

INTERNATIONAL STANDARD

**Electrostatics -
Part 4-7: Standard test methods for specific applications - Ionization**

Sample Document

get full document from standards.iteh.ai



THIS PUBLICATION IS COPYRIGHT PROTECTED
Copyright © 2025 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 Varembeé
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 It also gives information on projects, replaced and withdrawn publications.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 Test fixture and instrumentation	8
5 Specific requirements for equipment categories	10
5.1 Specific requirements for all ionization equipment	10
5.2 Room ionization	11
5.3 Laminar flow hood ionization	13
5.4 Worksurface ionization	15
5.5 Compressed gas ionizers – Guns and nozzles	17
Annex A (informative) Theoretical background and additional information on the standard test method for the performance of ionizers	19
A.1 Introductory remarks	19
A.2 Air ions	19
A.3 Mobility and ion current	19
A.4 Neutralization current	20
A.5 Neutralization rate	20
A.6 Ion depletion and field suppression	20
A.7 Charged plate monitor and charge neutralization	21
A.8 Relationship between charged plate monitor decay time and actual object	21
A.9 Offset voltage	21
A.10 Preparation of test area	22
A.11 Ion transport in airflow	22
A.12 Obstruction of airflow around the charged plate monitor	22
A.13 Effect of "air blanket"	23
A.14 Sources of measurement error	23
A.14.1 Typical decay time variability	23
A.14.2 Plate isolation	23
A.14.3 Charging voltage	23
A.14.4 Materials near the plate	23
A.14.5 Other field-producing devices in test area	23
A.14.6 Effect of offset voltage on decay time	24
A.15 Importance of ionization equipment maintenance	24
Annex B (normative) Method of measuring the capacitance of an isolated conductive plate	25
B.1 Method	25
B.2 Equipment	25
B.3 Procedure	25
B.4 Example	26
B.5 Sources of error	26
B.5.1 Measuring equipment	26
B.5.2 Poor plate isolation	27
B.5.3 Objects in the environment	27
B.5.4 Stray capacitance	28
Annex C (informative) Safety considerations	29

C.1	General.....	29
C.2	Electrical.....	29
C.3	Ozone.....	29
C.4	Radioactive.....	29
C.5	X-ray.....	29
C.6	Installation.....	29
	Bibliography.....	30
	Figure 1 – Charged plate monitor components for non-contacting plate measurement	9
	Figure 2 – Charged plate monitor components for contacting plate measurement	9
	Figure 3 – Conductive plate detail of the non-contacting CPM.....	9
	Figure 4 – Conductive plate detail of the voltage follower CPM	10
	Figure 5 – Test locations for room ionization – AC bars, grids and DC bar systems	12
	Figure 6 – Test locations for room ionization – Single polarity emitter systems	12
	Figure 7 – Test locations for room ionization – Two DC-line systems	13
	Figure 8 – Test locations for room ionization – Pulsed DC emitter systems	13
	Figure 9 – Test locations for vertical laminar flow hood – Top view	14
	Figure 10 – Test locations for vertical laminar flow hood – Side view	14
	Figure 11 – Test locations for horizontal laminar flow hood – Top view	15
	Figure 12 – Test locations for horizontal laminar flow hood – Side view	15
	Figure 13 – Test locations for benchtop ionizer – Top view	16
	Figure 14 – Test locations for benchtop ionizer – Side view	16
	Figure 15 – Test locations for overhead ionizer – Top view.....	17
	Figure 16 – Test locations for overhead ionizer – Side view.....	17
	Figure 17 – Test locations for compressed gas ionizer (gun or nozzle) – Side view.....	18
	Table 1 – Test set-ups and test locations and points (TP).....	11
	Table B.1 – Example measurement data	26

INTERNATIONAL ELECTROTECHNICAL COMMISSION

Electrostatics - Part 4-7: Standard test methods for specific applications - Ionization

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 61340-4-7 has been prepared by IEC technical committee 101: Electrostatics. It is an International Standard.

This third edition cancels and replaces the second edition published in 2017. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) in Figure 5, a NOTE 3 was added to clarify that for AC bars and grids, a single emitter alternating between +/- polarity is used;
- b) in Annex B, the relative error for measurement equipment was updated to include the consideration for the resolution of the voltmeter.

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

Draft	Report on voting
101/739/FDIS	101/744/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 61340 series, published under the general title *Electrostatics*, 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

Grounding is the primary method used to limit static charge when protecting electrostatic discharge sensitive items in the work environment. However, grounding methods are not effective in removing static charges from the surfaces of non-conductive (insulative) or isolated (ungrounded) conductive materials. Air ionization techniques, by means of ionizer systems, can be utilized to reduce this charge.

The preferred way of evaluating the ability of an ionizer to neutralize a static charge is to directly measure the rate of charge decay. Charges to be neutralized can be located on insulators as well as on isolated conductors. It is difficult to charge an insulator reliably and repeatably. Charge neutralization is more easily evaluated by measuring the rate of decay of the voltage of an isolated conductive plate. The measurement of this decay should not interfere with or change the nature of the actual decay. Four practical methods of air ionization are addressed in this document:

- a) radioactive emission;
- b) high-voltage corona from AC electric fields;
- c) high-voltage corona from DC electric fields;
- d) soft X-ray emission.

This part of IEC 61340 provides test methods and procedures that can be used when evaluating ionization equipment. The objective of the test methods is to generate meaningful, reproducible data. The test methods are not meant to be a recommendation for any particular ionizer configuration. The wide variety of ionizers, and the environments within which they are used, will often require test methods different from those described in this document. Users of this document should be prepared to adapt the test methods as required to produce meaningful data in their own application of ionizers.

Similarly, the test conditions chosen in this document do not represent a recommendation for acceptable ionizer performance. There is a wide range of item sensitivities to static charge. There is also a wide range of environmental conditions affecting the operation of ionizers. Performance specifications should be agreed upon between the user and manufacturer of the ionizer in each application. Users of this document should be prepared to establish reasonable performance requirements for their own application of ionizers.

Annex B provides a method for measuring capacitance of the isolated conductive plate.

1 Scope

This part of IEC 61340 provides test methods and procedures for evaluating and selecting air ionization equipment and systems (ionizers).

This document establishes measurement techniques, under specified conditions, to determine offset voltage (ion balance) and decay (charge neutralization) time for ionizers.

This document does not include measurements of electromagnetic interference (EMI), or the use of ionizers in connection with ordnance, flammables, explosive items or electrically initiated explosive devices.

As contained in this document, the test methods and test conditions can be used by manufacturers of ionizers to provide performance data describing their products. Users of ionizers are urged to modify the test methods and test conditions for their specific application in order to qualify ionizers for use, or to make periodic verifications of ionizer performance. The user will decide the extent of the data required for each application.

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 61010-1, *Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 1: General requirements*

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

air conductivity

ability of air to conduct (pass) an electric current under the influence of an electric field

3.2

air ions

molecular clusters of about ten molecules (water, impurities, etc.) bound by polarization forces to a singly charged oxygen or nitrogen molecule

3.3

charge decay

decrease or neutralization or both of a net electrostatic charge

3.4
charged plate monitor
CPM

instrument using a charged metal plate of a defined capacitance and geometry which is discharged in order to measure charge dissipation and neutralization properties of products or materials

3.5
compressed gas ionizer

ionization device that can be used to neutralize charged surfaces or remove surface particles or both with pressurized gas

Note 1 to entry: This type of ionizer can be used to ionize the gas within production equipment.

3.6
corona

production of positive or negative ions by a very localized high electric field

Note 1 to entry: The field is normally established by applying a high voltage to a conductor in the shape of a sharp point or wire.

3.7
decay time

time necessary for a voltage (due to an electrostatic charge) to decay from an initial value to some chosen final value

3.8
emitter

conducting sharp object, usually a needle or wire, which will cause a corona discharge when kept at a high potential

3.9
horizontal laminar flow

non-turbulent airflow in a horizontal direction

3.10
ionizer

device designed to generate positive or negative or both air ions

3.11
isolated conductor

conductor that has sufficiently high resistance to ground that significant charge dissipation is prevented within the timescale of interest

3.12
laminar flow hood ionization

device or system that provides local area ionization coverage in vertical or horizontal laminar flow hoods or benches

3.13
offset voltage
ion balance

observed voltage on the isolated conductive plate of a charged plate monitor (CPM) that has been placed in an ionized environment

3.14
peak offset voltage

for pulsed ionizers, maximum value of the offset voltage for each polarity, as the ionizer cycles between positive and negative ion outputs