

Glossary of Medical radiology terms —

(Implementation of
CENELEC HD 501 S1)

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Committees responsible for this British Standard

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- Association of X-Ray Equipment Manufacturers (BEAMA Ltd.)
- British Institute of Radiology
- College of Radiographers
- Hospital Physicists Association
- Medical Sterile Products Association
- Ministry of Defence
- National Radiological Protection Board

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National foreword

This British Standard has been prepared under the direction of the Health Care Standards Committee. It is identical with IEC 788:1984 *“Medical radiology — Terminology”* published by the International Electrotechnical Commission (IEC).

It also implements Harmonization Document HD 501 S1 which was published by the European Committee for Electrotechnical Standardization (CENELEC) and approved by the CENELEC Technical Board on 22 September 1987. There are no CENELEC modifications in HD 501 S1.

Its principal purpose is to provide definitions of radiological terms which are used in Sections of BS 5724 *“Medical electrical equipment”*.

Some of the terms in this British Standard are defined also in BS 4727-5:Group 01 *“Glossary of electrotechnical, power, telecommunication, electronics, lighting and colour terms. Part 5: Terms particular to electromedical equipment. Group 01. Radiology and radiological physics terminology”* which is technically identical to IEC 50(881) *“Advance edition of the International Electrotechnical Vocabulary. Chapter 881: Radiology and radiological physics”*. Differences between definitions in the two British Standards are mainly editorial but some are technical. In case of difference, the definition given in this British Standard is to be preferred for use in connection with BS 5724. It is hoped that the difference will be resolved in future editions of these British Standards.

Some terms are different from those in current use, as explained in the Introduction; attention is especially drawn to the following:

32-02 Radiogram (also 32-03 and 32-04).

41-01 Radioscopy (also 41-02, 41-03 and 41-04)

Fluoroscopy is still shown as a special type of radioscopy but radiograph is now replaced by radiogram.

A full list of terms not to be used, with preferred replacements, is given after the alphabetical index.

For the purposes of this British Standard, only the English text of IEC 788 has been reproduced. References to the French text which appear in the Introduction do not therefore apply. It was not considered necessary to this British Standard to give the corresponding French terms.

The “rm-” prefix used in the terms numbering system employed by IEC has been omitted in this British Standard except where it appears in running text in which case it should be ignored.

Terminology and conventions. The text of the International Standard has been approved 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 drawn to the following.

Cross-references

International Standard	Corresponding British Standard
ISO 921:1972	BS 3455:1973 <i>Glossary of terms used in nuclear science and technology</i> (Identical)

The Technical Committee has reviewed the provisions of IEC 50(391) and ICRU Report 33¹⁾, to which reference is made in the Introduction, and has decided that they are acceptable for use in conjunction with this standard.

¹⁾ Published by the International Commission on Radiological Units.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 48, 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.

0 Introduction

This Terminology Standard contains a compilation of terms and definitions as used or to be used in safety and performance standards dealing with electrical equipment in medical practice.

All concepts are concerned with medical radiology, most of them restricted to physical and technical subjects of a nature specific to medical radiology.

Some concepts of a more general nature have been assembled in Sections 7 and 8 and might disappear from a future revised edition of this Terminology Standard on medical radiology when a more comprehensive Terminology Standard for medical electrical equipment containing these concepts becomes available.

Where in this Terminology Standard a definition starts by words such as: "In RADIOTHERAPY, ..." (rm-37-20) or "For a LINEAR GRID, ..." (rm-32-17) it is recognized that the same term might be applied in another context to a different concept. That means, in some cases it may be necessary to include an appropriate qualifier into the term or to use it with another identification.

Purely medical terms and physical or technical concepts with a more general application have been excluded, as for such concepts reference to medical, physical and technical handbooks or vocabularies should be made. However, for some of such physical and technical concepts the terms are given to ensure the consistent use of the corresponding terms in the French and English languages. Such terms (without definition) are identified by a minus sign after their number.

Likewise only the terms in the two languages are given, where the terms are derived from a defined basic term by addition of an unambiguous qualification.

As far as possible for the purpose of this Terminology Standard, terms and definitions contained in existing publications of ICRU, ICRP, ISO and IEC have been adopted. In particular, the following publications have been used:

- ICRU Report 33,
- ISO Standard 921: Nuclear Energy Glossary,
- IEC Publication 50(391): International Electrotechnical Vocabulary (IEV), Chapter 391: Detection and Measurement of Ionizing Radiation by Electric Means.

In a restricted number of cases new terms have been adopted which may express the intended concept more clearly and which may, by deprecation of some existing terms and by new structures of interdependent concepts, avoid serious misinterpretation of the requirements and other misunderstandings.

Some terms which have been commonly used in the past and which are deprecated for the said reasons are listed at the end of the French alphabetical index, page 92 and at the end of the English alphabetical index, page 37, giving reference to the terms and concepts to be used instead.

Throughout this Terminology Standard synonyms have been avoided as they may constitute possible sources of confusion.

Only in a few rare cases, where the full term would impede the flow of the language out of proportion and where no misinterpretation is possible, shortened terms are recognized and contained in the alphabetical indices.

Generally, the relation between terms of interdependent concepts follows a number of logical schemes. However, in some cases, compromises had to be found where the use of certain terms appeared obligatory because of tradition.

In some sections, a sub-section headed "General" combines the concepts commonly applying to more than one of its sub-sections.

Wherever applicable for quantities and related quantitative concepts, the strict use of SI units is presumed when referring to this Terminology Standard.

This Terminology Standard does not claim to be exhaustive with respect to the concepts needed for the various aspects of standardization of radiological equipment and related aspects. Supplements will be published in due time.

Section 1. Radiological physics

11 Ionizing radiations

11-01 Radiation

Propagation of emitted energy through space or through a material medium in the form of waves or in the form of kinetic energy of particles.

NOTE When unqualified, the term RADIATION usually refers

— to ELECTROMAGNETIC RADIATIONS according to frequency or origin such as:
RADIOFREQUENCY RADIATION
INFRA-RED RADIATION

VISIBLE RADIATION (light) ULTRAVIOLET RADIATION
X-RADIATION
GAMMA RADIATION

— to CORPUSCULAR RADIATIONS according to particles or origin such as:

ALPHA RADIATION BETA RADIATION
ELECTRON RADIATION
NEUTRON RADIATION.

11-02 Ionizing radiation

391-02-01 RADIATION consisting of DIRECTLY or INDIRECTLY IONIZING PARTICLES or a mixture of both.

By convention ultraviolet radiation is excluded.

11-03 Natural ionizing radiation

IONIZING RADIATION attributable to natural sources in the terrestrial environment including those in living organisms, and to extraterrestrial sources.

11-04 Background radiation

IONIZING RADIATION at a point, consisting of NATURAL IONIZING RADIATION and RADIATION from man-made sources other than the RADIATION from the source under consideration.

11-05 Bremsstrahlung

391-02-06 X-RADIATION produced by the deceleration or the acceleration of charged particles, upon passage through the electric field of nuclei or of other charged particles.

11-06 Primary radiation

IONIZING RADIATION emitted directly by the TARGET or by a RADIOACTIVE SOURCE.

11-07 Secondary radiation

IONIZING RADIATION emitted by matter as a result of INTERACTION of PRIMARY RADIATION with that matter.

11-08 Polyenergetic radiation

IONIZING RADIATION consisting of PHOTONS of various RADIATION ENERGIES, or particles of one type having different kinetic energies.

Thus:

POLYENERGETIC X-RADIATION

POLYENERGETIC GAMMA RADIATION

11-09 Monoenergetic radiation

IONIZING RADIATION consisting of PHOTONS of nearly the same RADIATION ENERGY, or of particles of one type having nearly the same kinetic energy.

11-10 Focal radiation

In an X-RAY SOURCE ASSEMBLY, X-RADIATION emitted from the ACTUAL FOCAL SPOT.

11-11 Extra-focal radiation

In an X-RAY SOURCE ASSEMBLY, X-RADIATION emitted from the RADIATION SOURCE other than that emitted from the ACTUAL FOCAL SPOT.

11-12 Stray radiation

For IONIZING RADIATION, all RADIATION except that of the specified RADIATION BEAM under consideration, but including its RESIDUAL RADIATION.

11-13 Scattered radiation

IONIZING RADIATION emitted by INTERACTION of IONIZING RADIATION with matter, the INTERACTION being accompanied by a reduction in RADIATION ENERGY and/or by a change in direction of the RADIATION.

11-14 Residual radiation

In MEDICAL RADIOLOGY, that part of the RADIATION BEAM which remains after having passed the plane of the IMAGE RECEPTION AREA and any relevant radiation measuring device, or, in RADIOTHERAPY, which emerges from the part of the body being intentionally irradiated.

11-15	<i>Leakage radiation</i>	12-03	<i>Scattering</i>
	IONIZING RADIATION which has passed through the PROTECTIVE SHIELDING of a RADIATION SOURCE as well as that which, for some types of X-RAY GENERATORS, has passed through the RADIATION APERTURE before and after LOADING (for example one containing a grid controlled X-RAY TUBE).	391-04-05	Process in which a change in direction or energy of an incident particle or incident RADIATION is caused by a collision with a particle or a system of particles.
11-16	<i>Proton</i>	12-04	<i>Back-scattering</i>
391-01-01	Stable elementary particle having a positive charge of $1.602\ 19 \times 10^{-19}$ C and a REST MASS of $1.672\ 61 \times 10^{-27}$ kg.	391-04-10	SCATTERING of particles or RADIATION by material through angles greater than 90° with respect to their initial direction.
11-17	<i>Neutron</i>	12-05 –	<i>Absorption</i>
391-01-02	Elementary particle having no electric charge, a REST MASS of $1.674\ 92 \times 10^{-27}$ kg, and a MEAN LIFE of about 1 000 s.	12-06	<i>Energy absorption</i>
11-18	<i>Electron</i>	391-04-13	Phenomenon in which incident RADIATION transfers to the matter which it traverses some or all of its energy.
391-01-04	Stable elementary particle having an electric charge of $\pm 1.602\ 19 \times 10^{-19}$ C and a REST MASS of $9.109\ 56 \times 10^{-31}$ kg.		NOTE SCATTERING accompanied by energy loss, for example the Compton effect and neutron slowing down, is considered to be ENERGY ABSORPTION.
11-19	<i>Photon</i>		<i>Particle absorption</i>
391-01-05	Stable elementary particle, quantum of ELECTROMAGNETIC RADIATION.	391-04-14	Atomic or nuclear interaction in which an incident particle disappears as a free particle even when one or more of the same or different particles are subsequently emitted.
11-20	<i>Directly ionizing particle</i>		NOTE SCATTERING is not considered to be PARTICLE ABSORPTION.
391-01-12	Charged particle (ELECTRON, PROTON, alpha particle, etc.), having sufficient kinetic energy to produce IONIZATION by collision.	12-08	<i>Attenuation</i>
11-21	<i>Indirectly ionizing particle</i>		Reduction of a radiation quantity upon passage of the RADIATION through matter resulting from all types of INTERACTION with this matter. The radiation quantity may be, for example, the PARTICLE FLUX DENSITY or the ENERGY FLUX DENSITY.
391-01-13	Uncharged particle (NEUTRON, PHOTON, etc.), which can liberate DIRECTLY IONIZING PARTICLES or can initiate a nuclear transformation.		NOTE ATTENUATION does not include the geometric reduction of the radiation quantity with distance from the RADIATION SOURCE.
11-22	<i>Radionuclide</i>		
391-02-09	Radioactive nuclide.		
12	Interactions		
12-01 –	<i>Interaction</i>		
12-02	<i>Ionization</i>		
391-04-01	Formation of ions by the division of molecules or by the addition or removal of ELECTRONS from atoms or molecules.		

12-09	<i>Irradiation</i>	12-16	<i>SECULAR EQUILIBRIUM</i>
	Exposing of a living being or matter to RADIATION.		State when the ACTIVITY of a radioactive daughter is the same as the ACTIVITY of its parent and the RADIOACTIVE HALF LIFE of the parent is long, compared to the period of interest of the observer.
	In RADIOLOGY, exposing of a living being or matter to IONIZING RADIATION.		
	<i>Thus:</i>		
	X-IRRADIATION	12-17	<i>Luminescence</i>
	GAMMA IRRADIATION		Phenomenon in which certain substances, when excited, emit light of wavelength characteristic of the substance.
	ELECTRON IRRADIATION		
	NEUTRON IRRADIATION		
12-10	<i>Transmission</i>	12-18	<i>Fluorescence</i>
	In RADIOLOGY, passage of IONIZING RADIATION through, and emergence from, matter essentially in the direction of its incidence without or after INTERACTION with that matter.		LUMINESCENCE that occurs essentially only during excitation.
12-11	<i>Filtration</i>	12-19	<i>Thermoluminescence</i>
	Modification of characteristics of IONIZING RADIATION on passing through matter.		LUMINESCENCE released by heating a substance previously irradiated.
	NOTE FILTRATION may be:	12-20	<i>Scintillation</i>
	— preferential ABSORPTION of certain components of POLYENERGETIC X or GAMMA RADIATION accompanying its ATTENUATION		In RADIOLOGY, LUMINESCENCE of short duration (of the order of a few micro-seconds or less) caused by a DIRECTLY or INDIRECTLY IONIZING PARTICLE.
	— a modification of the distribution of radiation intensity over the cross-section of a RADIATION BEAM.	12-21	<i>Thermionic emission</i>
12-12	<i>Build up</i>		Emission of ELECTRONS from a substance resulting from its elevated temperature.
	Phenomenon of the increase with depth of the ABSORBED DOSE RATE due to the release of secondary charged particles and to SCATTERED RADIATION in matter beyond the ENTRANCE SURFACE.	12-22	<i>Cold emission</i>
12-13	<i>Radioactivity</i>	13	Quantities, units and related concepts
921-451	Property of certain nuclides of spontaneously emitting particles or GAMMA RADIATION or of emitting X-RADIATION following orbital electron capture or of undergoing spontaneous fission.	13-01 –	<i>Radiation quantity</i>
		13-02	<i>Particle fluence</i>
12-14	<i>Induced radioactivity</i>		Letter symbol: Φ
	RADIOACTIVITY of material caused by IRRADIATION.	391-03-20	At a given point of space, the number dN of particles incident during a given time interval on a suitably small sphere centred at that point divided by the cross-sectional area da of the sphere.
12-15	<i>Radioactive equilibrium</i>		$\Phi = \frac{dN}{da}$
	Among the members of a radioactive series, state which prevails when the ratios between the ACTIVITIES of successive members of the series remain constant.		

13-03	<i>Energy fluence</i>	13-08	<i>Absorbed dose</i>
391-03-23	Letter symbol: Ψ At a given point of space, the sum of energies dE_f exclusive of REST ENERGY, of all the particles incident during a given time interval on a suitably small sphere centred at that point, divided by the cross-sectional area da of that sphere. $\psi = \frac{dE_f}{da}$	Letter symbol: D MEAN ENERGY IMPARTED by IONIZING RADIATION to matter. ABSORBED DOSE is determined as the quotient of $d\bar{\epsilon}$ by dm , where $d\bar{\epsilon}$ is the MEAN ENERGY IMPARTED by IONIZING RADIATION to matter of mass dm : $D = \frac{d\bar{\epsilon}}{dm}$	
13-04	<i>Particle fluence rate</i>	The unit of ABSORBED DOSE is the joule per kilogram ($J.kg^{-1}$). The special name of the unit of ABSORBED DOSE is the gray (Gy). The earlier unit of ABSORBED DOSE was the rad, 1 rad being equal to $10^{-2} J.kg^{-1}$.	
391-03-21	Letter symbol: φ Increment of PARTICLE FLUENCE during a suitably small interval of time dt divided by that interval of time. $\varphi = \frac{d\Phi}{dt}$	13-09	<i>Absorbed dose rate</i>
13-05	<i>Energy fluence rate</i>	Letter symbol: $\dot{D}$ ABSORBED DOSE per unit time. ABSORBED DOSE RATE is determined as the quotient of dD by dt , where dD is the increment of ABSORBED DOSE in the time interval dt : $\dot{D} = \frac{dD}{dt}$	
391-03-24	Letter symbol: Ψ Increment of ENERGY FLUENCE during a suitably small interval of time dt divided by that interval of time. $\psi = \frac{d\Psi}{dt}$		
13-06	<i>Energy imparted</i> Letter symbol: ϵ Stochastic quantity of the energy imparted by IONIZING RADIATION to the matter in a volume: $\epsilon = R_{in} - R_{out} + \Sigma Q$ where: R_{in} is the quantity of radiant energy incident on the volume R_{out} is the quantity of radiant energy emerging from the volume ΣQ is the sum of all changes of the REST ENERGY of nuclei and elementary particles in any nuclear transformations which occur in the volume The unit of ENERGY IMPARTED is the joule (J).	13-10	<i>Kerma</i> Letter symbol: K Kinetic energy released in material by IONIZING RADIATION. KERMA is determined as the quotient of dE_{tr} by dm , where dE_{tr} is the sum of the initial kinetic energies of all the charged ionizing particles liberated by uncharged ionizing particles in a material of mass dm : $K = \frac{dE_{tr}}{dm}$
13-07	<i>Mean energy imparted</i> Letter symbol: $\bar{\epsilon}$ Non-stochastic quantity of the expectation value of the ENERGY IMPARTED.	The unit of KERMA is the joule per kilogram ($J.kg^{-1}$). The special name of the unit of KERMA is the gray (Gy). The earlier unit of KERMA was the rad, 1 rad being equal to $10^{-2} J.kg^{-1}$.	

13-11	<i>Air kerma</i>	13-16	<i>Area exposure product</i>
	KERMA measured in a mass of air.		Product of the area of a cross-section of a RADIATION BEAM and the averaged EXPOSURE over that cross-section.
13-12	<i>Water kerma</i>		
	KERMA measured in a mass of water.		
13-13	<i>Kerma rate</i>	13-17	<i>Decay constant</i>
	Letter symbol: $\dot{K}$	391-03-06	Letter symbol: λ
	KERMA per unit time. KERMA RATE is determined as the quotient of dK by dt , where dK is the increment of KERMA in the time interval dt :		For a RADIONUCLIDE, the probability for the spontaneous decay of one of its nuclei within a unit time. It is given by:
	$\dot{K} = \frac{dK}{dt}$		$\lambda = - \frac{1}{N} \frac{dN}{dt}$
	A unit of KERMA RATE is any quotient of the gray or its multiples or submultiples by a suitable unit of time (Gy.s^{-1} , mGy.h^{-1} , etc.).		in which N is the number of nuclei existing at time t .
13-14	<i>Exposure</i>	13-18	<i>Activity</i>
	Letter symbol: X		Letter symbol: A
	Electric charge produced by IONIZING RADIATION in air. EXPOSURE is determined as the quotient of dQ by dm , where the value of dQ is the absolute value of the total charge of the ions of one sign produced in air when all the ELECTRONS (negatrons and positrons) liberated by PHOTONS in air of mass dm are completely stopped in air:		Quantitative indication of the RADIOACTIVITY of an amount of RADIONUCLIDE in a particular energy state at a given time. ACTIVITY is determined as the quotient of dN by dt , where dN is the expectation value of the number of spontaneous nuclear transitions from that energy state in the time interval dt :
	$X = \frac{dQ}{dm}$		$A = \frac{dN}{dt}$
	The unit of EXPOSURE is the coulomb per kilogram (C.kg^{-1}).		The unit of ACTIVITY is the reciprocal second (s^{-1}). The special name of the unit of ACTIVITY is the becquerel (Bq), 1 Bq being equal to one transition per second.
	The earlier unit of EXPOSURE was the roentgen (R), 1 R being equal to $2.58 \times 10^{-4} \text{ C.kg}^{-1}$.		The earlier unit of ACTIVITY was the curie (Ci), 1 Ci being equal to 3.7×10^{10} transitions per second.
13-15	<i>Exposure rate</i>	13-19	<i>Specific activity</i>
	Letter symbol: $\dot{X}$		For a RADIONUCLIDE, ACTIVITY per unit mass of that RADIONUCLIDE.
	EXPOSURE per unit time. EXPOSURE RATE is determined as the quotient of dX by dt , where dX is the increment of EXPOSURE in the time interval dt :		For a chemical element containing a radioactive isotope, ACTIVITY of the isotope per unit mass of the element.
	$\dot{X} = \frac{dX}{dt}$		For a material containing a RADIONUCLIDE, ACTIVITY per unit mass of that material.
	A unit of EXPOSURE RATE is any quotient of the unit of EXPOSURE or its multiples or submultiples by a suitable unit of time ($\text{C.kg}^{-1}.\text{s}^{-1}$, $\text{mC.kg}^{-1}.\text{h}^{-1}$, etc.).	13-20	<i>Radioactive half-life</i>
		391-03-07	Letter symbol: T

	For a single radioactive decay process, the time required for the ACTIVITY to decrease to half its value.				where:
	NOTE For a RADIONUCLIDE, the RADIOACTIVE HALF-LIFE T is related to the DECAY CONSTANT λ by the expression:				D is the ABSORBED DOSE,
	$T = \frac{\ln 2}{\lambda} = \frac{0.693}{\lambda}$				Q is the QUALITY FACTOR and
					N is the product of any other modifying factors.
					The unit of DOSE EQUIVALENT is the joule per kilogram (J.kg^{-1}). The special name of the unit of DOSE EQUIVALENT is the sievert (Sv).
					The earlier unit of DOSE EQUIVALENT was the rem, 1 rem being equal to $10^{-2} \text{ J.kg}^{-1}$.
13-21	<i>Biological half-life</i>				
	Time required for the amount of a particular substance in a biological system to be reduced to one half of its value by biological processes when its removal follows an approximately exponential law.	13-25		<i>Effective dose equivalent</i>	
13-22	<i>Effective half-life</i>				Quantity used to express the weighted DOSE EQUIVALENT to the whole body when it is irradiated non-uniformly or partially.
	Time required for the amount of a particular RADIONUCLIDE in a system to be reduced to half of its value as a consequence of both radioactive decay and other processes, such as biological elimination, when its removal follows an approximately exponential law.	13-26		<i>Dose monitor unit</i>	
					In a DOSE MONITORING SYSTEM, arbitrary unit in which a quantity is displayed and from which ABSORBED DOSE can be calculated.
13-23	<i>Mean life</i>	13-27 –		<i>Dose rate monitor unit</i>	
391-03-08	Letter symbol: τ	13-28		<i>Radiation quality</i>	
	The average lifetime of an atomic or nuclear system in a specified state.				Characteristic of IONIZING RADIATION determined by the spectral distribution of a radiation quantity with respect to RADIATION ENERGY.
	For an exponentially decaying system, average time for the number of atoms or nuclei in a specified state to be divided by a factor e (2.718...).				NOTE For various purposes concerning X-RADIATION, practical approximations of RADIATION QUALITY are expressed in terms of variables such as:
	NOTE For a RADIONUCLIDE, the MEAN LIFE τ is the reciprocal of the DECAY CONSTANT λ :				a) high voltage with PERCENTAGE RIPPLE and TOTAL FILTRATION,
	$\tau = \frac{1}{\lambda}$				b) first HALF-VALUE LAYER for specified high voltage with its PERCENTAGE RIPPLE,
					c) first HALF-VALUE LAYER and TOTAL FILTRATION,
					d) the first HALF-VALUE LAYER and the quotient of the first HALF-VALUE LAYER by the second HALF-VALUE LAYER,
					e) EQUIVALENT ENERGY.
13-24	<i>Dose equivalent</i>	13-29		<i>Radiation energy</i>	
	Letter symbol: H				In RADIOLOGY, quantity indicating the energy that a PHOTON or other particle is carrying, except its REST ENERGY.
	Quantity used to express the risk of the deleterious effects of IONIZING RADIATION upon living organisms, given by the product of D , Q and N , at the point of interest in tissue:				The unit of RADIATION ENERGY is the electronvolt (eV), 1 eV being equal to $1.602 \ 19 \times 10^{-19} \text{ J}$.
	$H = Q N D$				

- Thus:*
X-RAY ENERGY
GAMMA RAY ENERGY
- 13-30 *Rest mass*
Letter symbol: m_0
Mass of a particle at zero or low velocity, not augmented by relativistic mass.
- 13-31 *Rest energy*
Letter symbol: E_0
Energy corresponding to the REST MASS of a particle given by the equation:
$$E_0 = m_0 c^2$$

where:
 m_0 is the REST MASS
 c is the velocity of light.
- 13-32 *Maximum energy*
Highest RADIATION ENERGY contained in a beam of POLYENERGETIC RADIATION.
- 13-33 *Equivalent energy*
RADIATION ENERGY of MONOENERGETIC RADIATION which would have the same specified effect as the POLYENERGETIC RADIATION under consideration.
- 13-34 *Radiation spectrum*
Distribution of a radiation quantity with respect to RADIATION ENERGY.
Thus:
X-RAY SPECTRUM
GAMMA-RAY SPECTRUM
- 13-35 *Continuous radiation spectrum*
RADIATION SPECTRUM without pronounced discontinuities in the distribution of the specified radiation quantity over the range of RADIATION ENERGIES.
Thus:
CONTINUOUS BETA SPECTRUM
- 13-36 *Continuous X-ray spectrum*
Continuous spectrum of X-RADIATION, excluding characteristic X-RADIATIONS, having a maximum RADIATION ENERGY that is equal to the product of the electron charge and the maximum accelerating high voltage.
- 13-37 *Attenuation equivalent*
Letter symbol: 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.
The ATTENUATION EQUIVALENT is expressed in suitable submultiples of the metre together with the reference material and the RADIATION QUALITY of the incident beam.
- 13-38 *Lead equivalent*
Letter symbol: δ_{pb}
ATTENUATION EQUIVALENT expressed in thickness of lead as reference material.
NOTE For protection against IONIZING RADIATION it is unnecessary for a material containing a significant amount of lead to specify the RADIATION QUALITY.
- 13-39 *Attenuation coefficient*
Letter symbol: μ
For a material in a beam of uncharged ionizing particles, quotient $\frac{dN}{N}$ by dl ,
where $\frac{dN}{N}$ is the fraction of particles that experience INTERACTIONS in traversing a distance dl in the material.
$$\mu = - \frac{1}{N} \frac{dN}{dl}$$
- 13-40 *Attenuation ratio*
Ratio of the value of a specified radiation quantity in the centre of a BROAD BEAM of specified RADIATION QUALITY with the attenuating material under consideration outside the beam, to the value at the same position and under the same conditions with this attenuating material placed in the beam.
- 13-41 *Transmission ratio*
Ratio of the value of a specified radiation quantity in the centre of a beam of specified RADIATION QUALITY and under specified geometrical conditions after passage through a material to the value which would be present at the same position without this material in the beam.

- 13-42 *Half-value layer*
Thickness of a specified material which attenuates under NARROW BEAM CONDITIONS X-RADIATION or GAMMA RADIATION with a particular RADIATION ENERGY or with a particular spectrum to an extent such that the KERMA RATE, EXPOSURE RATE or ABSORBED DOSE RATE is reduced to one half of the value that is measured without the material.
The HALF VALUE LAYER is expressed in suitable submultiples of the metre together with the material.
- 13-43 *Tenth-value layer*
Thickness of a specified material which attenuates under BROAD BEAM CONDITIONS X-RADIATION or GAMMA RADIATION with a particular RADIATION ENERGY or with a particular spectrum to an extent such that the KERMA RATE, EXPOSURE RATE or ABSORBED DOSE RATE is reduced to one-tenth of the value that is measured without the material.
The TENTH-VALUE LAYER is expressed in suitable submultiples of the metre together with the material.
- 13-44 *Half-value depth*
In RADIOTHERAPY, depth in tissue on the axis of a beam of specified RADIATION QUALITY and under specified geometrical conditions, at which the ABSORBED DOSE is one-half of that at a specified reference point.
- 13-45 *Quality equivalent filtration*
Quantitative indication of the FILTRATION effected by one or several layer(s) of reference material(s) which, if substituted in a beam of specified RADIATION QUALITY under NARROW BEAM CONDITION for the material under consideration, give(s) the same RADIATION QUALITY as gives the material under consideration.
The QUALITY EQUIVALENT FILTRATION is expressed in suitable submultiples of the metre together with the reference material(s) and the RADIATION QUALITY of the incident beam.
- 13-46 *Inherent filtration*
QUALITY EQUIVALENT FILTRATION due to the irremovable materials through which the RADIATION BEAM passes before emerging from a RADIATION SOURCE ASSEMBLY or from components thereof.
For an X-RAY TUBE ASSEMBLY, the INHERENT FILTRATION is expressed in thickness of a reference material which, at a specified voltage and waveform, gives the same RADIATION QUALITY in terms of first HALF-VALUE LAYER.
- 13-47 *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.
- 13-48 *Total filtration*
The total of INHERENT FILTRATION and ADDITIONAL FILTRATION.
- 13-49 *Build up factor*
Letter symbol: *B*
For a material irradiated, ratio of the value of a radiation quantity in the centre of a BROAD BEAM of specified RADIATION QUALITY and the corresponding value of the radiation quantity in the centre of a NARROW BEAM, both values measured in the material under consideration.
- 13-50 *Surface dose*
ABSORBED DOSE, including that caused by BACK-SCATTERING, at a point of the ENTRANCE SURFACE of the irradiated object, usually on the RADIATION BEAM AXIS.
- 13-51 *Depth dose*
ABSORBED DOSE at a specified depth beneath the ENTRANCE SURFACE of the irradiated object, usually on the RADIATION BEAM AXIS.

13-52 *Percentage depth dose*
Ratio, expressed as a percentage, of the ABSORBED DOSE at any depth to the ABSORBED DOSE at a specified point on the RADIATION BEAM AXIS.

13-53 *Exit dose*
ABSORBED DOSE at a point on the surface through which the beam emerges from the irradiated object, usually on the RADIATION BEAM AXIS.

Section 2. Generation and emission of ionizing radiation

20 General

20-01 *Radiation source*
RADIOACTIVE SOURCE or part of equipment capable of emitting IONIZING RADIATION.

20-02 *Radioactive source*
Quantity of radioactive material having both an ACTIVITY and a SPECIFIC ACTIVITY above specific levels.

20-03 *Sealed radioactive source*
RADIOACTIVE SOURCE sealed in a container or having a bonded cover, the container or cover being such as to prevent contact with, and dispersion of, the radioactive material under the conditions of use and wear for which it was designed.

20-04 *Unsealed radioactive source*
RADIOACTIVE SOURCE which is not a SEALED RADIOACTIVE SOURCE.

20-05 *Radiation source assembly*
Assembly of components comprising:
— the RADIATION SOURCE,
— the means providing protection against IONIZING RADIATION and, where applicable, against electric shock,
— the BEAM LIMITING SYSTEM.

Thus:

X-RAY SOURCE ASSEMBLY
GAMMA-RAY SOURCE ASSEMBLY
RADIONUCLIDE SOURCE ASSEMBLY

20-06 *Radiation head*
Structure from which the RADIATION BEAM emerges.

20-07 *X-ray tube head*
X-RAY SOURCE ASSEMBLY containing the HIGH-VOLTAGE TRANSFORMER ASSEMBLY.

20-08 *Target*
Part of an X-RAY TUBE or a PARTICLE ACCELERATOR onto which is directed a beam of accelerated particles to produce IONIZING RADIATION or other particles.

20-09 *Reflection target*
TARGET from which the beam of IONIZING RADIATION emerges through the surface struck by the beam of accelerated particles.

20-10 *Transmission target*
TARGET from which the beam of IONIZING RADIATION emerges through the surface opposite to that struck by the beam of accelerated particles.

20-11 *Target angle*
Acute angle between the plane of the ACTUAL FOCAL SPOT and the REFERENCE AXIS.

20-12 *Actual focal spot*
Area on the surface of the TARGET that intercepts the beam of accelerated particles.

20-13 *Effective focal spot*
Perpendicular projection of the ACTUAL FOCAL SPOT on the REFERENCE PLANE.
NOTE The shortened term FOCAL SPOT refers to the EFFECTIVE FOCAL SPOT.

20-14 *Nominal focal spot value*
Dimensionless numerical value having a specific relation to the dimensions of the EFFECTIVE FOCAL SPOT of an X-RAY TUBE, measured under specific conditions.

20-15	<i>Blooming value</i>	20-24	<i>Radiological installation</i>
	As a characteristic of the EFFECTIVE FOCAL SPOT of an X-RAY TUBE, ratio of two resolution limits obtained under specific loading conditions.		Installed RADIOLOGICAL EQUIPMENT including all means for its intended operation.
20-16	<i>Capsule</i>		<i>Thus:</i>
	Of a SEALED RADIOACTIVE SOURCE, container in which the radioactive material is hermetically sealed for its intended use.		GAMMA-RAY INSTALLATION
			X-RAY INSTALLATION
20-17	<i>X-ray generator</i>	21	High-voltage generators
	Combination of all components provided for the generation and control of X-RADIATION, comprising at least the HIGH-VOLTAGE GENERATOR interconnected with an X-RAY SOURCE ASSEMBLY.	21-01	<i>High-voltage generator</i>
	<i>Thus:</i>		In an X-RAY GENERATOR, combination of all components for control and production of the electrical energy to be supplied to an X-RAY TUBE, usually consisting of a HIGH-VOLTAGE TRANSFORMER ASSEMBLY and a CONTROL ASSEMBLY.
	CAPACITOR DISCHARGE X-RAY GENERATOR	21-02	<i>One-peak high-voltage generator</i>
20-18 –	<i>High-voltage cable connection</i>		HIGH-VOLTAGE GENERATOR for operation on a single-phase supply that delivers an unrectified output voltage, or a rectified output voltage with one peak during each cycle of the supply.
20-19	<i>Radiological equipment</i>	21-03	<i>Two-peak high-voltage generator</i>
	Equipment designed for use in RADIOLOGY.		HIGH-VOLTAGE GENERATOR for operation on a single-phase supply that delivers a rectified output voltage with two peaks during each cycle of the supply.
20-20	<i>X-ray equipment</i>	21-04	<i>Six-peak high-voltage generator</i>
	Equipment consisting of a combination of an X-RAY GENERATOR, ASSOCIATED EQUIPMENT and ACCESSORIES.		HIGH-VOLTAGE GENERATOR for operation on a three-phase supply that delivers a rectified output voltage with six peaks during each cycle of the supply.
20-21	<i>X-ray imaging arrangement</i>	21-05	<i>Twelve-peak high-voltage generator</i>
	In X-RAY EQUIPMENT, arrangement of RADIATION SOURCE and X-RAY IMAGE RECEPTOR for a specified radiological technique.		HIGH-VOLTAGE GENERATOR for operation on a three-phase supply that delivers a rectified output voltage with twelve peaks during each cycle of the supply.
20-22	<i>Examination room</i>	21-06	<i>Constant potential high-voltage generator</i>
	In MEDICAL DIAGNOSTIC RADIOLOGY, room in which IONIZING RADIATION is applied to the PATIENT or measured on the PATIENT, and which has the required structural means for RADIATION PROTECTION and for mechanical support.		HIGH-VOLTAGE GENERATOR with a PERCENTAGE RIPPLE of the output voltage not exceeding a specific value.
20-23	<i>Treatment room</i>		
	In RADIOTHERAPY, room in which IONIZING RADIATION is administered to the PATIENT, and which has the required structural means for RADIATION PROTECTION and for mechanical support.		