

INTERNATIONAL STANDARD

**Linear accelerator - Electron linear accelerator for radiation processing -
Part 1: General requirement and test methods**

Sample Document

get full document from standards.iteh.ai



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2026 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.

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

Tel.: +41 22 919 02 11
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 corrigendum or an amendment might have been published.

IEC publications search -

webstore.iec.ch/advsearchform

The advanced search enables 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 It also gives information on projects, replaced and withdrawn publications.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 online and once a month by email.

IEC 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: sales@iec.ch.

IEC Products & Services Portal - products.iec.ch

Discover our powerful search engine and read freely all the publications previews, graphical symbols and the glossary. With a subscription you will always have access to up to date content tailored to your needs.

Electropedia - www.electropedia.org

The world's leading online dictionary on electrotechnology, containing more than 22 500 terminological entries in English and French, with equivalent terms in 25 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

Warning! Make sure that you obtained this publication from an authorized distributor.

CONTENTS

FOREWORD	3
INTRODUCTION	5
1 Scope	6
2 Normative references	6
3 Terms and definitions	6
4 Composition, naming convention and working conditions	9
4.1 Composition	9
4.2 Naming convention	10
4.3 Working conditions	10
4.3.1 Environment requirements	10
4.3.2 Power supply	10
5 Technical requirements	10
5.1 Electron beam energy	10
5.2 Electron beam intensity	11
5.3 Electron beam power	11
5.4 Scan uniformity	11
5.5 Operational reliability	11
5.6 Control system	11
5.7 Safety interlocking system	11
5.7.1 General requirements	11
5.7.2 Essential interlocking devices for equipment	12
5.7.3 The interlocks for personal safety protection	12
5.8 Electrical safety	13
5.8.1 Protective grounding	13
5.8.2 Insulation resistance	13
5.8.3 Dielectric strength	13
5.8.4 Protection against electric shock	13
5.9 Appearance	13
5.10 Electromagnetic compatibility (EMC)	13
5.10.1 Surge immunity	13
5.10.2 Electrical fast transient (EFT) immunity	13
5.10.3 Emission	13
5.10.4 Immunity	13
6 Test requirements and methods	14
6.1 Test requirements	14
6.1.1 Test conditions	14
6.1.2 Test instruments and equipment	14
6.1.3 Working status	16
6.2 Test methods	17
6.2.1 Electron beam energy	17
6.2.2 Electron beam intensity	18
6.2.3 Electron beam power	19
6.2.4 Scan uniformity	20
6.2.5 Operational reliability	20
6.2.6 Control system	20
6.2.7 Safety interlocking system	21

6.2.8	Electrical safety testing.....	21
6.2.9	Appearance.....	21
6.2.10	EMC.....	22
7	Inspection rules.....	22
7.1	Inspection classification.....	22
7.1.1	General.....	22
7.1.2	Type inspection.....	22
7.1.3	Delivery inspection.....	22
7.2	Inspection items.....	22
7.3	Criterion rules.....	23
8	Marking, packaging, storage, transportation and accompanying documents.....	23
8.1	Marking.....	23
8.1.1	Accelerator signs.....	23
8.1.2	Warning signs.....	23
8.2	Packaging.....	24
8.3	Storage.....	24
8.4	Transportation.....	24
8.5	Accompanying documents.....	24
8.5.1	Instruction manual.....	24
8.5.2	Product certificate.....	24
8.5.3	Other documents.....	24
	Bibliography.....	25
	Figure 1 – A typical depth-dose distribution for an electron beam in a homogeneous material.....	9
	Figure 2 – Naming convention.....	10
	Figure 3 – Stacked test module.....	15
	Figure 4 – Wedge device.....	15
	Figure 5 – Average beam measurement circuit diagram.....	16
	Table 1 – Test conditions.....	14
	Table 2 – Inspection items.....	23

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**Linear accelerator -
Electron linear accelerator for radiation processing -
Part 1: General requirements and test methods**

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 itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 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) IEC draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). IEC takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, IEC had not received notice of (a) patent(s), which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at <https://patents.iec.ch>. IEC shall not be held responsible for identifying any or all such patent rights.

IEC 63589-1 has been prepared by IEC technical committee 45: Nuclear instrumentation. It is an International Standard.

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

Draft	Report on voting
45/1036XX/FDIS	45/1051XX/RVD

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

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

A list of all parts in the IEC 63589 series, published under the general title *Linear accelerator - Electron linear accelerator for radiation processing*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn, or
- revised.

Sample Document

get full document from standards.iteh.ai

INTRODUCTION

An electron linear accelerator for radiation processing is a device that generates a high-energy electron beam through a linear radio frequency resonant structure. The accelerator device has the advantages of no toxicity or radiation residue, high radiation efficiency, and easy operation and control. It is an important equipment for radiation sterilization, radiation modification, radiation solidification, radiation degradation, agricultural breeding, and other radiation-processing fields.

Sample Document

get full document from standards.iteh.ai

1 Scope

This document specifies the general requirements and test methods of radiation processing electron linear accelerator device. The rules of naming, technical requirements, test methods, inspection rules, marking, packaging, storage, and transportation requirements are also provided.

This document applies to the electron linear accelerators for radiation processing with energy 1,0 MeV to 15 MeV.

NOTE Linear accelerators described in this document produce electron beams used for radiation processing. Please see IEC 62976 for accelerators producing X-ray bremsstrahlung used for non-destructive testing.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60364-1:2025, *Low-voltage electrical installations - Part 1: Fundamental principles, assessment of general characteristics, and definitions*

IEC 61000-4-4, *Electromagnetic compatibility (EMC) - Part 4-4: Testing and measurement techniques - Electrical fast transient/burst immunity test*

IEC 61000-4-5, *Electromagnetic compatibility (EMC) - Part 4-5: Testing and measurement techniques - Surge immunity test*

IEC 61000-6-2, *Electromagnetic compatibility (EMC) - Part 6-2: Generic standards - Immunity standard for industrial environments*

IEC 61000-6-4, *Electromagnetic compatibility (EMC) - Part 6-4: Generic standards - Emission standard for industrial environments*

ISO 780, *Packaging - Distribution packaging - Graphical symbols for handling and storage of packages*

ISO/IEC Guide 37, *Instructions for use of products by consumers*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- IEC Electropedia: available at <https://www.electropedia.org/>
- ISO Online browsing platform: available at <https://www.iso.org/obp>

3.1

radiation processing

intentional irradiation of products or materials to preserve, modify or to improve their characteristics

[SOURCE: ISO/ASTM 52628:2020, 3.1.14]

**3.2
electron beam energy**

E
kinetic energy of the accelerated electrons in the beam

Note 1 to entry: *E* is expressed in megaelectronvolts (MeV).

[SOURCE: ISO/ASTM 51649:2015, 3.1.10]

**3.3
nominal electron beam energy**

nominal electron beam energy refers to the highest energy at which the accelerator can operate stably and reliably

**3.4
electron beam energy instability**

rate of change in electron beam energy due to uncontrolled natural changes in accelerator parameters over a given period

**3.5
electron beam intensity**

time average of the electron beam current by the reference plane, which for the pulse accelerator means the average beam intensity

**3.6
nominal electron beam intensity**

maximum electron beam intensity at which the accelerator can operate stably and reliably

**3.7
electron beam intensity instability**

rate of change in electron beam intensity due to uncontrolled natural changes in accelerator parameters over a given period

**3.8
pulse electron beam**

electron beam that recurs periodically, with a pulse duration much shorter than the interval between consecutive pulses

**3.9
pulse rate**

f
pulse repetition frequency in hertz, or pulses per second

Note 1 to entry: *f* is expressed in hertz (Hz).

[SOURCE: ISO/ASTM 51649:2015, 3.2.12]

**3.10
beam width**

dimension of the irradiation zone perpendicular to the direction of product movement at a specified distance from the accelerator window

[SOURCE: ISO/ASTM 51649:2015, 3.1.5]