

**Elektrilised meditsiiniseadmed. Osa 2-44:
Erinõuded arvutitomograafia
röntgeniseadmestiku ohutusele**

Medical electrical equipment - Part 2-44: Particular requirements for the safety of X-ray equipment for computed tomography

EESTI STANDARDI EESSÕNA

NATIONAL FOREWORD

Käesolev Eesti standard EVS-EN 60601-2-44:2002 sisaldab Euroopa standardi EN 60601-2-44:2001 ingliskeelset teksti.

Standard on kinnitatud Eesti Standardikeskuse 18.12.2002 käskkirjaga ja jõustub sellekohase teate avaldamisel EVS Teatajas.

Standard on kättesaadav Eesti standardiorganisatsioonist.

This Estonian standard EVS-EN 60601-2-44:2002 consists of the English text of the European standard EN 60601-2-44:2001.

This standard is ratified with the order of Estonian Centre for Standardisation dated 18.12.2002 and is endorsed with the notification published in the official bulletin of the Estonian national standardisation organisation.

The standard is available from Estonian standardisation organisation.

ICS 11.040.50

Standardite reprodutseerimis- ja levitamiseõigus kuulub Eesti Standardikeskusele

Andmete paljundamine, taastekitamine, kopeerimine, salvestamine elektroonilisse süsteemi või edastamine ükskõik millises vormis või millisel teel on keelatud ilma Eesti Standardikeskuse poolt antud kirjaliku loata.

Kui Teil on küsimusi standardite autorikaitse kohta, palun võtke ühendust Eesti Standardikeskusega:
Aru 10 Tallinn 10317 Eesti; www.evs.ee; Telefon: 605 5050; E-post: info@evs.ee

Right to reproduce and distribute Estonian Standards belongs to the Estonian Centre for Standardisation

No part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying, without permission in writing from Estonian Centre for Standardisation.

If you have any questions about standards copyright, please contact Estonian Centre for Standardisation:
Aru str 10 Tallinn 10317 Estonia; www.evs.ee; Phone: +372 605 5050; E-mail: info@evs.ee

English version

Medical electrical equipment
Part 2-44: Particular requirements for the safety of
X-ray equipment for computed tomography
(IEC 60601-2-44:2001)

Appareils électromédicaux
Partie 2-44: Règles particulières de
sécurité pour les équipements
à rayonnement X de tomographie
(CEI 60601-2-44:2001)

Medizinische elektrische Geräte
Teil 2-44: Besondere Festlegungen
für die Sicherheit von
Röntgeneinrichtungen
für die Computer-Tomographie
(IEC 60601-2-44:2001)

This European Standard was approved by CENELEC on 2001-07-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

Central Secretariat: rue de Stassart 35, B - 1050 Brussels

Foreword

The text of document 62B/426/FDIS, future edition 2 of IEC 60601-2-44, prepared by SC 62B, Diagnostic imaging equipment, of IEC TC 62, Electrical equipment in medical practice, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 60601-2-44 on 2001-07-01.

This European Standard supersedes EN 60601-2-44:1999.

The following dates were fixed:

- latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2002-04-01
- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 2004-07-01

Annexes designated "normative" are part of the body of the standard.
Annexes designated "informative" are given for information only.
In this standard, annex AA is normative and annex BB is informative.

In this standard, the following print types are used:

- requirements, compliance with which can be tested, and definitions: roman type;
- explanations, advice, notes, general statements and exceptions: smaller roman type;
- *test specifications and headings of subclauses*: italic type;
- TERMS DEFINED IN CLAUSE 2 OF THE GENERAL STANDARD OR IN IEC 60788: SMALL CAPITALS.

Endorsement notice

The text of the International Standard IEC 60601-2-44:2001 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

- | | |
|----------------|--|
| IEC 60417-2 | NOTE: Harmonized as EN 60417-2:1999 (not modified). |
| IEC 60601-1-4 | NOTE: Harmonized as EN 60601-1-4:1996 (not modified). |
| IEC 60601-2-32 | NOTE: Harmonized as EN 60601-2-32:1994 (not modified). |
| IEC 60313 | NOTE: Harmonized as EN 60613:1990 (not modified). |
-

INTERNATIONAL
STANDARD

IEC
60601-2-44

Second edition
2001-06

Medical electrical equipment –

Part 2-44:
Particular requirements for the safety of
X-ray equipment for computed tomography

Appareils électromédicaux –

*Partie 2-44:
Règles particulières de sécurité pour les équipements
à rayonnement X de tomographie*



Reference number
IEC 60601-2-44:2001(E)

Publication numbering

As from 1 January 1997 all IEC publications are issued with a designation in the 60000 series. For example, IEC 34-1 is now referred to as IEC 60034-1.

Consolidated editions

The IEC is now publishing consolidated versions of its publications. For example, edition numbers 1.0, 1.1 and 1.2 refer, respectively, to the base publication, the base publication incorporating amendment 1 and the base publication incorporating amendments 1 and 2.

Further information on IEC publications

The technical content of IEC publications is kept under constant review by the IEC, thus ensuring that the content reflects current technology. Information relating to this publication, including its validity, is available in the IEC Catalogue of publications (see below) in addition to new editions, amendments and corrigenda. Information on the subjects under consideration and work in progress undertaken by the technical committee which has prepared this publication, as well as the list of publications issued, is also available from the following:

- **IEC Web Site** (www.iec.ch)
- **Catalogue of IEC publications**
The on-line catalogue on the IEC web site (www.iec.ch/catlg-e.htm) enables you to search by a variety of criteria including text searches, technical committees and date of publication. On-line information is also available on recently issued publications, withdrawn and replaced publications, as well as corrigenda.
- **IEC Just Published**
This summary of recently issued publications (www.iec.ch/JP.htm) is also available by email. Please contact the Customer Service Centre (see below) for further information.
- **Customer Service Centre**
If you have any questions regarding this publication or need further assistance, please contact the Customer Service Centre:

Email: custserv@iec.ch
Tel: +41 22 919 02 11
Fax: +41 22 919 03 00

This document is a preview generated by EVS

INTERNATIONAL STANDARD

IEC 60601-2-44

Second edition
2001-06

Medical electrical equipment –

**Part 2-44:
Particular requirements for the safety of
X-ray equipment for computed tomography**

Appareils électromédicaux –

*Partie 2-44:
Règles particulières de sécurité pour les équipements
à rayonnement X de tomographie*

© IEC 2001 — Copyright - all rights reserved

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 the publisher.

International Electrotechnical Commission 3, rue de Varembé Geneva, Switzerland
Telefax: +41 22 919 0300 e-mail: inmail@iec.ch IEC web site <http://www.iec.ch>



Commission Electrotechnique Internationale
International Electrotechnical Commission
Международная Электротехническая Комиссия

PRICE CODE

Q

For price, see current catalogue

CONTENTS

FOREWORD 4

SECTION 1: GENERAL

1 Scope and object 6
1.1 Scope 6
1.2 Object 6
1.3 Particular Standards 7
2 Terminology and definitions 8
3 General requirements 10
5 Classification 10
6 Identification, marking and documents 11
6.1 Marking on the outside of EQUIPMENT or EQUIPMENT parts 11
6.7 Indicator lights and push buttons 11
6.8 ACCOMPANYING DOCUMENTS 12

SECTION 2: ENVIRONMENTAL CONDITIONS

10 Environmental conditions 13

SECTION 3: PROTECTION AGAINST ELECTRIC SHOCK HAZARDS

15 Limitation of voltage and/or energy 14
16 ENCLOSURES and PROTECTIVE COVERS 14
19 Continuous LEAKAGE CURRENTS and PATIENT AUXILIARY CURRENTS 15
19.3 Allowable values 15
20 Dielectric strength 15
20.3 Values of test voltages 15
20.4 Tests 16

SECTION 4: PROTECTION AGAINST MECHANICAL HAZARDS

22 Moving parts 17
27 Pneumatic and hydraulic power 18

SECTION 5: PROTECTION AGAINST HAZARDS FROM UNWANTED OR EXCESSIVE RADIATION

29 X-RADIATION 19
36 Electromagnetic compatibility 26

SECTION 6: PROTECTION AGAINST HAZARDS OF IGNITION OF
FLAMMABLE ANAESTHETIC MIXTURES

SECTION 7: PROTECTION AGAINST EXCESSIVE TEMPERATURES AND
OTHER SAFETY HAZARDS

42	Excessive temperatures	26
----	------------------------------	----

SECTION 8: ACCURACY OF OPERATING DATA AND PROTECTION
AGAINST HAZARDOUS OUTPUT

50	Accuracy of operating data	27
	50.101 Accuracy of radiation output	27
	50.102 Accuracy of recorded examination data	27
51	Protection against hazardous output	28

SECTION 9: ABNORMAL OPERATION AND FAULT CONDITIONS;
ENVIRONMENTAL TESTS

SECTION 10: CONSTRUCTIONAL REQUIREMENTS

56	Components and general assembly	28
	56.7 Batteries	29
57	MAINS PARTS, components and layout	29
	57.10 CREEPAGE DISTANCES and AIR CLEARANCES	29

Tables

101	HALF-VALUE LAYERS in CT SCANNERS	24
-----	--	----

Figures

101	Coordinate system	9
-----	-------------------------	---

Annex AA (normative)	Terminology – Index of defined terms	30
----------------------	--	----

Annex BB (informative)	Choosing LOADING FACTORS for tests	33
------------------------	--	----

Bibliography		34
--------------------	--	----

This document is a preview generated by EVS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

MEDICAL ELECTRICAL EQUIPMENT –

Part 2-44: Particular requirements for the safety of X-ray equipment for computed tomography

FOREWORD

- 1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the 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, the IEC publishes International Standards. 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. The 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 the 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 National Committees.
- 3) The documents produced have the form of recommendations for international use and are published in the form of standards, technical specifications, technical reports or guides and they are accepted by the National Committees in that sense.
- 4) In order to promote international unification, IEC National Committees undertake to apply IEC International Standards transparently to the maximum extent possible in their national and regional standards. Any divergence between the IEC Standard and the corresponding national or regional standard shall be clearly indicated in the latter.
- 5) The IEC provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with one of its standards.
- 6) Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. The IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 60601-2-44 has been prepared by subcommittee 62B: Diagnostic imaging equipment, of IEC technical committee 62: Electrical equipment in medical practice.

This second edition cancels and replaces the first edition published in 1999 and constitutes a technical revision.

The text of this Particular Standard is based on the following documents:

FDIS	Report of voting
62B/426/FDIS	62B/437/RVD

Full information on the voting for the approval of this standard can be found in the report of voting indicated in the above table.

Annex AA forms an integral part of this standard.

Annex BB is for information only.

In this standard, the following print types are used:

- requirements, compliance with which can be tested and definitions: roman type;
- explanations, advice, notes, general statements and exceptions: smaller type;
- *test specifications and headings of subclauses: italic type;*
- TERMS DEFINED IN CLAUSE 2 OF THE GENERAL STANDARD OR IN IEC 60788: SMALL CAPITALS.

The committee has decided that the contents of this publication will remain unchanged until 2002-12. At this date, the publication will be

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

A bilingual version of this publication may be issued at a later date.

This document is a preview generated by EVS

MEDICAL ELECTRICAL EQUIPMENT –

Part 2-44: Particular requirements for the safety of X-ray equipment for computed tomography

SECTION 1: GENERAL

The clauses and subclauses of this section of the General Standard apply except as follows:

1 Scope and object

This clause of the General Standard applies except as follows:

1.1 Scope

Addition:

This Particular Standard applies to X-RAY EQUIPMENT for COMPUTED TOMOGRAPHY (CT SCANNERS).

It includes safety requirements for the X-RAY GENERATOR, and those where HIGH VOLTAGE GENERATORS are integrated with an X-RAY TUBE ASSEMBLY.

1.2 Object

Replacement:

The object of this standard is to establish particular requirements to ensure safety, and to specify methods for demonstrating compliance with those requirements, for CT SCANNERS.

NOTE 1 Requirements for reproducibility, linearity, constancy and accuracy are given because of their relationship to the quality and quantity of the IONIZING RADIATION produced and are confined to those considered necessary for safety.

NOTE 2 Both the levels for compliance and the tests prescribed to determine compliance reflect the fact that the safety of HIGH-VOLTAGE GENERATORS is not sensitive to small differences in levels of performance. The combinations of LOADING FACTORS specified for the tests are therefore limited in number but chosen from experience as being appropriate in most cases. It is considered important to standardize the choice of combinations of LOADING FACTORS so that comparison can be made between tests performed in different places on different occasions. However, combinations other than those specified could be of equal technical validity.

NOTE 3 The safety philosophy on which this standard is based is described in the introduction to the General Standard and in IEC 60513.

NOTE 4 Concerning RADIOLOGICAL PROTECTION it has been assumed in the preparation of this standard that MANUFACTURERS and USERS do accept the general principles of the ICRP as stated in ICRP 60, 1990, paragraph 112,¹⁾ namely:

"(a) No practice involving exposures to radiation should be adopted unless it produces sufficient benefit to the exposed individuals or to society to offset the radiation detriment it causes. (The justification of a practice.)

(b) In relation to any particular source within a practice, the magnitude of individual doses, the number of people exposed, and the likelihood of incurring exposures where these are not certain to be received should all be kept as low as reasonably achievable, economic and social factors being taken into account. This procedure should be constrained by restrictions on the doses to individuals (dose constraints), or the risks to individuals in the case of potential exposures (risk constraints), so as to limit the inequity likely to result from the inherent economic and social judgements. (The optimisation of protection.)

¹⁾ ICRP Publication 60: *Recommendations of the International Commission on Radiological Protection (Annals of the ICRP Vol. 21 No 1-3, 1990)*. Published by Pergamon Press

(c) The exposure of individuals resulting from the combination of all the relevant practices should be subject to dose limits, or to some control of risk in the case of potential exposures. These are aimed at ensuring that no individual is exposed to radiation risks that are judged to be unacceptable from these practices in any normal circumstances. Not all sources are susceptible of control by action at the source and it is necessary to specify the sources to be included as relevant before selecting a dose limit. (Individual dose and risk limits.)"

NOTE 5 Most of the requirements on X-RAY EQUIPMENT and its sub-assemblies for protection against IONIZING RADIATION are given in the Collateral Standard IEC 60601-1-3.

This standard does, however, deal with some aspects of RADIOLOGICAL PROTECTION, mainly those that depend upon the supply, control and indication of electrical energy from the HIGH-VOLTAGE GENERATOR.

NOTE 6 It is recognized that many of the judgements necessary to follow the ICRP general principles have to be made by the USER and not by the MANUFACTURER of the EQUIPMENT.

1.3 Particular Standards

Addition:

This Particular Standard hereinafter referred to as "this standard", amends and supplements a set of IEC publications, hereinafter referred to as "General Standard", consisting of IEC 60601-1:1988, *Medical electrical equipment – Part 1: General requirements for safety*, its amendments No. 1 (1991) and No. 2 (1995), and all Collateral Standards. The numbering of sections, clauses and subclauses of this standard corresponds to that of the General Standard. 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 is replaced completely by the text of this standard.

"Addition" means that the text of this standard is additional to the requirements of the General Standard.

"Amendment" means that the clause or subclause of the General Standard is amended as indicated by the text of this standard.

Subclauses or figures which are additional to those of the General Standard are numbered starting from 101, additional annexes are lettered AA, BB etc., and additional items aa), bb), etc.

Where there is no corresponding section, clause or subclause in this standard, the section, clause or subclause of the General Standard applies without modification.

Where it is intended that any part of the General Standard, although possibly relevant, is not to be applied, a statement to that effect is given in this standard.

A requirement of this standard replacing or modifying requirements of the General Standard takes precedence over the original requirements concerned.

1.3.101 Related International Standards

IEC 60601-1-2:1993, *Medical electrical equipment – Part 1: General requirements for safety – 2. Collateral Standard: Electromagnetic compatibility – Requirements and tests*

IEC 60601-1-3:1994, *Medical electrical equipment – Part 1: General requirements for safety – 3. Collateral Standard: General requirements for radiation protection in diagnostic X-ray equipment*

IEC 60601-2-28:1993, *Medical electrical equipment – Part 2: Particular requirements for the safety of X-ray source assemblies and X-ray tube assemblies for medical diagnosis*

IEC 60664-1:1992, *Insulation coordination for equipment within low-voltage systems – Part 1: Principles, requirements and tests*

IEC 60788:1984, *Medical radiology – Terminology*

ISO 2092:1981, *Light metals and their alloys – Code of designation based on chemical symbols*

2 Terminology and definitions

This clause of the General Standard applies except as follows:

Addition before 2.1:

In this standard, terms printed in SMALL CAPITALS are used in accordance with their definitions in the General Standard or in IEC 60788.

NOTE Attention is drawn to the fact, that in cases where the concept addressed is not strongly confined to the definition given in one of the publications listed above a corresponding term is printed in lower case letters.

An index of defined terms used in this standard is given in annex AA.

Associated conditions qualifying the usage of certain terms are given in the additional definitions below.

In this standard unless otherwise indicated:

- values of X-RAY TUBE VOLTAGE refer to peak values, transients being disregarded;
- values of X-RAY TUBE CURRENT refer to average values.

Additional definitions:

2.101

CT SCANNER

X-RAY EQUIPMENT for COMPUTED TOMOGRAPHY (CT). A computed tomography X-ray system is a diagnostic X-ray system intended to generate cross-sectional images of the body by computer reconstruction of X-ray transmission data from the same axial plane at different angles. This generic type of device may include signal analysis and display equipment, patient and equipment supports, support parts and ACCESSORIES.

NOTE Secondary imaging processing is not included in the scope of this standard.

2.102

CT CONDITIONS OF OPERATION

all selectable parameters governing the operation of a CT SCANNER, for example NOMINAL TOMOGRAPHIC SECTION THICKNESS, PITCH FACTOR, FILTRATION, peak X-RAY TUBE VOLTAGE and either X-RAY TUBE CURRENT and LOADING TIME or CURRENT TIME PRODUCT