

INTERNATIONAL STANDARD

NORME INTERNATIONALE

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

**Électrostatique –
Partie 4-7: Méthodes d'essai normalisées pour des applications spécifiques –
Ionisation**



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2017 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.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de l'IEC ou du Comité national de l'IEC du pays du demandeur. Si vous avez des questions sur le copyright de l'IEC ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de l'IEC de votre pays de résidence.

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

Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00
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 corrigenda or an amendment might have been published.

IEC Catalogue - webstore.iec.ch/catalogue

The stand-alone application for consulting the entire bibliographical information on IEC International Standards, Technical Specifications, Technical Reports and other documents. Available for PC, Mac OS, Android Tablets and iPad.

IEC publications search - www.iec.ch/searchpub

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 also once a month by email.

Electropedia - www.electropedia.org

The world's leading online dictionary of electronic and electrical terms containing 20 000 terms and definitions in English and French, with equivalent terms in 16 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary

65 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

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: csc@iec.ch.

A propos de l'IEC

La Commission Electrotechnique Internationale (IEC) est la première organisation mondiale qui élabore et publie des Normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

A propos des publications IEC

Le contenu technique des publications IEC est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

Catalogue IEC - webstore.iec.ch/catalogue

Application autonome pour consulter tous les renseignements bibliographiques sur les Normes internationales, Spécifications techniques, Rapports techniques et autres documents de l'IEC. Disponible pour PC, Mac OS, tablettes Android et iPad.

Recherche de publications IEC - www.iec.ch/searchpub

La recherche avancée permet de trouver des publications IEC en utilisant différents critères (numéro de référence, texte, comité d'études,...). Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

IEC Just Published - webstore.iec.ch/justpublished

Restez informé sur les nouvelles publications IEC. Just Published détaille les nouvelles publications parues. Disponible en ligne et aussi une fois par mois par email.

Electropedia - www.electropedia.org

Le premier dictionnaire en ligne de termes électroniques et électriques. Il contient 20 000 termes et définitions en anglais et en français, ainsi que les termes équivalents dans 16 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

Glossaire IEC - std.iec.ch/glossary

65 000 entrées terminologiques électrotechniques, en anglais et en français, extraites des articles Termes et Définitions des publications IEC parues depuis 2002. Plus certaines entrées antérieures extraites des publications des CE 37, 77, 86 et CISPR de l'IEC.

Service Clients - webstore.iec.ch/csc

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: csc@iec.ch.

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Electrostatics –

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

Électrostatique –

Partie 4-7: Méthodes d'essai normalisées pour des applications spécifiques – Ionisation

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 17.200.99; 29.020

ISBN 978-2-8322-3775-5

Warning! Make sure that you obtained this publication from an authorized distributor. Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.
--

CONTENTS

FOREWORD.....	4
INTRODUCTION.....	6
1 Scope.....	7
2 Normative references	7
3 Terms and definitions	7
4 Test fixture and instrumentation.....	9
5 Specific requirements for equipment categories.....	11
5.1 Specific requirements for all ionization equipment.....	11
5.2 Room ionization	12
5.3 Laminar flow hood ionization.....	14
5.4 Work surface ionization.....	16
5.5 Compressed gas ionizers – Guns and nozzles	19
Annex A (informative) Theoretical background and additional information on the standard test method for the performance of ionizers.....	21
A.1 Introductory remarks	21
A.2 Air ions	21
A.3 Mobility and ion current.....	21
A.4 Neutralization current.....	21
A.5 Neutralization rate	22
A.6 Ion depletion and field suppression.....	22
A.7 Charged plate monitor and charge neutralization	22
A.8 Relationship between charged plate monitor decay time and actual object.....	23
A.9 Offset voltage	23
A.10 Preparation of test area	23
A.11 Ion transport in airflow	24
A.12 Obstruction of airflow around the charged plate monitor.....	24
A.13 Effect of “air blanket”	24
A.14 Sources of measurement error	25
A.14.1 Typical decay time variability	25
A.14.2 Plate isolation.....	25
A.14.3 Charging voltage	25
A.14.4 Materials near the plate	25
A.14.5 Other field-producing devices in test area.....	25
A.14.6 Effect of offset voltage on decay time	25
A.15 Importance of ionization equipment maintenance	26
Annex B (normative) Method of measuring the capacitance of an isolated conductive plate	27
B.1 Method	27
B.2 Equipment	27
B.3 Procedure	27
B.4 Example.....	27
B.5 Sources of error.....	28
B.5.1 Measuring equipment	28
B.5.2 Poor plate isolation.....	28
B.5.3 Objects in the environment	29
B.5.4 Stray capacitance	29
Annex C (informative) Safety considerations.....	30

C.1	General.....	30
C.2	Electrical.....	30
C.3	Ozone.....	30
C.4	Radioactive.....	30
C.5	X-ray.....	30
C.6	Installation	30
	Bibliography.....	31
	Figure 1 – Charged plate monitor components for non-contacting plate measurement	10
	Figure 2 – Charged plate monitor components for contacting plate measurement	10
	Figure 3 – Conductive plate detail for the non-contacting CPM	11
	Figure 4 – Conductive plate detail for the voltage follower CPM.....	11
	Figure 5 – Test locations for room ionization – AC grids and DC bar systems	13
	Figure 6 – Test locations for room ionization – Single polarity emitter systems	13
	Figure 7 – Test locations for room ionization – Dual DC line systems.....	14
	Figure 8 – Test locations for room ionization – Pulsed DC emitter systems	14
	Figure 9 – Test locations for vertical laminar flow hood – Top view	15
	Figure 10 – Test locations for vertical laminar flow hood – Side view	15
	Figure 11 – Test locations for horizontal laminar flow hood – Top view	16
	Figure 12 – Test locations for horizontal laminar flow hood – Side view	16
	Figure 13 – Test locations for benchtop ionizer – Top view	17
	Figure 14 – Test locations for benchtop ionizer – Side view	18
	Figure 15 – Test locations for overhead ionizer – Top view	18
	Figure 16 – Test locations for overhead ionizer – Side view	19
	Figure 17 – Test locations for compressed gas ionizer (gun or nozzle) – Side view.....	20
	Table 1 – Test set-ups and test locations/points (TP).....	12
	Table B.1 – Example measurement data	28

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) 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 61340-4-7 has been prepared by IEC technical committee 101: Electrostatics.

This second edition cancels and replaces the first edition, published in 2010, and constitutes a technical revision.

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

- the use of contacting plate voltage measurements in addition to the previous non-contacting plate voltage measurements has been added. Charged plate monitors (CPMs) using this technology have been in use in the industry for many years.

The text of this standard is also based on the following documents:

FDIS	Report on voting
101/521/FDIS	101/524/RVD

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

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

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 publication will remain unchanged until the stability date indicated on the IEC website 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.

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 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 may 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 a.c. electric fields;
- c) high-voltage corona from d.c. 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.