
**Nuclear energy — Radiation protection —
Individual thermoluminescence dosimeters
for extremities and eyes**

*Énergie nucléaire — Radioprotection — Dosimètres individuels
thermoluminescents pour yeux et extrémités*



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ISO 12794:2000(E)

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

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 International Standard may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 12794 was prepared by Technical Committee ISO/TC 85, *Nuclear energy*, Subcommittee SC 2, *Radiation protection*.

Annexes A, B, C and E form integral parts of this International Standard. Annex D is for information only.

Introduction

This International Standard covers dosimeters for the eyes and extremities.

This International Standard should be used in conjunction with IEC 1066:1991, which provides performance criteria and tests for thermoluminescence dosimetry systems comprising dosimeters, readers, ancillary equipment and procedures for converting light output into dose, for the assessment of personal or environmental doses, excluding extremities. It also includes some performance criteria and tests for thermoluminescent detectors and thermoluminescence dosimeters where these criteria are dependent on the characteristics of the detectors or dosimeters, rather than on the reader or ancillary equipment.

This document was prepared and discussed by Working Group WG 7 of ISO/TC85/SC2 following meetings in Paris in August 1988, Moscow in May 1990, Rome in November 1991, Paris in September 1992 and London in October 1993. It was not possible to hold a WG meeting in Orlando in October 1994. The draft was agreed at the Paris meeting by the working group and circulated by the Secretariat as a CD. A further meeting of the WG was held in London in October but the results of the voting were not available until later in October 1995. A final draft, dated February 1996, incorporating comments included with the results of the voting on ISO/CD (WI 7-2.07.1), circulated as ISO/TC85/SC2 N 475 in October 1993, was agreed by WG 7 in Albuquerque in February 1996. The comments following circulation as a DIS were considered by the WG in July 1997 and this International Standard incorporates those that were agreed upon.

Nuclear energy — Radiation protection — Individual thermoluminescence dosimeters for extremities and eyes

1 Scope

This International Standard provides performance criteria and tests for determining the performance of thermoluminescence dosimeters intended to be used for the measurement of radiation doses to the eyes and extremities (fingers, and limbs defined as hands, feet, forearms including the elbow, and leg including the patella), for photons from 15 keV to 3 MeV and beta radiation from 0,5 MeV to 3 MeV. It is conditional upon the use of an appropriate reader, procedures and ancillary equipment. It does not cover information access and data processing.

This International Standard provides performance criteria and tests for dosimeters intended to measure dose equivalent at depths of $7 \text{ mg}\cdot\text{cm}^{-2}$ in tissue for fingers and limbs and $300 \text{ mg}\cdot\text{cm}^{-2}$ in tissue for the eyes, including provision for the use of dosimeters only intended to be used once. Appropriate phantoms and dose conversion coefficients are recommended but others are not precluded.

In all cases, performance is assessed under laboratory conditions which may not adequately simulate conditions actually experienced in personal dosimetry. For example, it may be necessary to sterilize dosimeters for medical applications. Therefore, caution is necessary in applying the results of these performance tests in real situations.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 31-0, *Quantities and units — Part 0: General principles*.

ISO 4037-3:1999, *X and gamma reference radiation for calibrating dosimeters and dose-rate meters and for determining their response as a function of photon energy — Part 3: Calibration of area and personal dosimeters and the measurement of their response as a function of energy and angle of incidence*.

ISO 6980, *Reference beta radiations for calibrating dosimeters and dose-rate meters and for determining their response as a function of beta-radiation energy*.

3 Terms and definitions

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

3.1

thermoluminescence

radiothermoluminescence

TL

property exhibited by certain substances, namely the emission of light, which is induced by irradiation when the substance is heated following exposure to ionizing radiation or UV

NOTE Strictly speaking, the property should be referred to as radiothermoluminescence but the abbreviated form thermoluminescence is usually adequate.

3.2

thermoluminescent material

TL material

substance exhibiting the property of thermoluminescence

3.3

thermoluminescent detector

TL detector

detector

specified quantity of TL material, or such material incorporated with other non-luminescent material into a matrix, defined by mass, shape or size or the mass of material incorporated in the matrix

3.4

thermoluminescence dosimeter

TL dosimeter

dosimeter

passive device consisting of one or more TL detectors, which may be mounted in a holder (appropriate for the application), intended to be worn on a person's body or placed in an environment for the purpose of assessing the appropriate dose equivalent at or near the position where it is placed

3.5

thermoluminescence dosimeter reader

TL dosimeter reader

reader

instrument used to measure the light emitted from the detectors in thermoluminescence dosimeters; consisting essentially of a heating device, a light measuring device and the associated electronics

3.6

extremity dosimeter

dosimeter intended to be worn on the finger or limb [hands, feet, forearms (including the elbow), and lower leg (including the patella)]

3.7

eye dosimeter

dosimeter intended to be worn near the eyes

3.8

reusable dosimeter

dosimeter intended to be reused, as opposed to one which is discarded after one use

NOTE When used in medical applications, appropriate sterilization may be necessary.

3.9**batch**

collection of detectors or dosimeters made to a specific design or specification and intended to have the same performance characteristics consistent with the appropriate requirements of this International Standard

3.10**annealing**

controlled thermal treatment of a TL detector or dosimeter during or after readout

3.11**prepare****reprepare**

normal treatment of annealing, cleaning, etc. which the dosimeters or detectors are intended to be subjected to in routine use

3.12**readout**

process of measuring the light emitted when a TL detector or dosimeter is heated in a reader

3.13**readout value**

m

value indicated by a TL reader after readout of a detector or dosimeter expressed in units appropriate to the output of the reader

3.14**absorbed dose**

D

quotient of $d\bar{\epsilon}$ by dm , where $d\bar{\epsilon}$ is the mean energy imparted by ionizing radiation to matter of mass dm .

NOTE 1 The special name for the unit of absorbed dose is gray (Gy) ($1 \text{ Gy} = 1 \text{ J} \cdot \text{kg}^{-1}$). In this International Standard, absorbed doses are specified in grays.

NOTE 2 Where no ambiguity could be involved, the term "absorbed dose" is abbreviated to "dose".

3.15**kerma**

K

quotient of $d\bar{\epsilon}_{\text{tr}}$ by dm , where $d\bar{\epsilon}_{\text{tr}}$ is the sum of the initial kinetic energies of all the charged ionising particles liberated by uncharged ionising particles in a matter of mass dm :

$$K = \frac{d\bar{\epsilon}_{\text{tr}}}{dm} \quad (1)$$

3.16**dose equivalent**

H

product of D and Q at the point of interest in tissue where D is the absorbed dose and Q is the quality factor:

$$H = DQ \quad (2)$$

NOTE The SI unit for both D and H is joule per kilogram. The special name for the unit of dose equivalent is the sievert (Sv): ($1 \text{ Sv} = 1 \text{ J} \cdot \text{kg}^{-1}$).

3.17**personal dose equivalent**

$H_p(d)$

dose equivalent in soft tissue below a specified point at an appropriate depth, d

NOTE The SI unit for $H_p(d)$ is joule per kilogram. The special name is sievert (Sv) ($1 \text{ Sv} = 1 \text{ J} \cdot \text{kg}^{-1}$).