ISO 2827).

6.2 Guide numbers for film of any ISO speed other than 100 may be obtained from the following formula:

$$\text{GN}_{(\text{ISO } S)} = (\text{ISO/GN}) \cdot \sqrt{\frac{S}{100}}$$

where

S is the ISO speed (arithmetic) of the film.

7 Designation of guide number

Designation of guide numbers on products or instructions should be rounded to two significant digits and followed by metres.³⁾ When a guide number does not express the ISO guide number (i.e. for films other than those of ISO speed 100 [arithmetic]), the ISO speed of the film should follow in parentheses.

EXAMPLES

ISO/GN: 20 metres

GN: 40 metres (ISO 400)

1) For ISO guide numbers in feet, see annex A.

2) For explanation of guide number equation, see annex B.

3) For designation of guide number in feet see A.2.

Annex A (informative)

Calculating ISO guide number in feet

A.1 Conversion factor

ISO guide numbers in feet can be obtained from the metre guide numbers by multiplying by the factor 3,28.

A.2 Designation of guide number in feet

Designation of guide numbers on products or instructions should be rounded to two significant digits and followed by feet. When a guide number does not

express the ISO guide number (for films other than those of ISO speed 100 [arithmetic]), the ISO speed of the film should follow in parentheses.

EXAMPLES

ISO/GN:	20 metres
ISO/GN:	66 feet
GN:	40 metres (ISO 400)
GN:	130 feet (ISO 400)

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Annex B (informative)

Explanation of guide number equation

B.1 Electronic flash

In the case of illuminating the object by means of an electronic flash light source, ISO 5763 gives the exposure H_F , in lux seconds, in the focal plane of a camera as:

$$H_F = \frac{bq\Omega_0}{A^2 d^2} \int Idt \quad \dots (B.1)$$

where

- b is a constant, mainly for radiation attenuation in the camera lens, and is considered to be $0,65 \text{ lx}\cdot\text{m}^2\cdot\text{cd}^{-1}$ for a representative lens;
- q is the luminance coefficient, in candelas per square metre per lux, of the object, which has a standard value of $q = 0,08 \text{ cd}\cdot\text{m}^{-2}\cdot\text{lx}^{-1}$; this corresponds to a reflectance of about 25 % for a uniform diffuser;
- Ω_0 is the solid angle = 1 sr;
- A is the f -number of the camera lens;
- d is the distance from the light source to the object, in metres;
- $\int Idt$ is the time integral of the luminous intensity of the light source, in candela seconds.

From the definition of the guide number in this International Standard it follows that:

$$GN = Ad \quad \dots (B.2)$$

From ISO 2721, the nominal (normal) exposure H_F in the focal plane for films of ISO speed S (arithmetic) should be:

$$H_F = \frac{10}{S} \quad \dots (B.3)$$

Equations (B.1), (B.2) and (B.3) may be combined to yield:

$$\frac{10}{S} = \frac{bq}{(\text{GN})^2} \int Idt \quad \dots (B.4)$$

Substituting the values $b = 0,65$ and $q = 0,08$:

$$\text{GN} = \sqrt{5,2 \times 10^{-3} S \int Idt} \quad \dots (B.5)$$

When $S = 100$:

$$\text{ISO}/\text{GN} = \sqrt{0,52 \int Idt} \quad \dots (B.6)$$

NOTE 2 In ISO 1230:1973, the constant C in the formulae for calculating guide numbers was given as $4,5 \times 10^{-3}$ based on the results of many experiments and experiences. Since then, many related International Standards, such as ISO 2240^[4], ISO 2721^[5] and ISO 5763^[6] have been established. In order to coincide with these International Standards, the constant C should have been amended to $4,6 \times 10^{-3}$. However, in the formulae in ISO 1230:1973, 0,3 was adopted as the metre/foot conversion factor. When $1/3,28 = 3,048 \times 10^{-1}$ is applied as defined in this second edition of this International Standard (see A.1), C should remain at $4,5 \times 10^{-3}$ (precisely $4,454 \times 10^{-3}$). Therefore the formulae given in this edition of this International Standard do not cause any inconvenience in practical applications.

B.2 Expendable photoflash lamps without integral reflectors

In the case of expendable photoflash lamps without integral reflectors, the value $\int Idt$ corresponds to $MQ/4\pi$, where M is the reflector factor (by definition in this International Standard, $M = 5$), and Q is the light output of the flash lamps in lumen seconds (see ISO 1229).

$$\text{GN} = \sqrt{\frac{5,2 \times 10^{-3} \times 5}{4\pi}} QS \quad \dots (B.7)$$

$$\text{GN} = \sqrt{2,1 \times 10^{-3}} QS \quad \dots (B.8)$$

When $S = 100$:

$$\text{ISO}/\text{GN} = \sqrt{0,21} Q \quad \dots (B.9)$$

Annex C (informative)

Bibliography

- [1] ISO 6:1974, *Photography — Determination of ISO speed of monochrome (black-and-white), continuous-tone photographic negative materials for still photography.*
- [2] ISO 516:1986, *Photography — Camera shutters — Timing.*
- [3] ISO 517:—⁴⁾, *Photography — Apertures and related properties pertaining to photographic lenses — Designations and measurements.*
- [4] ISO 2240:—⁵⁾, *Photography — Colour reversal camera films — Determination of ISO speed.*
- [5] ISO 2721:1982, *Photography — Cameras — Automatic controls of exposure.*
- [6] ISO 5763:1989, *Photography — Electronic flash equipment — Automatic control of exposure.*
- [7] ISO 5800:1987, *Photography — Colour negative films for still photography — Determination of ISO speed.*
- [8] ISO 10503:1991, *Photography — Expendable reflected photoflash lamp arrays — Definitions and requirements for luminous flux/time characteristics.*
- [9] CIE Publication No. 38, *Radiometric and photometric characteristics of materials and their measurement, 1977.*

4) To be published. (Revision of ISO 517:1973)

5) To be published. (Revision of ISO 2240:1982)