

INTERNATIONAL STANDARD

NORME INTERNATIONALE



**Medical electrical equipment –
Part 1-3: General requirements for basic safety and essential performance –
Collateral Standard: Radiation protection in diagnostic X-ray equipment**

**Appareils électromédicaux –
Partie 1-3: Exigences générales pour la sécurité de base et les performances
essentielle – Norme collatérale: Radioprotection dans les appareils à
rayonnement X de diagnostic**

<https://standards.iec.ch/catalog/standards/iec/8c5a3794-20ef-4880-8c75-c7fc8391f5b4/iec-60601-1-3-2008>

<https://standards.iec.ch/catalog/standards/iec/8c5a3794-20ef-4880-8c75-c7fc8391f5b4/iec-60601-1-3-2008>



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2013 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester.

If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de la CEI ou du Comité national de la CEI du pays du demandeur.

Si vous avez des questions sur le copyright de la CEI ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de la CEI de votre pays de résidence.

IEC Central Office
3, rue de Varembe
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00
info@iec.ch
www.iec.ch

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigenda or an amendment might have been published.

Useful links:

IEC publications search - www.iec.ch/searchpub

The advanced search enables you to find IEC publications by a variety of criteria (reference number, text, technical committee,...).

It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished

Stay up to date on all new IEC publications. Just Published details all new publications released. Available on-line and also once a month by email.

Electropedia - www.electropedia.org

The world's leading online dictionary of electronic and electrical terms containing more than 30 000 terms and definitions in English and French, with equivalent terms in additional languages. Also known as the International Electrotechnical Vocabulary (IEV) on-line.

Customer Service Centre - webstore.iec.ch/csc

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: csc@iec.ch.

A propos de la CEI

La Commission Electrotechnique Internationale (CEI) est la première organisation mondiale qui élabore et publie des Normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

A propos des publications CEI

Le contenu technique des publications de la CEI est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

Liens utiles:

Recherche de publications CEI - www.iec.ch/searchpub

La recherche avancée vous permet de trouver des publications CEI en utilisant différents critères (numéro de référence, texte, comité d'études,...).

Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

Just Published CEI - webstore.iec.ch/justpublished

Restez informé sur les nouvelles publications de la CEI. Just Published détaille les nouvelles publications parues. Disponible en ligne et aussi une fois par mois par email.

Electropedia - www.electropedia.org

Le premier dictionnaire en ligne au monde de termes électroniques et électriques. Il contient plus de 30 000 termes et définitions en anglais et en français, ainsi que les termes équivalents dans les langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (VEI) en ligne.

Service Clients - webstore.iec.ch/csc

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: csc@iec.ch.

INTERNATIONAL STANDARD

NORME INTERNATIONALE



Medical electrical equipment –
Part 1-3: General requirements for basic safety and essential performance –
Collateral Standard: Radiation protection in diagnostic X-ray equipment

Appareils électromédicaux –
Partie 1-3: Exigences générales pour la sécurité de base et les performances
essentielles – Norme collatérale: Radioprotection dans les appareils à
rayonnement X de diagnostic

<https://www.iec.ch/8c5a3794-20ef-4880-8c75-c7fc8391f5b4/iec-60601-1-3-2008>

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 11.040.50; 13.280

ISBN 978-2-8322-0765-9

Warning! Make sure that you obtained this publication from an authorized distributor.
Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.

CONTENTS

FOREWORD.....	5
INTRODUCTION.....	8
INTRODUCTION TO AMENDMENT 1	9
1 Scope, object and related standards.....	10
1.1 Scope.....	10
1.2 Object	10
1.3 Related standards	10
1.3.1 IEC 60601-1	10
1.3.2 Particular standards	10
2 Normative references	11
3 Terms and definitions	11
4 General requirements	21
4.1 Statement of compliance	21
4.2 Composition of reference materials	21
5 ME EQUIPMENT identification, marking and documents	21
5.1 Marking on the outside of ME EQUIPMENT or ME EQUIPMENT parts	21
5.1.1 General	21
5.1.2 Marking requirements in subclauses	21
5.2 ACCOMPANYING DOCUMENTS	21
5.2.1 References in subclauses	22
5.2.2 Dosimetric calibration	22
5.2.3 General requirements for the reference of subassemblies and ACCESSORIES.....	22
5.2.4 Instructions for use	23
6 RADIATION management.....	24
6.1 General	24
6.2 Initiation and termination of the IRRADIATION	25
6.2.1 Normal initiation and termination of the IRRADIATION.....	25
6.2.2 Safety measures against failure of normal termination of the IRRADIATION.....	25
6.3 RADIATION dose and RADIATION QUALITY.....	25
6.3.1 Adjustment of RADIATION dose and RADIATION QUALITY	25
6.3.2 Reproducibility of the RADIATION output	25
6.4 Indication of operational states.....	26
6.4.1 Indication of the X-RAY SOURCE ASSEMBLY selected	26
6.4.2 Indication of LOADING STATE	26
6.4.3 Indication of LOADING FACTORS and MODES OF OPERATION.....	26
6.4.4 Indication of automatic modes	26
6.4.5 Dosimetric indications.....	27
6.5 AUTOMATIC CONTROL SYSTEM	27
6.6 SCATTERED RADIATION reduction	27
6.7 Imaging performance	27
6.7.1 General	27
6.7.2 System performance.....	27
6.7.3 Nominal focal spot value.....	28

6.7.4	RADIATION DETECTOR or X-RAY IMAGE RECEPTOR	28
7	RADIATION QUALITY	28
7.1	HALF-VALUE LAYERS and TOTAL FILTRATION in X-RAY EQUIPMENT	28
7.2	Waveform of the X-RAY TUBE VOLTAGE	29
7.3	Indication of FILTER properties	29
7.4	Test for FILTRATION by irremovable materials	30
7.5	Test for ADDED FILTERS and materials	30
7.6	Test for HALF-VALUE LAYER	30
8	Limitation of the extent of the X-RAY BEAM and relationship between X-RAY FIELD and IMAGE RECEPTION AREA	30
8.1	General	30
8.2	Enclosure of X-RAY TUBES	30
8.3	Limiting DIAPHRAGM in X-RAY TUBE ASSEMBLIES	31
8.4	Confinement of EXTRA-FOCAL RADIATION	31
8.5	Relationship between X-RAY FIELD and IMAGE RECEPTION AREA	31
8.5.1	General	31
8.5.2	* FOCAL SPOT TO IMAGE RECEPTOR DISTANCE	31
8.5.3	Correspondence between X-RAY FIELD and EFFECTIVE IMAGE RECEPTION AREA	31
8.5.4	Positioning of the PATIENT and restriction of the irradiated area	32
9	FOCAL SPOT TO SKIN DISTANCE	32
9.1	General	32
9.2	Information in the ACCOMPANYING DOCUMENTS	32
10	ATTENUATION of the X-RAY BEAM between the PATIENT and the X-RAY IMAGE RECEPTOR	32
10.1	General	32
10.2	Information in the ACCOMPANYING DOCUMENTS	32
11	Protection against RESIDUAL RADIATION	33
12	* Protection against LEAKAGE RADIATION	33
12.1	General	33
12.2	Mounting of X-RAY SOURCE ASSEMBLIES and X-RAY IMAGING ARRANGEMENTS	33
12.3	Statement of reference LOADING conditions	34
12.4	LEAKAGE RADIATION in the LOADING STATE	34
12.5	LEAKAGE RADIATION when not in the LOADING STATE	35
13	Protection against STRAY RADIATION	35
13.1	General	35
13.2	Control of X-RAY EQUIPMENT from a PROTECTED AREA	35
13.3	Protection by distance	36
13.4	* Designated SIGNIFICANT ZONES OF OCCUPANCY	36
13.5	Handgrips and control devices	37
13.6	* Test for STRAY RADIATION	37
	Annex A (informative) General guidance and rationale	39
	Annex B (normative) Values of the series R'10 and R'20, ISO 497	41
	Annex C (informative) Mapping between this Edition 2 of IEC 60601-1-3 and Edition 1	42
	Bibliography	44

Index of defined terms used in this collateral standard 46

Figure 1 – Example of presentation of data on STRAY RADIATION 38

Table 1 – Subclauses containing requirements for marking 21

Table 2 – Subclauses requiring statements in ACCOMPANYING DOCUMENTS 22

Table 3 – HALF-VALUE LAYERS in X-RAY EQUIPMENT 29

iTeh Standards
(<https://standards.itih.ai>)
Document Preview

[IEC 60601-1-3:2008](https://standards.itih.ai/catalog/standards/iec/8c5a3794-20ef-4880-8c75-c7fc8391f5b4/iec-60601-1-3-2008)

<https://standards.itih.ai/catalog/standards/iec/8c5a3794-20ef-4880-8c75-c7fc8391f5b4/iec-60601-1-3-2008>

INTERNATIONAL ELECTROTECHNICAL COMMISSION

MEDICAL ELECTRICAL EQUIPMENT –**Part 1-3: General requirements for basic safety
and essential performance –
Collateral Standard:
Radiation protection in diagnostic X-ray equipment**

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as “IEC Publication(s)”). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with an IEC Publication.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

This consolidated version of IEC 60601-1-3 consists of the second edition (2008) [documents 62B/673/FDIS and 62B/683/RVD] and its amendment 1 (2013) [documents 62B/895/CDV and 62B/907/RVC]. It bears the edition number 2.1.

The technical content is therefore identical to the base edition and its amendment and has been prepared for user convenience. A vertical line in the margin shows where the base publication has been modified by amendment 1. Additions and deletions are displayed in red, with deletions being struck through.

International standard IEC 60601-1-3 has been prepared by IEC subcommittee 62B: Diagnostic imaging equipment, of IEC technical committee 62: Electrical equipment in medical practice.

This edition constitutes a collateral standard to IEC 60601-1: *Medical electrical equipment – Part 1: General requirements for basic safety and essential performance* hereafter referred to as the general standard.

This edition has been restructured and aligned to IEC 60601-1(2005) and focussed on general requirements for RADIATION PROTECTION that apply to all diagnostic X-RAY EQUIPMENT. Requirements particular to specific equipment have been removed and will be covered in particular standards. For a description of the changes, see the mapping in Annex C.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

In the 60601 series of publications, collateral standards specify general requirements for safety applicable to:

- a subgroup of MEDICAL ELECTRICAL EQUIPMENT (e.g. RADIOLOGICAL equipment); or
- a specific characteristic of all MEDICAL ELECTRICAL EQUIPMENT, not fully addressed in the general standard (e.g. alarm systems).

In this collateral standard, the following print types are used:

- requirements and definitions: roman type.
- *test specifications: italic type.*
- informative material appearing outside of tables, such as notes, examples and references: in smaller type. Normative text of tables is also in a smaller type.
- TERMS DEFINED IN CLAUSE 3 OF THE GENERAL STANDARD, IN THIS COLLATERAL STANDARD OR AS NOTED: SMALL CAPITALS.

In referring to the structure of this standard, the term

- “clause” means one of the thirteen numbered divisions within the table of contents, inclusive of all subdivisions (e.g. Clause 7 includes subclauses 7.1, 7.2, etc.);
- “subclause” means a numbered subdivision of a clause (e.g. 7.1, 7.2 and 7.2.1 are all subclauses of Clause 7).

References to clauses within this standard are preceded by the term “Clause” followed by the clause number. References to subclauses within this collateral standard are by number only.

In this standard, the conjunctive “or” is used as an “inclusive or” so a statement is true if any combination of the conditions is true.

The verbal forms used in this standard conform to usage described in Annex H of the ISO/IEC Directives, Part 2. For the purposes of this standard, the auxiliary verb:

- “shall” means that compliance with a requirement or a test is mandatory for compliance with this standard;
- “should” means that compliance with a requirement or a test is recommended but is not mandatory for compliance with this standard;
- “may” is used to describe a permissible way to achieve compliance with a requirement or test.

Clauses, subclauses and definitions for which a rationale is provided in informative Annex A are marked with an asterisk (*).

A list of all parts of the IEC 60601 series, published under the general title *Medical electrical equipment*, can be found on the IEC website.

The committee has decided that the contents of the base publication and its amendment will remain unchanged until the maintenance result date indicated on the IEC website under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

- reconfirmed;
- withdrawn;
- replaced by a revised edition, or
- amended

IMPORTANT – The “colour inside” logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this publication using a colour printer.

iTeh Standards
(<https://standards.iteh.ai>)
Document Preview

[IEC 60601-1-3:2008](https://standards.iteh.ai/catalog/standards/iec/8c5a3794-20ef-4880-8c75-c7fc8391f5b4/iec-60601-1-3-2008)

<https://standards.iteh.ai/catalog/standards/iec/8c5a3794-20ef-4880-8c75-c7fc8391f5b4/iec-60601-1-3-2008>

INTRODUCTION

The requirements in this collateral Standard concern protective measures to be taken by the MANUFACTURER in the design and construction of medical diagnostic X-RAY EQUIPMENT and its subassemblies. They relate to the application of the X-RADIATION generated, both deliberately and incidentally, in fulfilling the medical purpose of the EQUIPMENT. Additional measures are necessary to regulate the generation processes themselves. These are described in the general requirements for safety, IEC 60601-1, and, where appropriate, in particular requirements for the EQUIPMENT concerned. The second edition of this collateral standard is focused on general requirements for RADIATION PROTECTION. The aim of the revision was to restrict to those requirements that apply to all diagnostic X-RAY EQUIPMENT. In consequence, most of the clauses have been reduced compared with the first edition of this standard, owing to the exclusion of content specific to projection RADIOGRAPHY and RADIOSCOPY. Implementation shall be considered in the RISK MANAGEMENT process or by using particular standards.

The recommended principles governing the use of RADIATION for medical purposes, as stated in Publication 60 of the International Commission on Radiological Protection (ICRP)[17]¹⁾, Chapter 4, have been taken into account. The implementation of these principles is essentially determined in the prevailing circumstances at the point of use. It requires judgements to be made by the user and the establishment of measures and working practices part of which are connected with the construction of EQUIPMENT. The requirements in this collateral Standard are intended to be consistent with generally accepted good practice in the administration of X-RADIATION in medicine.

In some cases, the formulation of the requirements is deliberately designed to provide scope for accommodating local laws and regulations at the time of installation and commissioning. Several of the requirements include provisions for relevant technical information to be included in ACCOMPANYING DOCUMENTS.

RESPONSIBLE ORGANIZATIONS for medical diagnostic X-RAY EQUIPMENT should be aware that effective protection against IONIZING RADIATION requires the consideration of many aspects additional to the construction of the EQUIPMENT. Among these are the following:

- compatibility of components and correct installation of EQUIPMENT;
- the protective properties of rooms where X-RAY EQUIPMENT is installed;
- measures for monitoring and maintaining the safety and effectiveness of EQUIPMENT throughout its life, with particular attention to components that can deteriorate progressively with time and use;
- the need in appropriate circumstances for PROTECTIVE CLOTHING to be worn by staff and for suitable devices to be used to protect PATIENTS;
- the keeping of appropriate records concerning the usage of the EQUIPMENT and the results of tests, with systematic review and the application of corrective action when necessary;
- the training of staff in the principles of RADIATION PROTECTION and in the correct use of EQUIPMENT, including any PROTECTIVE DEVICES provided.

Further advice on these aspects can be found in ICRP Publications 33[15], 34[16], 60[17], 73[18], 85[21], 87[22] and 93[23].

Readers of this collateral standard are reminded that, in accordance with IEC 60601-1, Clause 5, all the test procedures described are TYPE TESTS, intended to be carried out in a dedicated testing environment in order to determine compliance. Tests to be carried out by MANUFACTURERS to ensure compliance during production or installation and tests for detecting non-compliance subsequently to delivery, are not included.

1) Figures in square brackets refer to the Bibliography.

INTRODUCTION TO AMENDMENT 1

The purpose of the first amendment to IEC 60601-1-3:2008 is to introduce changes to reference the first amendment (2012) to IEC 60601-1:2005.

iTeh Standards
(<https://standards.iteh.ai>)
Document Preview

[IEC 60601-1-3:2008](https://standards.iteh.ai/catalog/standards/iec/8c5a3794-20ef-4880-8c75-c7fc8391f5b4/iec-60601-1-3-2008)

<https://standards.iteh.ai/catalog/standards/iec/8c5a3794-20ef-4880-8c75-c7fc8391f5b4/iec-60601-1-3-2008>

MEDICAL ELECTRICAL EQUIPMENT –
Part 1-3: General requirements for basic safety
and essential performance –
Collateral Standard:
Radiation protection in diagnostic X-ray equipment

1 Scope, object and related standards

1.1 Scope

This International Standard applies to the BASIC SAFETY and ESSENTIAL PERFORMANCE of MEDICAL ELECTRICAL EQUIPMENT and MEDICAL ELECTRICAL SYSTEMS, hereafter referred to as ME EQUIPMENT and ME SYSTEMS.

This collateral standard applies to X-RAY EQUIPMENT and to subassemblies of such equipment, where RADIOLOGICAL IMAGES of a human PATIENT are used for diagnosis, planning or guidance of medical procedures.

1.2 Object

The object of this collateral standard is to specify general requirements that are in addition to those of the general standard and to serve as the basis for particular standards.

The object of this collateral standard is to establish general requirements for protection against X-RADIATION in X-RAY EQUIPMENT, in order that the IRRADIATION of the human PATIENT, the OPERATOR, staff and members of the public can be kept as low as reasonably achievable, without jeopardizing the benefit of the RADIOLOGICAL procedure. Particular standards may specify their appropriate values and/or measures for general requirements specified in this collateral standard. The implementation of the general requirements or the reference to the particular standard instead, shall be justified in the RISK MANAGEMENT process.

This collateral standard considers RADIATION PROTECTION aspects related to X-RADIATION only.

Requirements for the control of the electrical energy used to generate X-RADIATION, which is also an important aspect of RADIATION PROTECTION, are included in IEC 60601-1 and in particular standards for the safety and ESSENTIAL PERFORMANCE of the EQUIPMENT concerned.

1.3 Related standards

1.3.1 IEC 60601-1

For ME EQUIPMENT and ME SYSTEMS, this collateral standard complements IEC 60601-1.

When referring to IEC 60601-1 or to this collateral standard, either individually or in combination, the following conventions are used:

- "the general standard" designates IEC 60601-1:~~2005+A1:2012-alone~~;
- "this collateral standard" designates IEC 60601-1-3:~~2008+A1:2013-alone~~;
- "this standard" designates the combination of the general standard and this collateral standard.

1.3.2 Particular standards

A requirement in a particular standard takes priority over the corresponding requirement in this collateral standard.

2 Normative references

The following ~~referenced~~ documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60336, *Medical electrical equipment – X-ray tube assemblies for medical diagnosis- Characteristics of focal spots*

IEC 60522:1999, *Determination of the permanent filtration of X-ray tube assemblies*

IEC 60601-1:2005, *Medical electrical equipment – Part 1: General requirements for basic safety and essential performance*
Amendment 1:2012

IEC 60788:2004, *Medical electrical equipment – Glossary of defined terms*

ISO 497, *Guide to the choice of series of preferred numbers and of series containing more rounded values of preferred numbers*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60601-1:2005+A1:2012, IEC 60788:2004 and the following apply.

NOTE An index of defined terms is found beginning on page 46.

3.1

ACCESSIBLE SURFACE

surface of EQUIPMENT or of an EQUIPMENT part that can be easily or accidentally touched by persons without the use of a TOOL

3.2

ADDED FILTER

removable or irremovable FILTER positioned in the RADIATION BEAM to provide part or all of the ADDITIONAL FILTRATION

3.3

ADDITIONAL FILTRATION

QUALITY EQUIVALENT FILTRATION due to ADDED FILTERS and other removable materials in the RADIATION BEAM which are between the RADIATION SOURCE and the PATIENT or a specified plane

3.4

AIR KERMA

K

quotient of dE_{tr} by dm , where dE_{tr} is the sum of the initial kinetic energies of all the charged particles liberated by uncharged particles in a mass dm of air, thus

$$K = \frac{dE_{tr}}{dm}$$

Unit: J kg⁻¹

The special name for the unit of AIR KERMA is gray (Gy) (ICRU 60) [20]

[IEC 60580:2000, definition 3.2, modified] [8]

3.5**AIR KERMA RATE** \dot{K}

quotient of dK by dt , where dK is the increment of AIR KERMA in the time interval dt , thus

$$\dot{K} = \frac{dK}{dt}$$

Unit: $\text{J kg}^{-1} \text{s}^{-1}$

If the special name gray is used, the unit of AIR KERMA RATE is gray per second (Gy s^{-1}) (ICRU 60) [20]

[IEC 60580:2000, definition 3.3] [8]

3.6**AMBIENT DOSE EQUIVALENT** $H^*(d)$

at a point in a RADIATION FIELD, the DOSE EQUIVALENT that would be produced by corresponding expanded and aligned field, in the ICRU sphere at a depth, d , on the radius opposing the direction of the aligned field

Unit: J kg^{-1}

The special name for the unit of AMBIENT DOSE EQUIVALENT is sievert (Sv) (ICRU 51)[19]

3.7**ATTENUATION**

reduction of a RADIATION QUANTITY upon passage of the RADIATION through matter resulting from all types of interaction with this matter

NOTE The RADIATION QUANTITY may be, for example, the particle flux density or the energy density. ATTENUATION does not include the geometric reduction of the RADIATION QUANTITY with distance from the RADIATION SOURCE.

3.8**ATTENUATION EQUIVALENT** δ

thickness of a layer of reference material which, if substituted for the material under consideration in a beam of specified RADIATION QUALITY and under specified geometrical conditions, gives the same degree of ATTENUATION. ATTENUATION EQUIVALENT is expressed in suitable submultiples of the metre together with the reference

3.9**AUTOMATIC CONTROL SYSTEM**

in an X-RAY EQUIPMENT, system in which the control or limitation of the electric energy delivered to an X-RAY TUBE ASSEMBLY depends upon the measurement of one or more RADIATION QUANTITIES or corresponding physical quantities

3.10**AUTOMATIC EXPOSURE CONTROL**

in an X-RAY EQUIPMENT, MODE OF OPERATION in which one or more LOADING FACTORS are controlled automatically in order to obtain at a pre-selected location a desired quantity of RADIATION

3.11**BEAM LIMITING DEVICE**

device to limit the RADIATION FIELD