

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE



**Medical electrical equipment –  
Part 2-8: Particular requirements for the basic safety and essential performance  
of therapeutic X-ray equipment operating in the range 10 kV to 1 MV**

**Appareils électromédicaux –  
Partie 2-8: Exigences particulières pour la sécurité de base et les performances  
essentielle des équipements à rayonnement X de thérapie fonctionnant dans la  
gamme de 10 kV à 1 MV**





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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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**MEDICAL ELECTRICAL EQUIPMENT –**

**Part 2-8: Particular requirements for the basic safety and essential performance of therapeutic X-ray equipment operating in the range 10 kV to 1 MV**

FOREWORD

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**This consolidated version of the official IEC Standard and its amendment has been prepared for user convenience.**

**IEC 60601-2-8 edition 2.1 contains the second edition (2010-11) [documents 62C/499/FDIS and 62C/505/RVD] and its amendment 1 (2015-09) [documents 62C/593/CDV and 62C/619/RVC].**

**In this Redline version, a vertical line in the margin shows where the technical content is modified by amendment 1. Additions are in green text, deletions are in strikethrough red text. A separate Final version with all changes accepted is available in this publication.**

International Standard IEC 60601-2-8 has been prepared by IEC subcommittee 62C: Equipment for radiotherapy, nuclear medicine and radiation dosimetry, of IEC technical committee 62: Electrical equipment in medical practice.

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

In this 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 PARTICULAR STANDARD OR AS NOTED: SMALL CAPITALS.

In referring to the structure of this standard, the term

- “clause” means one of the seventeen 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 particular 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.

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 stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
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- amended.

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## INTRODUCTION

X-RAY EQUIPMENT for RADIOTHERAPY purposes is used for TELETHERAPY, where the RADIATION SOURCE is far from the tissues to be treated (usually more than 50 cm), and also for BRACHYTHERAPY, where the RADIATION SOURCE is positioned within or adjacent to the tissue to be treated. This particular standard covers X-RAY EQUIPMENT for both TELETHERAPY and BRACHYTHERAPY.

The use of X-RAY EQUIPMENT for RADIOTHERAPY purposes may expose the PATIENT to danger if the equipment fails to deliver the required dose to the PATIENT, or if the equipment design does not satisfy standards of electrical and mechanical safety. The equipment may also cause danger to persons in the vicinity if the equipment itself fails to contain the radiation adequately and/or if there are inadequacies in the design of the TREATMENT ROOM.

This particular standard establishes requirements to be complied with by the MANUFACTURERS in the design and construction of therapeutic X-RAY EQUIPMENT. Subclause 201.10.1 contains limits beyond which INTERLOCKS prevent, INTERRUPT or TERMINATE IRRADIATION in order to avoid an unsafe condition.

Subclause 201.10.1 does not attempt to define optimum performance requirements. Its purpose is to identify those features of design that are regarded, at the present time, as essential for the safe operation of such equipment. It places limits on the degradation of equipment performance beyond which it can be presumed that a fault condition exists, e.g. a component failure, and where an INTERLOCK then operates to prevent continued operation of the equipment.

It should be understood that, before installation, a MANUFACTURER can provide a compliance certificate relating only to TYPE TESTS: data available from SITE TESTS should be incorporated in the ACCOMPANYING DOCUMENTS, in the form of a SITE TEST report, by those who test the equipment at installation.

## INTRODUCTION TO THE AMENDMENT

The second edition of IEC 60601-2-8 was published in 2010. Since that publication, an amendment to the parent standard, IEC 60601-1:2005, has been published (IEC 60601-1:2005/AMD1:2012). This Amendment 1 to IEC 60601-2-8:2010 addresses technical and editorial changes resulting from the amended general standard IEC 60601-1:2005 and IEC 60601-1:2005/AMD1:2012 and its collateral standards.

In addition, requirements regarding the original language of the ACCOMPANYING DOCUMENTS have been deleted.

## MEDICAL ELECTRICAL EQUIPMENT –

### Part 2-8: Particular requirements for the basic safety and essential performance of therapeutic X-ray equipment operating in the range 10 kV to 1 MV

#### 201.1 Scope, object and related standards

Clause 1 of the general standard<sup>1)</sup> applies, except as follows:

##### 201.1.1 Scope

*Replacement:*

This international standard applies to the basic safety and essential performance of therapeutic X-RAY EQUIPMENT with NOMINAL X-RAY TUBE VOLTAGES in the range 10 kV to 1 MV when connected to alternating current SUPPLY MAINS, hereafter referred to as ME EQUIPMENT.

NOTE This standard covers TELETHERAPY and BRACHYTHERAPY.

If a clause or subclause is specifically intended to be applicable to ME EQUIPMENT only, or to ME SYSTEMS only, the title and content of that clause or subclause will say so. If that is not the case, the clause or subclause applies both to ME EQUIPMENT and to ME SYSTEMS, as relevant.

##### 201.1.2 Object

*Replacement:*

The object of this particular standard is to establish particular basic safety and essential performance requirements for therapeutic X-RAY EQUIPMENT. It includes the requirements for accuracy and reproducibility of performance to the extent that these are related to radiation quality and the quantity of ionizing radiation produced and thus must be considered as aspects of safety.

##### 201.1.3 Collateral standards

*Addition:*

This particular standard refers to those applicable collateral standards that are listed in Clause 2 of the general standard and Clause 201.2 of this particular standard.

IEC 60601-1-3 and IEC 60601-1-10<sup>2)</sup> do not apply. All other published collateral standards in the IEC 60601-1 series apply as published.

##### 201.1.4 Particular standards

*Replacement:*

1) The general standard is IEC 60601-1:2005 and IEC 60601-1:2005/AMD1:2012, *Medical electrical equipment – Part 1: General requirements for basic safety and essential performance*

2) IEC 60601-1-10, *Medical electrical equipment – Part 1-10: General requirements for basic safety and essential performance – Collateral Standard: Requirements for the development of physiologic closed-loop controllers*

In the IEC 60601 series, particular standards may modify, replace or delete requirements contained in the general standard and collateral standards as appropriate for the particular ME EQUIPMENT under consideration, and may add other basic safety and essential performance requirements.

A requirement of a particular standard takes priority over the general standard.

For brevity, IEC 60601-1 is referred to in this particular standard as the general standard. Collateral standards are referred to by their document number.

The numbering of clauses and subclauses of this particular standard corresponds to that of the general standard with the prefix “201” (e.g. 201.1 in this standard addresses the content of Clause 1 of the general standard) or applicable collateral standard with the prefix “20x” where x is the final digit(s) of the collateral standard document number (e.g. 202.4 in this particular standard addresses the content of Clause 4 of the IEC 60601-1-2 collateral standard, 203.4 in this particular standard addresses the content of Clause 4 of the IEC 60601-1-3 collateral standard, etc.). The changes to the text of the general standard are SPECIFIED by the use of the following words:

"Replacement" means that the clause or subclause of the general standard or applicable collateral standard is replaced completely by the text of this particular standard.

"Addition" means that the text of this particular standard is additional to the requirements of the general standard or applicable collateral standard.

"Amendment" means that the clause or subclause of the general standard or applicable collateral standard is amended as indicated by the text of this particular standard.

Subclauses, figures or tables which are additional to those of the general standard are numbered starting from 201.101. However, due to the fact that definitions in the general standard are numbered 3.1 through 3.139, additional definitions in this standard are numbered beginning from 201.3.201. Additional annexes are lettered AA, BB, etc., and additional items aa, bb, etc.

Subclauses, figures or tables which are additional to those of a collateral standard are numbered starting from 20x, where “x” is the number of the collateral standard, e.g. 202 for IEC 60601-1-2, 203 for IEC 60601-1-3, etc.

The term "this standard" is used to make reference to the general standard, any applicable collateral standards and this particular standard taken together.

Where there is no corresponding clause or subclause in this particular standard, the clause or subclause of the general standard or applicable collateral standard, although possibly not relevant, applies without modification; where it is intended that any part of the general standard or applicable collateral standard, although possibly relevant, is not to be applied, a statement to that effect is given in this particular standard.

## 201.2 Normative references

Clause 2 of the general standard applies, except as follows:

*Addition:*

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

IEC 60601-2-1:2009, *Medical electrical equipment – Part 2-1: Particular requirements for the basic safety and essential performance of electron accelerators in the range 1 MeV to 50 MeV*

IEC 61217, *Radiotherapy equipment – Coordinates, movements and scales*

ISO/IEC Guide 98-3:2008, *Uncertainty of measurement – Part 3: Guide to the expression of uncertainty in measurement* (GUM:1995)

### 201.3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60601-1:2005 and IEC 60601-1:2005/AMD1:2012 and IEC TR 60788:2004 apply, except as follows.

NOTE An index of defined terms is found beginning on page 33.

*Addition:*

#### 201.3.201

##### BRACHYTHERAPY

RADIOTHERAPY using one or more RADIATION SOURCES with the RADIATION SOURCE/sources inside or close to the TARGET VOLUME

NOTE BRACHYTHERAPY techniques include INTERSTITIAL, INTRACAVITARY, SUPERFICIAL or INTRALUMINAL RADIOTHERAPY.

#### 201.3.202

##### INTERSTITIAL RADIOTHERAPY

RADIOTHERAPY with RADIATION SOURCES inserted within the TARGET VOLUME

#### 201.2.203

##### INTRACAVITARY RADIOTHERAPY

RADIOTHERAPY in which one or more RADIATION SOURCES, with or without SOURCE APPLICATORS, are introduced into a body cavity through a natural or artificial opening

#### 201.3.204

##### INTRALUMINAL RADIOTHERAPY

RADIOTHERAPY in which one or more RADIATION SOURCES, with or without SOURCE APPLICATORS, are introduced into a body lumen such as a blood vessel, air way, or the gastrointestinal tract

#### 201.3.205

##### SOURCE APPLICATOR

<BRACHYTHERAPY> device to bring one or more RADIATION SOURCES into the intended positions

NOTE A SOURCE APPLICATOR may include protective shielding.

#### 201.3.206

##### TELERADIOTHERAPY

TELEETHERAPY

RADIOTHERAPY with a large RADIATION SOURCE TO SKIN DISTANCE, usually not less than 50 cm

### 201.4 General requirements

Clause 4 of the general standard applies, except as follows:

*Additional subclause:*

#### **201.4.101 Conventional meaning of electrical quantities**

In this particular standard, unless otherwise indicated, values of X-RAY TUBE VOLTAGE refer to peak values.

### **201.5 General requirements for testing of ME EQUIPMENT**

Clause 5 of the general standard applies, except as follows:

#### **201.5.1 TYPE TESTS**

*Addition:*

##### **201.5.1.101 Test grades**

Three grades of TYPE TEST and two of SITE TEST procedures are SPECIFIED in 201.10 of this particular standard; their requirements are as follows:

- TYPE TEST grade A: an analysis of ME EQUIPMENT design, as related to the SPECIFIED radiation safety provisions, which shall result in a statement included in the technical description, regarding the working principles or constructional means by which the requirement is fulfilled;
- TYPE TEST/SITE TEST grade B: visual inspection or functional test or measurement of the ME EQUIPMENT. The test shall be in accordance with the procedure SPECIFIED in this particular standard and shall be based on operating states, including fault condition states, which are achievable only without interference with the circuitry or construction of the ME EQUIPMENT;
- TYPE TEST/SITE TEST grade C: functional test or measurement of the ME EQUIPMENT. The test shall be in accordance with the principle SPECIFIED in this particular standard. The SITE TEST procedure shall be included in the technical description. When the procedure involves operating states that require interference with the circuitry or the construction of the ME EQUIPMENT, the test should be performed by, or under the direct supervision of, the MANUFACTURER or the MANUFACTURER'S agent.

Table 201.101 summarises the data required in the technical description to support Clause 201.10 SITE TEST compliance.

#### **201.5.4 Other conditions**

*Addition:*

aa) The ACCOMPANYING DOCUMENTS shall include

- 1) statements resulting from TYPE TESTS: grade A;
- 2) details of and results from TYPE TESTS: grade B and grade C;
- 3) SPECIFIC procedures and test conditions for SITE TESTS grade C;
- 4) instructions on how to generate a described fault condition or, if not practicable, how to generate a test signal as close as practicable to the source of the signal that would have generated it, with a statement confirming that the test signal simulates the one that would be produced in a particular fault condition;

NOTE In some cases, one test signal may simulate more than one fault condition.

- 5) instructions on how to reset the ME EQUIPMENT for NORMAL USE after the completion of the SITE TEST and how to verify this condition.

*Compliance is checked by inspection of the ACCOMPANYING DOCUMENTS.*

NOTE The person responsible for the SITE TESTS should record the results in a report which should be included with the ACCOMPANYING DOCUMENTS; in addition, the SITE TEST report should contain at least the following: name and address of the RESPONSIBLE ORGANIZATION site; MODEL OR TYPE REFERENCE of the equipment; name, status and employment address of all personnel taking part in the tests, and date of their participation; environmental and power supply conditions; the actual conditions, when test conditions, procedures or devices differ from those given by the MANUFACTURER, or where the information cannot be derived from this particular standard.

**Table 201.101 – Data required in the technical description to support  
Clause 201.10 SITE and TYPE TEST compliance**

| Compliance subclause | Statement regarding data from TYPE TESTS grade A | Details of, and results from, TYPE TESTS or SITE TESTS grade B | Details of, and results from, TYPE TEST grade C | SPECIFIC procedures and test conditions for SITE TESTS grade C |
|----------------------|--|--|---|--|
| 201.10.1.2.101       |  | ☐  |   |  |
| 201.10.1.2.102       |  | ☐  |   |  |
| 201.10.1.2.103.1     | ☐  |  |   |  |
| 201.10.1.2.103.2     |  | ☐  |   |  |
| 201.10.1.2.104       |  | ☐  |   |  |
| 201.10.1.2.105.1     | ☐  |  |   | ☐  |
| 201.10.1.2.105.2     | ☐  |  |   | ☐  |
| 201.10.1.2.105.3     | ☐  |  |   | ☐  |
| 201.10.1.2.105.4     | ☐  |  |   | ☐  |
| 201.10.1.2.105.5     | ☐  |  |   |  |
| 201.10.1.2.105.6     | ☐  | ☐  |   |  |
| 201.10.1.2.105.7     | ☐  |  |   |  |
| 201.10.1.2.105.8     | ☐  |  |   |  |
| 201.10.1.2.106       | ☐  | ☐  |   |  |
| 201.10.1.2.107       | ☐  | ☐  |   |  |
| 201.10.1.2.108       | ☐  |  |   |  |
| 201.10.1.2.109.1     | ☐  |  |   | ☐  |
| 201.10.1.2.109.2     |  | ☐  |   |  |
| 201.10.1.2.109.3     |  | ☐ ☐  |   |  |
| 201.10.1.2.109.4     | b), d)   | d)   |   | a), b), c)   |
| 201.10.1.2.109.5     |  | a), b), c), d), e), f)   |   |  |
| 201.10.1.2.109.6     | a), c)   |  |   | a), b), c)   |
| 201.10.1.2.109.7     | ☐  |  |   | ☐  |
| 201.10.1.2.110.1     | ☐  |  |   |  |
| 201.10.1.2.110.2.1   | ☐  |  |   | ☐  |
| 201.10.1.2.110.2.2   | ☐  |  |   | ☐  |
| 201.10.1.2.110.2.3   | ☐  |  |   | ☐  |
| 201.10.1.2.110.3.1   | ☐  |  |   | ☐  |
| 201.10.1.2.110.3.2   | ☐  | ☐  |   |  |
| 201.10.1.2.110.3.3   | ☐  |  |   | ☐  |
| 201.10.1.2.110.4     | ☐  |  |   | ☐  |
| 201.10.1.2.110.5     | ☐  |  |   | ☐  |
| 201.10.1.2.110.6     | ☐  |  |   | ☐  |
| 201.10.1.2.110.7.1   | ☐  |  |   |  |
| 201.10.1.2.110.7.2   | ☐  |  |   |  |