SLOVENSKI STANDARD
SIST HD 379 S1:1998

01-oktober-1998

Area exposure product meter (IEC 60580:1977)

Area exposure product meter

Bereichsexponierungsproduktmesser

Radiamètre de produit exposition-surface

Ta slovenski standard je istoveten z: **HD 379 S1:1979**

ICS:

17.240 Merjenje sevanja Radiation measurements

SIST HD 379 S1:1998 **en**

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INFORMATION SHEET

HD 379 S1

Issue 3 1988-01-20

Area exposure product meter

Radiamètre de produit exposition-surface

Flächendosisprodukt - Meßgeräte

RD: IEC 580 (1977) ed 1; IEC/SC 62B (not appended)

The Harmonization Document consists of the following :

- Title Page

Related to Directive: -

date of ratification	:	1978-12-07
date of announcement	:	
date of latest publication	:	1980-01-01
date of withdrawal	:	

List of national deviations

LIST OF NATIONAL STANDARDS IS GIVEN OVERLEAF

AT :

BE : NOS

CH : SEV/ASE 3352.1978

DE : DIN 6819/01.84

DK : NOS

ES : UNE 20 610

FI :

FR : NOS

GB : NOS

GR :

IE :

IT : CEI 62-7 (1981)

LU :

NL : NEN 10 580 (1978)

NO :

PT :

SE : SS IEC 580 (1986)

C.D.U./U.D.C.: 621.3+615.47 615.849.001.11.004.12 621.317.39.083.084-777

COMMISSION ÉLECTROTECHNIQUE INTERNATIONALE

NORME DE LA CEI

INTERNATIONAL ELECTROTECHNICAL COMMISSION

IEC STANDARD

Publication 580

Première édition — First edition

1977

Radiamètre de produit exposition-surface

Area exposure product meter

Bureau Central de la Commission Electrotechnique Internationale

1, rue de Varembé

Genève, Suisse

Prix
Price Fr. s. 52.—

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

AREA EXPOSURE PRODUCT METER

FOREWORD

1) The formal decisions or agreements of the IEC on technical matters, prepared by Technical Committees on which all the National Committees having a special interest therein are represented, express, as nearly as possible, an international consensus of opinion on the subjects dealt with.
2) They have the form of recommendations for international use and they are accepted by the National Committees in that sense.
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4) The IEC has not laid down any procedure concerning marking as an indication of approval and has no responsibility when an item of equipment is declared to comply with one of its recommendations.

PREFACE

This standard has been prepared by Sub-Committee 62B, X-Ray Equipment Operating up to 400 kV and Accessories, of IEC Technical Committee No. 62, Electrical Equipment in Medical Practice.

A first draft was discussed at the meeting held in The Hague in 1974. As a result of this meeting, a draft, Document 62B(Central Office)23, was submitted to the National Committees for approval under the Six Months' Rule in August 1975.

The following countries voted explicitly in favour of publication:

Australia	Romania
Austria	South Africa (Republic of)
Belgium	Spain
Denmark	Sweden
Germany	Switzerland
Israel	Turkey
Italy	United Kingdom
Japan	United States of America
Netherlands	

Other IEC publications quoted in this standard:

Publications Nos. 50 (391): International Electrotechnical Vocabulary, Chapter 391: Detection and Measurement of Ionizing Radiation by Electric Means.
278: Documentation to be Supplied with Electronic Measuring Apparatus.

AREA EXPOSURE PRODUCT METER

1. Scope

This standard deals with the performance and testing of AREA EXPOSURE PRODUCT METERS intended to measure AREA EXPOSURE PRODUCT to the PATIENT during MEDICAL RADIOLOGICAL EXAMINATIONS.

2. Introduction

The purpose of routine measurement of AREA EXPOSURE PRODUCT is to help in achieving an overall reduction in the radiation received by PATIENTS undergoing MEDICAL RADIOLOGICAL EXAMINATIONS.

Provided adequate records are kept, it is possible to compare different examination techniques, to establish a technique giving minimum radiation to a PATIENT, and to ensure a maintenance of that technique; in this respect, such measurements have a place of particular importance in training establishments.

Examination of records may also indicate a deterioration in the efficiency of the image-production system.

3. Terminology

3.1 *Degree of requirements*

In this standard the auxiliary verb

- "shall" implies that compliance with a requirement is mandatory for compliance with the standard
- "should" implies that compliance with a requirement is strongly recommended but is not mandatory for compliance with the standard
- "may" implies that compliance with a requirement is permitted to be accomplished in a particular manner, for compliance with the standard.

Note. — These definitions are under consideration.

3.2 *Definitions*

This sub-clause contains only those definitions whose use is restricted to the use of AREA EXPOSURE PRODUCT METERS.

Definitions of other terms used in this standard are given in Appendix B.

3.2.1 *Area exposure product*

The product of the area of the USEFUL BEAM and the EXPOSURE over the cross-section of the USEFUL BEAM, both quantities being measured at the same distance from the FOCAL SPOT.

3.2.2 *Area exposure product meter*

RADIATION METER intended to measure AREA EXPOSURE PRODUCT.

3.2.3 *Area exposure product rate*

The quotient of an increment of AREA EXPOSURE PRODUCT by the corresponding increment of time.

3.2.4 *Useful field*

The cross section of the USEFUL BEAM, perpendicular to its specified direction at a specified distance from the FOCAL SPOT or at a specified plane of measurement.

3.2.5 *Measuring device*

A device which receives an output signal from a transducer and processes the signal into a form suitable to be fed into a PRESENTATION DEVICE or a DISPLAY DEVICE.

3.2.6 *Display device*

A device which receives the output signal from a MEASURING DEVICE and converts the information contained in the signal into a form suitable for visual observation.

3.2.7 *Presentation device*

A device which receives the output signal from a MEASURING DEVICE and converts the information contained in the signal into a form suitable for being fed into a further device.

3.2.8 *Stability check device*

A device, either a separate device or part of a RADIATION METER, which enables the stability of RESPONSE of the RADIATION METER to be checked. The stability check device may be a purely electrical device or may include a RADIATION SOURCE.

3.2.9 *Response*

The quotient of the INDICATED VALUE divided by the AREA EXPOSURE PRODUCT.

3.2.10 *Limits of error*

The maximum permissible deviations of the INDICATED VALUE from the true value of the AREA EXPOSURE PRODUCT.

4. Main components

The AREA EXPOSURE PRODUCT METER consists of the following main components:

- IONIZATION CHAMBER,
- MEASURING DEVICE,
- DISPLAY DEVICE,
- PRESENTATION DEVICE (optionally where appropriate),
- STABILITY CHECK DEVICE.

5. Performance

5.1 *Range of radiation qualities*

The instrument shall be suitable at least for RADIATION QUALITIES ranging from an X-RAY TUBE POTENTIAL DIFFERENCE of 50 kV and a HALF-VALUE LAYER of 1.5 mm aluminium to an X-RAY TUBE POTENTIAL DIFFERENCE of 150 kV and a HALF-VALUE LAYER of 6 mm aluminium.

5.2 *Plane of measurement*

The instrument shall be designed so as to indicate the AREA EXPOSURE PRODUCT in the USEFUL BEAM for the plane in which the radiation is incident on the PATIENT excluding, as far as practicable, the contribution of back-scattering to the measured value.

5.3 *Range of indication*

5.3.1 For an analogue display, the minimum INDICATED VALUE shall not exceed 10 R cm^2 (1 R cm^2 when specified for paediatric use); the maximum INDICATED VALUE shall not be less than 10^4 R cm^2 and should be not less than 10^5 R cm^2.

5.3.2 For a digital display, the minimum INDICATED VALUE shall not exceed 10 R cm^2 (1 R cm^2 when specified for paediatric use); the maximum INDICATED VALUE shall be not less than 9.99×10^3 R cm^2 and should be not less than 9.99×10^4 R cm^2.

5.3.3 The number of ranges should be such as to enable valid readings to be made throughout the entire range within the LIMITS OF ERROR required in Clause 6.

5.4 *Response time*

An indicated value of 90% of the final indicated value shall be reached within a time not greater than 5 s after the end of the IRRADIATION.

6. Limits of error

6.1 *Effect of area exposure product rate*

The output charge from the IONIZATION CHAMBER shall be proportional to the AREA EXPOSURE PRODUCT over a range of AREA EXPOSURE PRODUCT RATES from 3×10^{-1} R cm^2 s^{-1} to at least 3×10^4 R cm^2 s^{-1} within ± 10% LIMITS OF ERROR, with the higher AREA EXPOSURE PRODUCT RATE applied for a maximum time of 10 ms.

6.2 *Effect of irradiation time*

The accuracy of the indicated AREA EXPOSURE PRODUCT as required in Sub-clause 6.1 shall be achieved for an IRRADIATION time as short as 1 ms (or less, if specified) and for an examination time as long as 1 h.

6.3 *Limits of error of the combined measuring device and display device*

6.3.1 *Linear analogue display*

For SCALE READINGS greater than 50% of full scale, the error of an INDICATED VALUE shall not exceed ± 10% of that value. For SCALE READINGS less than 50% of full scale, the error of an INDICATED VALUE shall not exceed ± 5% of the INDICATED VALUE corresponding to the full SCALE READING.

6.3.2 *Logarithmic analogue display*

The error of an INDICATED VALUE shall not exceed ±10% of that value over the two upper decades of any range and not more than ±20% over the whole range.

6.3.3 *Digital display*

The error of an INDICATED VALUE shall not exceed ±10% of that value or ±1 digit, whichever is the greater.

Note. – The LIMITS OF ERROR in Sub-clause 6.3 refer only to an INDICATED VALUE of a known signal applied to the input of a MEASURING DEVICE. The overall LIMITS OF ERROR of an AREA EXPOSURE PRODUCT METER are given in Sub-clause 6.4.

6.4 *Overall limits of error*

The overall error of the INDICATED VALUE of an AREA EXPOSURE PRODUCT METER, calibrated in accordance with Sub-clause 10.3, shall not exceed ±25%.

7. Construction of the ionization chamber

7.1 The IONIZATION CHAMBER shall be capable of being situated between the BEAM-LIMITING DEVICE and the PATIENT; see Sub-clause 5.2.

7.2 The SENSITIVE VOLUME of the IONIZATION CHAMBER shall be capable of being positioned so that for variations in the area of the USEFUL FIELD the output current of the IONIZATION CHAMBER is proportional to the area of the USEFUL FIELD, all other conditions being constant.

7.3 If the IONIZATION CHAMBER is specified for use with a LIGHT BEAM DIAPHRAGM, the transparency of the IONIZATION CHAMBER to visible light shall be such as to transmit at least 70% of the luminous flux.

The presence of the IONIZATION CHAMBER shall not displace the edge of the indicated area in the plane of the exit surface of the chamber by more than 2 mm.

7.4 *Attenuation*

7.4.1 The ATTENUATION EQUIVALENT of the IONIZATION CHAMBER shall be measured using an X-radiation generated by an X-RAY TUBE POTENTIAL DIFFERENCE of 100 kV, a PERCENTAGE RIPPLE not exceeding 10% and a TOTAL FILTRATION of 2 mm aluminium.

7.4.2 The ATTENUATION EQUIVALENT shall not exceed 0.5 mm pure aluminium of a purity of not less than 99%.

7.4.3 The ATTENUATION EQUIVALENT determined according to Sub-clause 7.4.1 shall be marked in thickness of aluminium on the outside of the IONIZATION CHAMBER.

8. Display and presentation

8.1 *Display device – General*

8.1.1 The DISPLAY DEVICE shall clearly indicate the AREA EXPOSURE PRODUCT in R cm^2.

8.1.2 The INDICATED VALUE shall be proportional to the charge from the IONIZATION CHAMBER to an accuracy sufficient for the requirements of Clause 6 to be satisfied.