



IEC 61675-1

Edition 1.1 2008-06

# INTERNATIONAL STANDARD

---

**Radionuclide imaging devices – Characteristics and test conditions –  
Part 1: Positron emission tomographs**

INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

PRICE CODE **CH**

---

ICS 11.040.50

ISBN 2-8318-9780-7

## CONTENTS

|  |        |
|--|--------|
| FOREWORD.....  | 3      |
| INTRODUCTION (to amendment 1).....   | 5      |
| 1 General .....  | 6      |
| 1.1 Scope and object.....  | 6      |
| 1.2 Normative reference .....  | 6      |
| 2 Terminology and definitions .....  | 6      |
| 3 Test methods.....  | 12     |
| 3.1 SPATIAL RESOLUTION.....  | 12     |
| 3.2 RECOVERY COEFFICIENT .....   | 15     |
| 3.3 Tomographic sensitivity .....  | 16     |
| 3.4 Uniformity.....  | 18     |
| 3.5 COUNT RATE CHARACTERISTIC .....  | 18     |
| 3.6 Scatter measurement .....  | 21     |
| 3.7 ATTENUATION correction .....   | 23     |
| 4 ACCOMPANYING DOCUMENTS .....   | 25     |
| <br>Annex A (informative) Index of defined terms .....   | <br>38 |
| <br>Figure 1 – Cylindrical head phantom.....   | <br>28 |
| Figure 2 – Cross-section of body phantom.....  | 29     |
| Figure 3 – Arm phantom.....  | 29     |
| Figure 4 – Phantom insert with hollow spheres .....  | 30     |
| Figure 5 – Phantom insert with holders for the scatter source .....  | 31     |
| Figure 6 – Phantom insert for the evaluation of ATTENUATION correction .....                                   | 32     |
| Figure 7 – Phantom configuration for COUNT RATE measurements according to 3.5.3.1.2<br>(cardiac imaging) ..... | 33     |
| Figure 8 – Scheme of the evaluation of COUNT LOSS correction.....  | 33     |
| Figure 9 – Evaluation of ATTENUATION correction.....   | 34     |
| Figure 10 – Evaluation of SCATTER FRACTION.....  | 34     |
| Figure 11 – Evaluation of FWHM .....   | 35     |
| Figure 12 – Evaluation of EQUIVALENT WIDTH (EW).....   | 36     |
| Figure 13 – Phantom position and location of screws for abdominal imaging (see 3.5.3.1.3)...                   | 37     |
| <br>Table 1 – RADIONUCLIDES to be used in performance measurements.....  | <br>27 |

## INTERNATIONAL ELECTROTECHNICAL COMMISSION

**RADIONUCLIDE IMAGING DEVICES –  
CHARACTERISTICS AND TEST CONDITIONS –****Part 1: Positron emission tomographs**

## 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.

International Standard IEC 61675-1 has been prepared by subcommittee 62C: Equipment for radiotherapy, nuclear medicine and radiation dosimetry, of IEC technical committee 62: Electrical equipment in medical practice.

This consolidated version of IEC 61675-1 consists of the first edition (1998) [documents 62C/205/FDIS and 62C/214/RVD] and its amendment 1 (2008) [documents 62C/419/CDV and 62C/432/RVC].

The technical content is therefore identical to the base edition and its amendment and has been prepared for user convenience.

It bears the edition number 1.1.

A vertical line in the margin shows where the base publication has been modified by amendment 1.

In this standard, the following print types are used:

- TERMS DEFINED IN CLAUSE 2 OF THIS STANDARD OR LISTED IN ANNEX A: SMALL CAPITALS.

The requirements are followed by specifications for the relevant tests.

Annex A is for information only.

The committee has decided that the contents of the base publication and its amendments will remain unchanged until the maintenance result 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,
- replaced by a revised edition, or
- amended.

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

## INTRODUCTION (to amendment 1)

Further developments of POSITRON EMISSION TOMOGRAPHS allow most of the tomographs to be operated in fully 3D acquisition mode. To comply with this trend, this amendment describes test conditions in accordance with the acquisition characteristic. It is the intention to simulate 3D imaging without introducing new phantoms or new acquisition or processing protocols. The test does simulate more realistically count rate characteristics for whole body imaging. Measurement of SCATTER FRACTION is not intended with this test. Certain parts of the standard are amended as stated below.

# **RADIONUCLIDE IMAGING DEVICES – CHARACTERISTICS AND TEST CONDITIONS –**

## **Part 1: Positron emission tomographs**

### **1 General**

#### **1.1 Scope and object**

This part of IEC 61675 specifies terminology and test methods for declaring the characteristics of POSITRON EMISSION TOMOGRAPHS. POSITRON EMISSION TOMOGRAPHS detect the ANNIHILATION RADIATION of positron emitting RADIONUCLIDES by COINCIDENCE DETECTION.

The test methods specified in this part of IEC 61675 have been selected to reflect as much as possible the clinical use of POSITRON EMISSION TOMOGRAPHS. It is intended that the test methods be carried out by manufacturers, thereby enabling them to declare the characteristics of POSITRON EMISSION TOMOGRAPHS. So, the specifications given in the ACCOMPANYING DOCUMENTS shall be in accordance with this standard. This standard does not imply which tests will be performed by the manufacturer on an individual tomograph.

No test has been specified to characterize the uniformity of reconstructed images, because all methods known so far will mostly reflect the noise in the image.

#### **1.2 Normative reference**

The following normative document contains provisions which, through reference in this text, constitute provisions of this part of IEC 61675. At the time of publication, the edition indicated was valid. All normative documents are subject to revision, and parties to agreements based on this part of IEC 61675 are encouraged to investigate the possibility of applying the most recent edition of the normative document indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 60788:1984, *Medical radiology – Terminology*