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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

IEC 61340-4-7:2017-01(en-fr)

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ELECTROSTATICS –

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

FOREWORD

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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- withdrawn,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.

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. 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

There are no normative references in this document.

3 Terms and definitions

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

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- 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

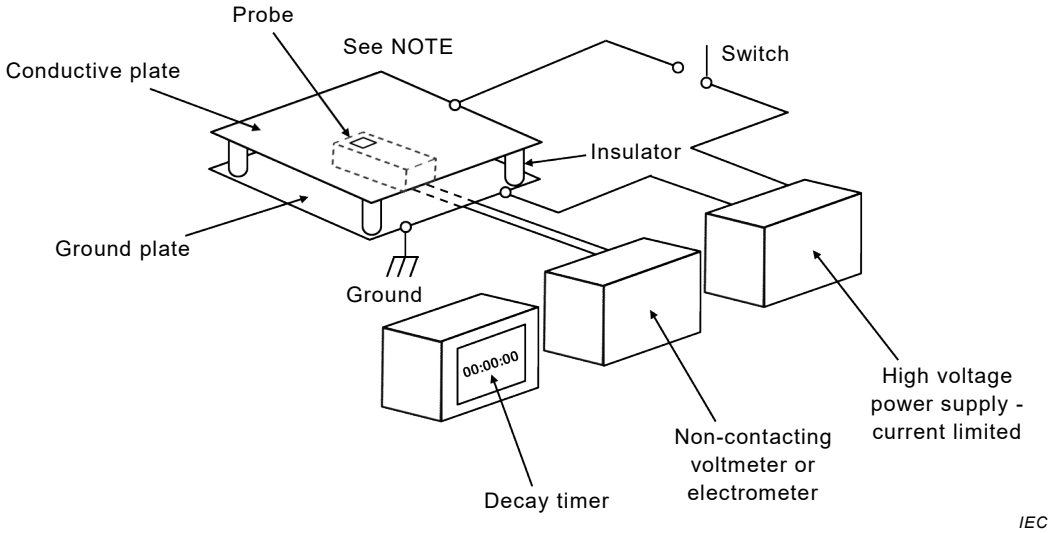
4.1 The instrument described in this document to make performance measurements on air ionization equipment is the charged plate monitor (CPM); refer to Figure 1 and Figure 2. The conductive plate shall be (15,0 ± 0,1) cm × (15,0 ± 0,1) cm and the total capacitance of the test circuit, with plate, while the instrument is in its normal operating mode, shall be 20 pF ± 2 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.

4.3 The conductive plate, when charged to the desired test voltage, shall not decay more than 10 % of the test voltage within 5 min, in the absence of ionization.

4.4 The voltage on the conductive plate shall be monitored in such a way that the system conforms to 4.1, 4.2 and 4.3. The response time of the monitoring device shall be sufficient to accurately measure changing plate voltages.

For safety reasons (see Clause C.1), the voltage source used to charge the plate should be current limited.



NOTE See Figure 3.

Figure 1 – Charged plate monitor components for non-contacting plate measurement

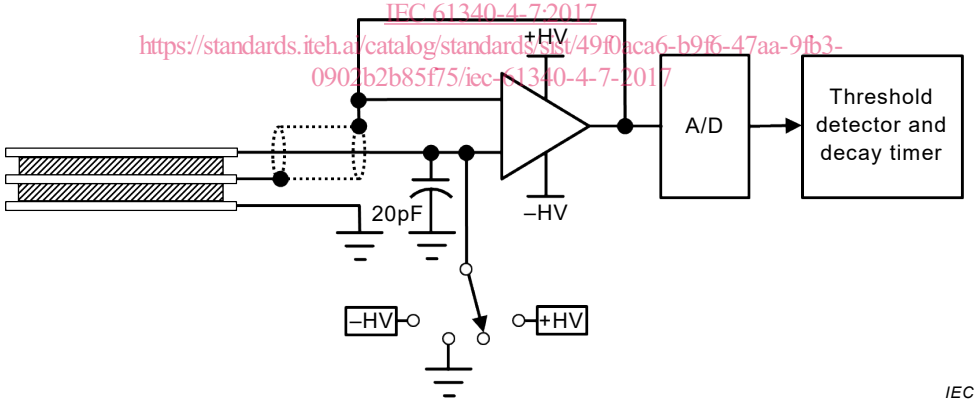


Figure 2 – Charged plate monitor components for contacting plate measurement

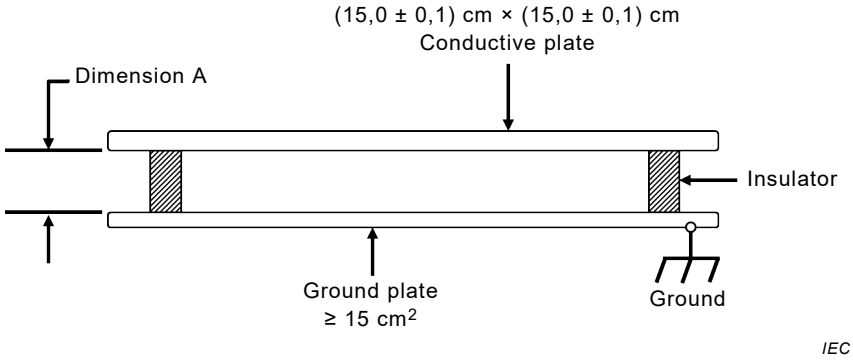


Figure 3 – Conductive plate detail for the non-contacting CPM

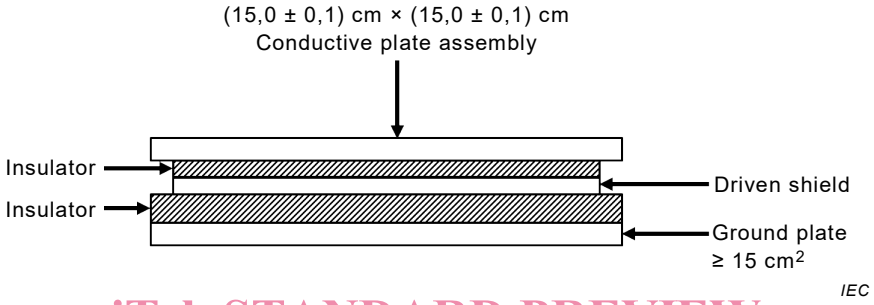


Figure 4 – Conductive plate detail for the voltage follower CPM

5 Specific requirements for equipment categories

5.1 Specific requirements for all ionization equipment

For the types of ionization equipment listed in 5.2, 5.3, 5.4 and 5.5, the following specific requirements apply:

a) Decay time test – The conductive plate of the test fixture shall be charged to an initial test voltage and allowed to decay to 10 % of the initial test voltage. The time required shall be monitored and recorded for both polarities of initial charge. This time is referred to as the decay time (refer to 4.1 and Figure 1).

b) Offset voltage test – The conductive plate shall be momentarily grounded to remove any residual charges and to verify zero of the voltage monitoring device. The plate is then monitored within the ionized environment, per the procedure described for each equipment category. The resulting observed voltage is referred to as the offset voltage.

c) Locations – The decay time and offset voltage shall be measured for each test location/point (TP) described in the test location figures (see Table 1).

d) Same conditions – Decay time and offset voltage shall be measured under the same conditions without any equipment adjustments. If ionizers from different categories are to be compared, the same test voltages shall be used for all tests.

e) Peak offset voltage – In the case of pulsed ionizers, offset voltage shall be measured and reported in peak values using the test equipment described in 4.1.

f) Other parameters – Application specific parameters such as humidity, temperature, air speed, etc., shall be recorded.

Table 1 – Test set-ups and test locations/points (TP)

Equipment category	Figure references	Number of test locations	Offset voltage measurement time interval	Charged plate initial voltage (both polarities) V
Room ionization				
Grids, AC	5	2	(1 to 5) min	1 000
Bars, pulsed and DC	5	2	(1 to 5) min	1 000
Single polarity emitter	6	3	(1 to 5) min	1 000
Dual DC line	7	3	(1 to 5) min	1 000
Pulsed DC emitter	8	2	(1 to 5) min	1 000
Laminar flow hood				
Vertical	9 and 10	8	(1 to 5) min	1 000
Horizontal	11 and 12	6	(1 to 5) min	1 000
Work surface ionization				
Benchtop	13 and 14	12	(1 to 5) min	1 000
Overhead	15 and 16	12	(1 to 5) min	1 000
Compressed gas ionization				
Guns and nozzles	17	1	10 s to 1 min	1 000

5.2 Room ionization

5.2.1 The area around the charged plate monitor should be cleared for a horizontal distance of 1,5 m in all directions. The ionization system should be operated for a minimum of 30 min to stabilize conditions in the test area.

5.2.2 To avoid affecting the test, the test technician should be grounded and stand outside the 1,5 m cleared area.

5.2.3 Decay time from a 1 000 V initial voltage to a 100 V final voltage shall be measured for both positive (+) and negative (-) polarities.

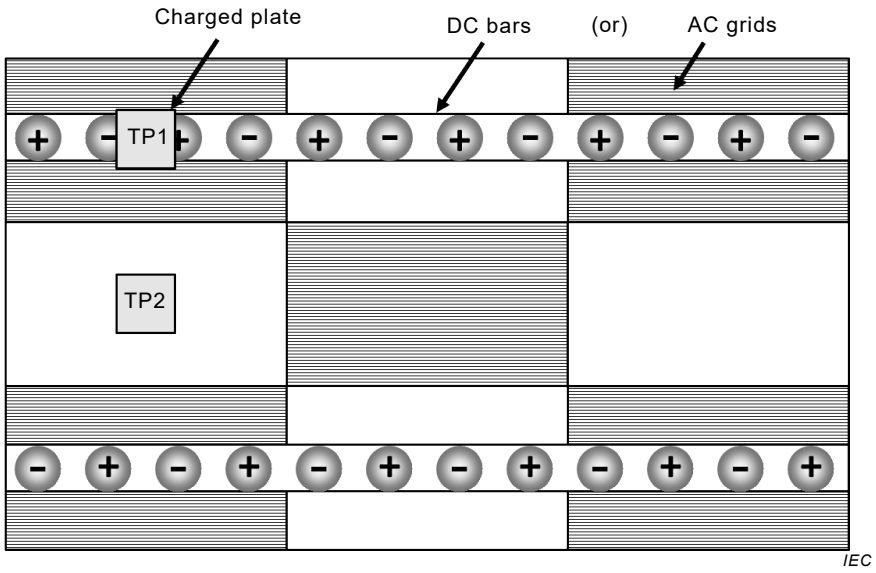
5.2.4 The air speed at the test location shall be recorded.

5.2.5 Measurements should be taken with the charged plate monitor at a distance of 1,5 m from the ionizer under test. Since installed ionizer heights can vary, a consistent measurement height should be selected for the evaluation of different systems. This height and the ionizer mounting height shall be recorded in the test results.

5.2.6 The minimum number of test locations is determined by the type of system (see Table 1 and refer to Figures 5 through 8.)

5.2.7 Decay time as described in 5.1, point a), shall be measured at each test location.

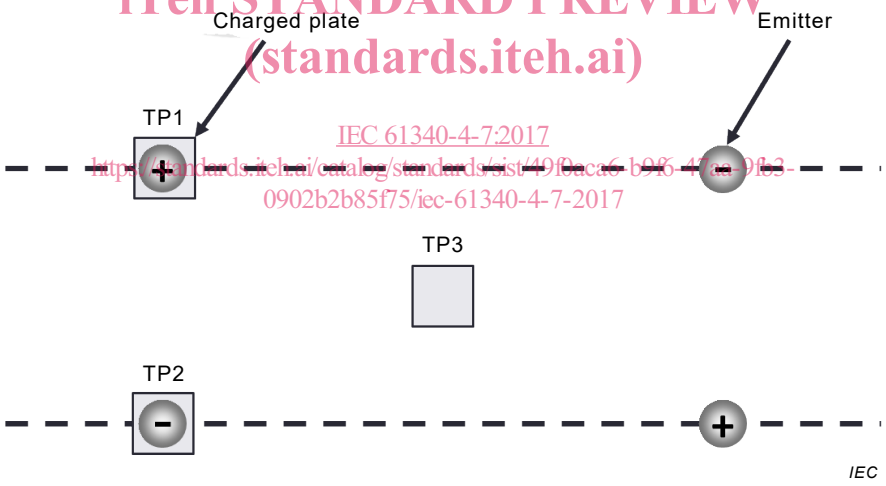
Offset voltage as described in 5.1, points b) and e) shall be determined at each test location. Offset voltage shall be measured after a period of at least 1 min to allow the reading to stabilize (5 min maximum).



NOTE 1 Example for AC grids (shaded areas, less than 100 % coverage) and pulsed or steady-state DC bars.

NOTE 2 TP1 is directly under grid or bar while TP2 is centred between grids or bars.

Figure 5 – Test locations for room ionization – AC grids and DC bar systems



Three measurement locations required.

Figure 6 – Test locations for room ionization – Single polarity emitter systems