



DPC: 21/30433339 DC

BSI Group Headquarters

389 Chiswick High Road London W4 4AL

Tel: +44 (0)20 8996 9000

Fax: +44 (0)20 8996 7400

www.bsigroup.com

Date: 16 April 2021

Origin: International

Latest date for receipt of comments: 09 June 2021

Project No. 2021/00285

Responsible committee: GEL/101 Electrostatics

Interested committees:

Title: Draft BS EN 61340-4-7 Ed.3.0 Electrostatics. Part 4-7: Standard test methods for specific applications - Ionization.

Please notify the secretary if you are aware of any keywords that might assist in classifying or identifying the standard or if the content of this standard

- i) has any issues related to 3rd party IPR, patent or copyright
- ii) affects other national standard(s)
- iii) requires additional national guidance or information

WARNING: THIS IS A DRAFT AND MUST NOT BE REGARDED OR USED AS A BRITISH STANDARD. THIS DRAFT IS NOT CURRENT BEYOND 09 June 2021

This draft is issued to allow comments from interested parties; all comments will be given consideration prior to publication. No acknowledgement will normally be sent. **See overleaf for information on the submission of comments.**

No copying is allowed, in any form, without prior written permission from BSI except as permitted under the Copyright, Designs and Patent Act 1988 or for circulation within a nominating organization for briefing purposes. Electronic circulation is limited to dissemination by e-mail within such an organization by committee members.

Further copies of this draft may be purchased from BSI Shop <http://shop.bsigroup.com> or from BSI Customer Services, Tel: +44(0) 20 8996 9001 or email cservices@bsigroup.com. British, International and foreign standards are also available from BSI Customer Services.

Information on the co-operating organizations represented on the committees referenced above may be obtained from <https://standardsdevelopment.bsigroup.com/>.

Introduction

This draft standard is based on national and international discussions. Your comments on this draft are invited and will assist in the preparation of the consequent standard.

For international standards, comments will be reviewed by the relevant UK national committee before sending the consensus UK vote and comments to the international committee, which will then decide appropriate action. If the international standard is approved, it is usual for the text to be published as a British Standard.

For national standards, comments will be reviewed by the relevant UK national committee and the resulting standards published as a British Standard.

UK Vote

Please indicate whether you consider the UK should submit a negative (with supporting technical reasons) or positive vote on this draft. Please indicate if you are aware of any reason why this draft standard should not be published as a British Standard.

Submission of Comments

- **Annotated drafts are not acceptable and will be rejected.**
- All comments should be submitted online at <https://standardsdevelopment.bsigroup.com/>. You will need to register in order to comment.

Template for comments and secretariat observations

Date: xx/xx/20xx	Document: ISO/DIS xxxx
------------------	------------------------

1	2	(3)	4	5	(6)	7
MB	Clause No./ Subclause No./Annex (e.g. 3.1)	Paragraph/Figure/ Table/Note	Type of comment	Commend (justification for change) by the MB	Proposed change by the MB	Secretariat observations on each comment submitted
	3.1	Definition 1	ed	Definition is ambiguous and needs clarifying.	Amend to read '...so that the mains connector to which no connection...'	
	6.4	Paragraph 2	te	The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK.	Delete reference to UV photometer.	



101/629/CD

COMMITTEE DRAFT (CD)

PROJECT NUMBER: IEC 61340-4-7 ED3	
DATE OF CIRCULATION: 2021-04-16	CLOSING DATE FOR COMMENTS: 2021-07-09
SUPERSEDES DOCUMENTS: 101/621/RR	

IEC TC 101 : ELECTROSTATICS	
SECRETARIAT: Germany	SECRETARY: Mr Hartmut Berndt
OF INTEREST TO THE FOLLOWING COMMITTEES:	PROPOSED HORIZONTAL STANDARD: ☐ Other TC/SCs are requested to indicate their interest, if any, in this CD to the secretary.
FUNCTIONS CONCERNED: ☐ EMC ☐ ENVIRONMENT ☒ QUALITY ASSURANCE ☐ SAFETY	

This document is still under study and subject to change. It should not be used for reference purposes.

Recipients of this document are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

TITLE:

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

NOTE FROM TC/SC OFFICERS:

Copyright © 2021 International Electrotechnical Commission, IEC. All rights reserved. It is permitted to download this electronic file, to make a copy and to print out the content for the sole purpose of preparing National Committee positions. You may not copy or "mirror" the file or printed version of the document, or any part of it, for any other purpose without permission in writing from IEC.

CONTENTS

1		
2	FOREWORD	4
3	INTRODUCTION	6
4	1 Scope	7
5	2 Normative references	7
6	3 Terms and definitions	7
7	4 Test fixture and instrumentation	9
8	5 Specific requirements for equipment categories	11
9	5.1 Specific requirements for all ionization equipment	11
10	5.2 Room ionization	12
11	5.3 Laminar flow hood ionization	14
12	5.4 Work surface ionization	16
13	5.5 Compressed gas ionizers – Guns and nozzles	18
14	Annex A (informative) Theoretical background and additional information on the	
15	standard test method for the performance of ionizers	20
16	A.1 Introductory remarks	20
17	A.2 Air ions	20
18	A.3 Mobility and ion current	20
19	A.4 Neutralization current	20
20	A.5 Neutralization rate	21
21	A.6 Ion depletion and field suppression	21
22	A.7 Charged plate monitor and charge neutralization	21
23	A.8 Relationship between charged plate monitor decay time and actual object	22
24	A.9 Offset voltage	22
25	A.10 Preparation of test area	22
26	A.11 Ion transport in airflow	23
27	A.12 Obstruction of airflow around the charged plate monitor	23
28	A.13 Effect of “air blanket”	23
29	A.14 Sources of measurement error	24
30	A.14.1 Typical decay time variability	24
31	A.14.2 Plate isolation	24
32	A.14.3 Charging voltage	24
33	A.14.4 Materials near the plate	24
34	A.14.5 Other field-producing devices in test area	24
35	A.14.6 Effect of offset voltage on decay time	24
36	A.15 Importance of ionization equipment maintenance	25
37	Annex B (normative) Method of measuring the capacitance of an isolated conductive	
38	plate	26
39	B.1 Method	26
40	B.2 Equipment	26
41	B.3 Procedure	26
42	B.4 Example	27
43	B.5 Sources of error	27
44	B.5.1 Measuring equipment	27
45	B.5.2 Poor plate isolation	27
46	B.5.3 Objects in the environment	28
47	B.5.4 Stray capacitance	28
48	Annex C (informative) Safety considerations	29

49	C.1	General.....	29
50	C.2	Electrical.....	29
51	C.3	Ozone.....	29
52	C.4	Radioactive.....	29
53	C.5	X-ray.....	29
54	C.6	Installation	29
55		Bibliography.....	33
56			
57		Figure 1 – Charged plate monitor components for non-contacting plate measurement	10
58		Figure 2 – Charged plate monitor components for contacting plate measurement	10
59		Figure 3 – Conductive plate detail for the non-contacting CPM	11
60		Figure 4 – Conductive plate detail for the voltage follower CPM.....	11
61		Figure 5 – Test locations for room ionization – AC grids and DC bar systems	13
62		Figure 6 – Test locations for room ionization – Single polarity emitter systems	13
63		Figure 7 – Test locations for room ionization – Dual DC line systems.....	14
64		Figure 8 – Test locations for room ionization – Pulsed DC emitter systems	14
65		Figure 9 – Test locations for vertical laminar flow hood – Top view	15
66		Figure 10 – Test locations for vertical laminar flow hood – Side view	15
67		Figure 11 – Test locations for horizontal laminar flow hood – Top view	16
68		Figure 12 – Test locations for horizontal laminar flow hood – Side view	16
69		Figure 13 – Test locations for benchtop ionizer – Top view	17
70		Figure 14 – Test locations for benchtop ionizer – Side view	17
71		Figure 15 – Test locations for overhead ionizer – Top view	18
72		Figure 16 – Test locations for overhead ionizer – Side view	18
73		Figure 17 – Test locations for compressed gas ionizer (gun or nozzle) – Side view.....	19
74			
75		Table 1 – Test set-ups and test locations/points (TP).....	12
76		Table B.1 – Example measurement data	27
77			
78			

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

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

- To be completed after text is finalised.

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

FDIS	Report on voting
101/xxx/FDIS	101/xxx/RVD

132
133 Full information on the voting for the approval of this standard can be found in the report on
134 voting indicated in the above table.

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

136 A list of all parts in the IEC 61340 series, published under the general title *Electrostatics*, can
137 be found on the IEC website.

138 The committee has decided that the contents of this publication will remain unchanged until
139 the stability date indicated on the IEC website under "<http://webstore.iec.ch>" in the data
140 related to the specific publication. At this date, the publication will be

- 141 • reconfirmed,
142 • withdrawn,
143 • replaced by a revised edition, or
144 • amended.

145

146

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.

ELECTROSTATICS –

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

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.

CAUTION: Procedures and equipment described in this document can expose personnel to hazardous electrical and non-electrical conditions. Safety requirements for electrical equipment for measurements are given in IEC 61010-1. Users of this document are responsible for selecting equipment that complies with applicable laws, regulatory codes and both external and internal policy. Users are cautioned that this document cannot replace or supersede any requirements for personnel safety.

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 terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://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 and/or neutralization 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/neutralization properties of products or materials

Note 1 to entry: This note applies to the French language only.

3.5**compressed gas ionizer**

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

Note 1 to entry: This type of ionizer may 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 rate**

decrease of charge or voltage per unit time

3.8**decay time**

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

3.9**emitter**

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

3.10**horizontal laminar flow**

non-turbulent airflow in a horizontal direction

3.11**ionizer**

device designed to generate positive and/or negative air ions

3.12**isolated conductor**

non-grounded conductor

3.13**laminar flow hood ionization**

device or systems that provide local area ionization coverage in vertical or horizontal laminar flow hoods or benches

3.14**non-contacting voltage measurement**

measurement technique using an electrostatic fieldmeter or voltmeter to monitor the voltage induced on an isolated conductive plate where there is no direct connection from the measurement sensor to the isolated conductive plate

3.15**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

3.16**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

3.17**room ionization**

ionization systems that provide large area coverage with air ions

3.18**work surface ionization**

ionization devices or systems used to control static charges at a work surface

Note 1 to entry: This type includes benchtop ionizers, overhead work surface ionizers and laminar flow hood ionizers.

3.19**vertical laminar flow**

non-turbulent airflow in a vertical direction

3.20**contacting voltage measurement**

measurement technique using high input impedance circuitry used to monitor the voltage induced on an isolated conductive plate where there is a direct connection from the circuitry to the conductive plate

4 Test fixture and instrumentation

4.1 The instrument described in this document to make performance measurements on air ionization equipment is the charged plate monitor (CPM); refer to Figure 1 and Figure 2. The conductive plate shall be $(15,0 \pm 0,1)$ cm $\times$ $(15,0 \pm 0,1)$ cm and the total capacitance of the test circuit, with plate, while the instrument is in its normal operating mode, shall be $20 \text{ pF} \pm 2 \text{ pF}$ (refer to Annex B). See Figure 3 and Figure 4. The instrument described in this document may also be used for compliance verification of air ionizers.

4.2 For the isolated conductive plate design shown in Figure 3, there shall be no objects, grounded or otherwise, closer than dimension "A" of the conductive plate, except the supporting insulators or plate voltage contacts, as shown in Figure 3 (refer to Annex B). For the conductive plate assembly shown in Figure 4, there shall be no objects, grounded or otherwise, within 2,54 cm of the plate assembly in any direction, other than a support structure (e.g. a tripod) located below the ground plate of the assembly.