

Specification for

Personal photographic dosemeters

UDC 539.1.074.86:614.876

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- British Electrical and Allied Manufacturers' Association (BEAMA)
- British Insurance (Atomic Energy) Committee
- Electricity Supply Industry in England and Wales*
- Health and Safety Executive*
- Institution of Nuclear Engineers*
- Lloyd's Register of Shipping
- National Radiological Protection Board*
- Radiochemical Centre
- Scientific Instrument Manufacturers' Association*
- United Kingdom Atomic Energy Authority*
- Water-tube Boilermakers' Association

The organizations marked with an asterisk in the above list, together with the following, were directly represented on the Technical Committee entrusted with the preparation of this British Standard:

- AERE Harwell
- Association of University Protection Officers
- Association of X-ray Equipment Manufacturers
- British Institute of Radiology
- British Ship Research Association
- British Steel Industry
- Department of Industry (National Physical Laboratory)
- Electronic Engineering Association
- Hospital Physicists' Association
- Institute of Physics
- Ministry of Defence
- Society for Radiological Protection

This British Standard, having been prepared under the direction of the Nuclear Engineering Standards Committee, was published under the authority of the Executive Board and comes into effect on 27 February 1981

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The following BSI references relate to the work on this standard:
Committee reference NCE/2
Draft for comment 78/75081 DC

ISBN 0 580 11887 8

Amendments issued since publication

Amd. No.	Date of issue	Comments

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National foreword

This British Standard is identical with ISO 1757:1980 “*Personal photographic doseimeters*” and it has been prepared under the direction of the Nuclear Engineering Standards Committee.

The United Kingdom has taken part in the discussion in Technical Committee TC 85 of the International Organization for Standardization (ISO) that resulted in the preparation of ISO 1757:1980.

Terminology and conventions. The text of the International Standard has been accepted as suitable for publication as a British Standard without deviation. Some terminology and certain conventions are not identical with those used in British Standards; attention is especially drawn to the following:

The comma has been used throughout as a decimal marker. In British Standards it is current practice to use a full point on the baseline as the decimal marker.

Wherever the words “International Standard” or “ISO 1757” appear, referring to this standard, they should be read as “British Standard” and “BS 6090” respectively.

NOTE Marking BS 6090 on or in relation to a product is a claim by the manufacturer that the product has been manufactured in accordance with the requirements of the standard. The accuracy of such a claim is therefore solely the manufacturer’s responsibility. Enquiries as to the availability of third party certification to support such claims should be addressed to the Director, British Standards Institution, Maylands Avenue, Hemel Hempstead, Herts HP2 4SQ in the case of certification marks administered by BSI or to the appropriate authority for other certification marks.

Cross-references

International Standard	Corresponding British Standard
ISO 5:1974	BS 1384:1947 <i>Measurement of photographic transmission density</i> (Technically equivalent)
ISO 4037:1979	BS 5869:1980 <i>Specification for X and γ reference radiations for calibrating doseimeters and dose ratemeters and for determining their response as a function of photon energy</i> (Identical)

NOTE *Textual error.* When adopting the text of the International Standard, the error given below was noticed. It has been reported to ISO in a proposal to amend the text of the International Standard. In the note to 3.3, the equation should be read as

$$1R = 2,58 \times 10^{-4} \text{ C/kg}$$

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 12, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

1 Scope and field of application

This International Standard specifies the classification, characteristics and test procedures for personal photographic dosimeters¹⁾ used to determine

- absorbed doses due to X or gamma radiations with an energy less than 3 MeV;
- absorbed doses due to beta radiations with maximum energy from 0,6 MeV to 3 MeV, whether or not this radiation be accompanied by X, gamma or bremsstrahlung photon radiation.

This International Standard is particularly applicable to dosimeters intended to be carried on the chest or wrist.

It is also applicable to dosimeters carried on the fingers and used in the presence of these types of radiation. However, certain specifications should be adapted or supplemented according to the special requirements for these dosimeters.

Dosimeters equipped with fluorescent intensifying screens will be the subject of additional specifications, particularly regarding reciprocity defects.

Some requirements of this International Standard may also be applicable to photographic dosimeters for thermal neutrons, whether or not they are mixed with X or gamma radiation. A supplement will specify the requirements which have to be adapted or supplemented to satisfy the special requirements for these dosimeters.

This International Standard is not applicable without restriction

- to dosimeters used to determine the absorbed doses due to sources of pulsed radiation (for example, accelerators), or
- to dosimeters used in significant fields of fast neutrons.²⁾

It is not applicable to nuclear track emulsions.

NOTE The term “dosimeter” is used in the text of this International Standard to mean “personal photographic dosimeter” in every instance that the complete instrument, as it may be used in practice, is concerned and the word “dose” is used instead of “absorbed dose” for purposes of simplification.

2 References

ISO 5, *Photography — Determination of diffuse transmission density*.

ISO 4037, *X and γ reference radiations for calibrating dosimeters and dose ratemeters for determining their response as a function of photon energy*.

3 Definitions

3.1

personal photographic dosimeter

dosimeter comprising

- a) one or more photographic emulsions which, after measurement of the optical density and interpretation of the result, to assess the dose on that part of the body where the dosimeter is worn;
- b) filters;
- c) protective wrapping.

3.2

filter

the part of the dosimeter that modifies the effect of various radiations on the emulsion, enabling on the one hand an assessment to be made of the dose and (in many cases) the energy of the radiation, and on the other hand a differentiation to be made between the various types of radiation

¹⁾ Personal photographic dosimeters are a particular class of individual dosimeters which represent a fraction of the existent absorbed dose measuring devices.

²⁾ For many emulsions, 1 rem of fast neutrons causes the same density as does 200 μGy of 1 MeV gamma radiation.

3.3

kerma in air

quotient of the sum of the initial energies of all the charged particles liberated by indirectly ionising particles in a volume element of air by the mass of air contained in that volume element

the unit for kerma in air is the gray (Gy)

$$1 \text{ Gy} = 1 \text{ J/kg}$$

NOTE Kerma in air is used instead of exposure whose unit was the röntgen (R)

$$1 \text{ R} = 2,58,10^{-4} \text{ C/kg}$$

in the energy range under consideration, it is considered that:

1 Gy is equivalent to 115 R, so that 1 R is equivalent to 8,69 mGy.

3.4

absorbed dose $D^{3)}$

the quotient of the mean energy imparted to matter ΔE_D in a volume element suitably small by the mass Δm of that volume element

the unit of absorbed dose is the gray (Gy):

$$1 \text{ Gy} = 1 \text{ J kg}^{-1} = 100 \text{ rd}$$

in this International Standard, the matter considered is air

3.5

calibration curve

curve representing, for a given radiation, the value of the optical density of the emulsion expressed under given conditions as a function of the dose in air

3.6

optical density (transmission)

the common logarithm of the ratio of the incident luminous flux to the luminous flux transmitted by the sample

3.7

optical density (reflection)

the common logarithm of the ratio of the luminous flux received by the sample at an incidence of 45° to the luminous flux perpendicularly diffused by the sample

3.8

latent image

invisible change which occurs within the silver halide crystals when an emulsion is exposed to an actinic radiation or to a radiation directly or indirectly ionising and which will “appear” upon processing to produce a visible silver image

3.9

stability of latent image

property of the latent image to produce images through processing that are as identical to one another as possible whatever the time period observed between their formation and development and whatever the ambient effects undergone during this period (temperature or humidity variation)

3.10

solarization

an inversion phenomenon occurring past a certain exposure or a certain absorbed dose beyond which the densities obtained diminish instead of increasing

3.11

maximum beta energy ($E_{\max}$) of a beta emitter

the maximum value of the complete energy spectrum of the beta radiation associated with the considered source

³⁾ Also more simply mentioned as “dose” in this International Standard.