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

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

IEC 61340-4-7:2025-08(en-fr)

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Electrostatics -
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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.

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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.

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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.

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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.

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

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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*

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3 Terms and definitions

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- 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

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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

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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

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3.15
room ionization
ionization system that provides large area coverage with air ions

3.16
worksurface ionization
ionization device or system used to control static charges on a worksurface

Note 1 to entry: Worksurface ionizers include benchtop ionizers, overhead worksurface ionizers and laminar flow hood ionizers.

3.17
vertical laminar flow
non-turbulent airflow in a vertical direction

4 Test fixture and instrumentation

WARNING – 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. See Annex C for safety considerations.

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 as measured per Annex B. See Figure 3 and Figure 4. The instrument described in this document can also be used for compliance verification of air ionizers.

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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 2,5 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.

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

The voltage on the conductive plate shall be monitored with a response time sufficient to accurately measure changing plate voltages. Changing plate voltages are a function of the ionization technology type being monitored.

For safety reasons (see Clause C.1), the voltage source used to charge the conductive plate should be current limited. The voltage source used to charge the conductive plate shall meet the requirements of IEC 61010-1.

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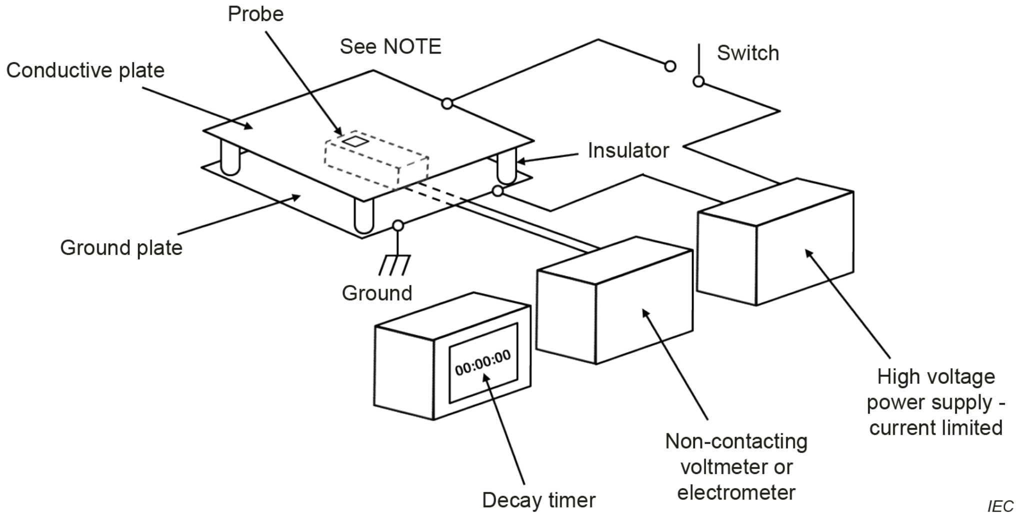
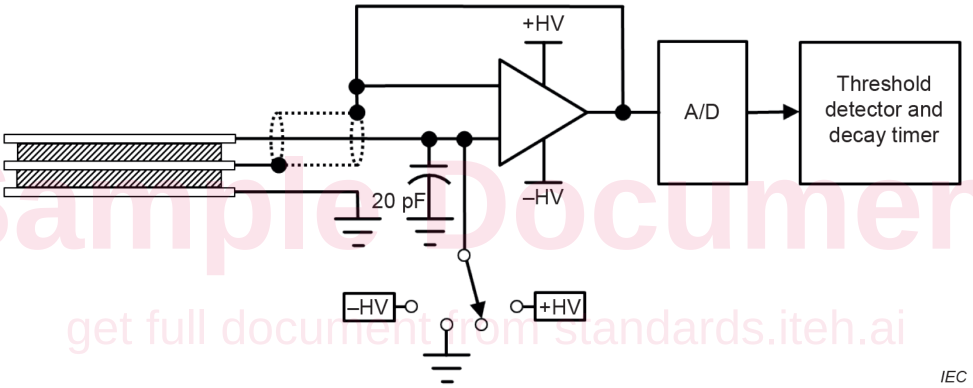


NOTE See Figure 3 for a detailed drawing of the non-contacting CPM.

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



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NOTE See Figure 4 for a detailed drawing of the contacting CPM.

Figure 2 – Charged plate monitor components for contacting plate measurement

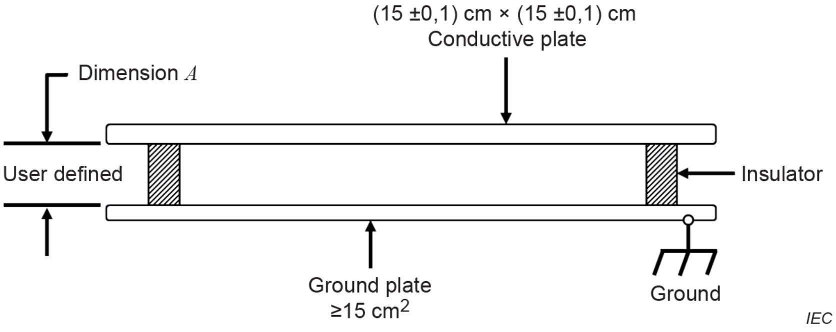

Figure 3 – Conductive plate detail of the non-contacting CPM

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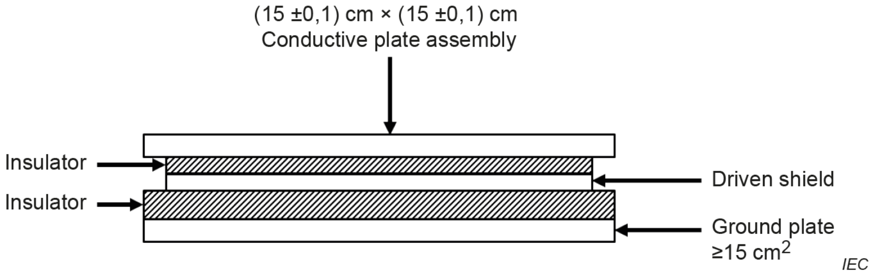

Figure 4 – Conductive plate detail of the voltage follower CPM

5 Specific requirements for equipment categories

5.1 Specific requirements for all ionization equipment

See Annex A for information regarding theoretical background and additional information on the standard test method for the performance of ionizers.

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 charging voltage, which shall be higher than the initial test voltage. The time required for the voltage to decay from the initial test voltage to 10 % of that value shall be recorded (refer to Clause 4 and Figure 1). Measurements shall be made with both polarities of charging voltage.

b) Offset voltage test – The conductive plate shall be momentarily grounded to remove any residual charges and to verify the zero setting 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 and recorded for each test location and 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.

e) Peak offset voltage – In the case of pulsed ionizers, offset voltage shall be measured and recorded in peak values using the test equipment described in Clause 4.

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

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

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

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5.2 Room ionization

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.

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

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

The air speed at the test location shall be recorded.

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.

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

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

Offset voltage as described in 5.1 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).

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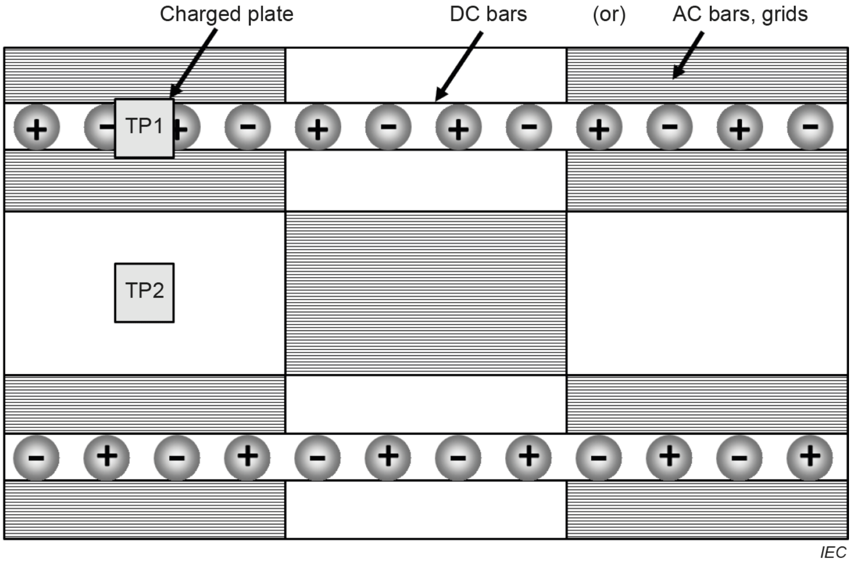

NOTE 1 For AC bars or grids, the shaded areas represent areas where the coverage is less than 100 %.

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

NOTE 3 For AC bars and grids, a single emitter alternating between +/− polarity is used.

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

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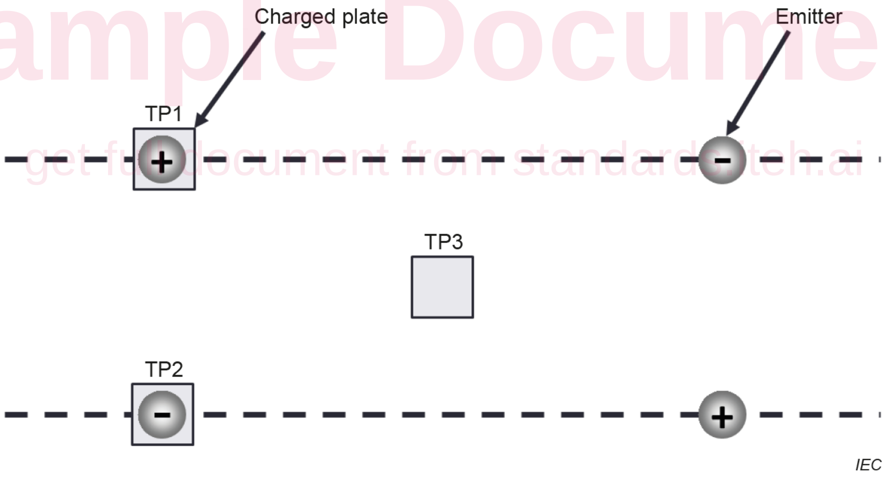
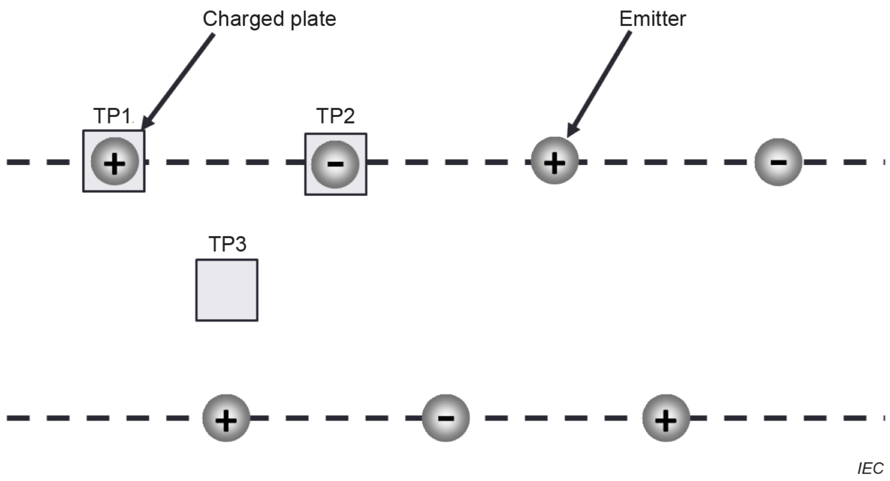


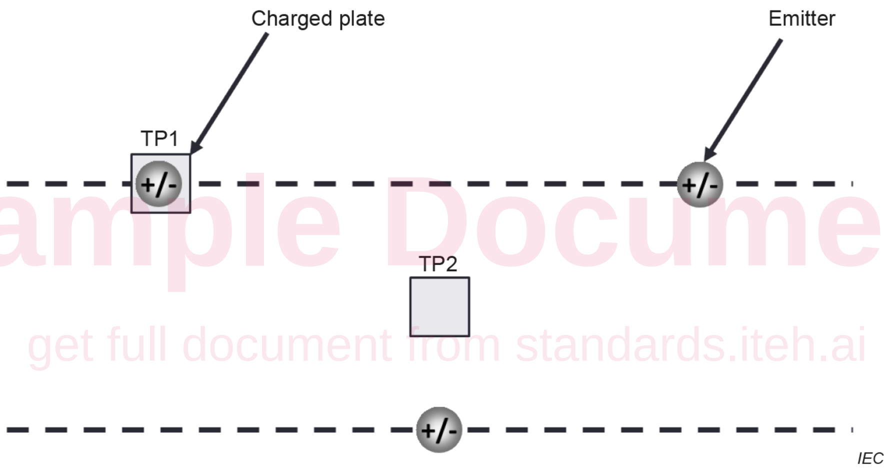
Three measurement locations required.

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



Three measurement locations required.

Figure 7 – Test locations for room ionization – Two DC-line systems



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Two measurement locations required.

Figure 8 – Test locations for room ionization – Pulsed DC emitter systems

5.3 Laminar flow hood ionization

The test should be performed on a surface that does not contain obstructions to airflow. Unless otherwise specified, the test surface should be static dissipative or conductive and grounded.

To avoid affecting the test, the test technician should be grounded.

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

The air speed at test location TP4, as shown in Figure 9 and Figure 11, shall be recorded.

For a vertical laminar flow hood, the test set-up is shown in Figure 9 and Figure 10. Data shall be taken at test positions TP1 through TP8 as shown in Figure 9.

For a horizontal laminar flow hood, the test set-up is shown in Figure 11 and Figure 12. Data shall be taken at test positions TP1 through TP6 as shown in Figure 11.

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