ANSI/ESD SP3.3-2016

ESD Association Standard for the Protection of Electrostatic Discharge Susceptible Items - Periodic Verification of Air Ionizers

ANSI/ESD SP3.3-2016

ANSI/ESD SP3.3-2016
Reaffirmation of ANSI/ESD SP3.3-2012

For the Protection of Electrostatic Discharge Susceptible Items -

Periodic Verification of Air Ionizers

Electrostatic Discharge Association
7900 Turin Road, Bldg. 3
Rome, NY 13440

An American National Standard
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ESD Association Standard Practice for the Protection of Electrostatic Discharge Susceptible Items -

Periodic Verification of Air Ionizers

Approved September 23, 2016
EOS/ESD Association, Inc.

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FOREWORD

Grounding of conductive and static dissipative materials, personnel, and equipment is the primary method used to limit static charge for the protection of electrostatic discharge susceptible items in the work environment. A static control program may include air or nitrogen ionization techniques to mitigate charge on isolated conductors (conductors that are not grounded), and insulating materials (e.g., most common plastics).

The ionization standard test method, ANSI/ESD STM3.1, defines test methods and instrumentation, the Charged Plate Monitor (CPM), for making discharge (charge neutralization) time and offset voltage (ion balance) measurements of air ionization equipment in defined environments. These standard test methods are applicable for product qualification, selecting an air ionizer for a specific application, as well as subsequently determining that the incoming product meets the selection criteria.

The test instrumentation and methods of the standard test method are also usable for compliance verification of ionizer performance per ESD TR53. ANSI/ESD STM3.1 also contains additional information regarding ionizer physics, ionizer measurement issues, and sources of measurement error. The user is advised to review ANSI/ESD STM3.1 before using the procedures described in this standard practice[1].

Detailed performance testing under laboratory conditions may be required during selection, product qualification, and acceptance testing due to the variety of environments in which ionizers are used. Periodic and compliance verification, however, are most often performed under actual use conditions. In general, all ionizers must be tested, rather than a sampling of product types or incoming lots.

Periodic verification procedures should also be part of the initial acceptance process to provide a baseline for comparison with future measurements. Compliance verification may be necessary to meet audit requirements.

ANSI/ESD STM3.1 is sufficient to be used for product qualification, selection or acceptance testing, as well as for compliance verification. However, these procedures require a typically expensive test instrument and a substantial amount of time to test each ionizer. The cost of this testing is often unacceptable for purposes of periodic verification.

There is a need for a simpler verification procedure using less expensive, preferably portable, test equipment. Periodic verification provides a relative measure of performance and can indicate when it is necessary to check the calibration of the ionizer under test with the CPM (refer to ANSI/ESD STM3.1).

This standard practice presents a test procedure and instrumentation for periodic verification of ionizers contained in the existing ionization standard test method ANSI/ESD STM3.1. The test procedure can be carried out under actual use conditions and is capable of rapidly demonstrating ionizer performance. Discharge times and offset voltage testing contained in the ionization standard test method were adapted for this periodic test procedure. It is important that a simplified verification procedure correlate reasonably with CPM test results.

The objective of the test procedure described in this document is to identify if a significant change in ionizer performance has occurred. The test setups proposed 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 setups different from those described in this standard practice. For purposes of periodic verification, it is important that ionizers are tested in their normal operating configuration. Users of this standard practice should

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[1] **ESD Association Standard Practice:** A procedure for performing one or more operations or functions that may or may not yield a test result. Note, if a test result is obtained it may not be reproducible.

be prepared to adapt the test procedure and setups as required to produce meaningful data in their own application of ionizers.

Similarly, the test procedure and conditions chosen in this standard practice 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 an agreement between the user and manufacturer of the ionizer in each application. Compliance with these specifications should be demonstrated during product qualification or selection and acceptance testing of the ionizers.

Users of this standard practice will be able to establish baseline performance in the actual use location for their own application of ionizers. At any time in the future, using the same procedures in this standard practice, the user will be able to verify whether or not the ionizer is providing a comparable level of performance. The user will need to decide the extent of the data required for each application.

This standard practice was originally designated ESD SP3.3-2000 and approved on February 6, 2000. ANSI/ESD SP3.3-2006 was a reaffirmation, re-designation of ESD SP3.3-2000 and approved on June 11, 2006. ANSI/ESD SP3.3-2016 is a reaffirmation of ANSI/ESD SP3.3-2012 and was approved on September 23, 2016.

At the time ANSI/ESD SP3.3-2016 was prepared, the 3.0 Ionization Subcommittee had the following members:

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1.0 PURPOSE AND SCOPE

1.1 Purpose

This standard practice provides test procedures for periodic verification of the performance of air ionization equipment and systems (ionizers).

1.2 Scope

This standard practice establishes measurement procedures, under recommended conditions, to periodically determine offset voltage (ion balance) and discharge (charge neutralization) times for ionizers in their actual use locations. This standard practice does not include measurements of electromagnetic interference (EMI), or uses of ionizers in connection with ordnance, flammables, explosive items, or electrically initiated explosive devices.

2.0 REFERENCED PUBLICATIONS

Unless otherwise specified, the following documents of the latest issue, revision or amendment form a part of this standard to the extent specified herein:

ESD ADV 1.0, ESD Association's Glossary of Terms[2]

ANSI/ESD STM3.1, Ionization[2]

3.0 DEFINITIONS

The terms used in the body of this document are in accordance with the definitions found in ESD ADV1.0, ESD Association's Glossary of Terms available for complimentary download at www.esda.org.

4.0 PERSONNEL SAFETY

THE PROCEDURES AND EQUIPMENT DESCRIBED IN THIS DOCUMENT MAY EXPOSE PERSONNEL TO HAZARDOUS 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.

GROUND FAULT CIRCUIT INTERRUPTERS (GFCI) AND OTHER SAFETY PROTECTION SHOULD BE CONSIDERED WHEREVER PERSONNEL MIGHT COME INTO CONTACT WITH ELECTRICAL SOURCES.

ELECTRICAL HAZARD REDUCTION PRACTICES SHOULD BE EXERCISED AND PROPER GROUNDING INSTRUCTIONS FOR EQUIPMENT SHOULD BE FOLLOWED.

THE RESISTANCE MEASUREMENTS OBTAINED THROUGH THE USE OF THIS TEST METHOD SHALL NOT BE USED TO DETERMINE THE RELATIVE SAFETY OF PERSONNEL EXPOSED TO HIGH AC OR DC VOLTAGES.

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[2] EOS/ESD Association, Inc., 7900 Turin Road, Bldg. 3, Rome, NY 13440, 315-339-6937, www.esda.org

5.0 TEST FIXTURE AND INSTRUMENTATION

The following sections describe the instrumentation required for periodic verification of air ionization equipment and systems (ionizers). The test fixture uses an isolated conductive plate for air ion collection. The instrumentation may consist of separate components (high voltage [HV] charging source, voltage monitor, voltage threshold detector and timer), or these components may be integrated into a single instrument. A Charged Plate Monitor (CPM) as described in ANSI/ESD STM3.1 may also be used for periodic and compliance verification. Correlation of the instrumentation used in this document with the CPM defined in STM3.1 is recommended. See Annex B for additional information.

The test fixture is to consist of an isolated conductive plate separated from a ground plate on insulating standoff(s). Additional instrumentation is used to charge the isolated conductive plate and monitor the voltage (See Figures 1 and 2).

A voltage source that provides a voltage in excess of the initial test voltage of each polarity is required to charge the isolated conductive plate of the test fixture. The voltage source should be current limited so as to meet the requirements of Section 4.0 - Personnel Safety.

The voltage on the isolated conductive plate shall be monitored in such a way that, when in the absence of ionization, the isolated conductive plate voltage shall not decay more than 10% of the initial test voltage within one minute. The response time of the monitoring device shall be sufficient to accurately measure changing voltages.

A timer or other appropriate means should be used to measure the discharge times.

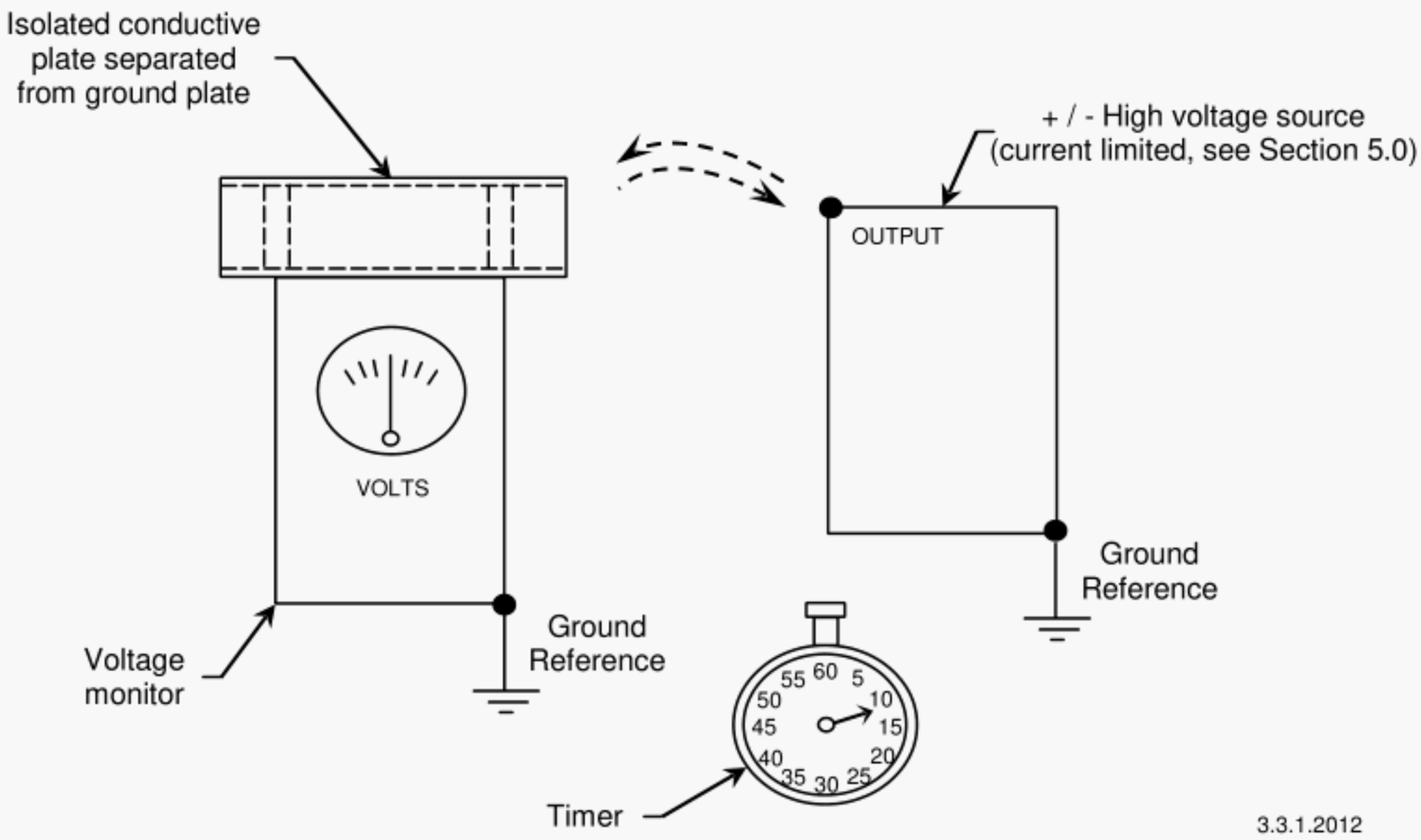


Figure 1: Example Test Fixture and Instrumentation

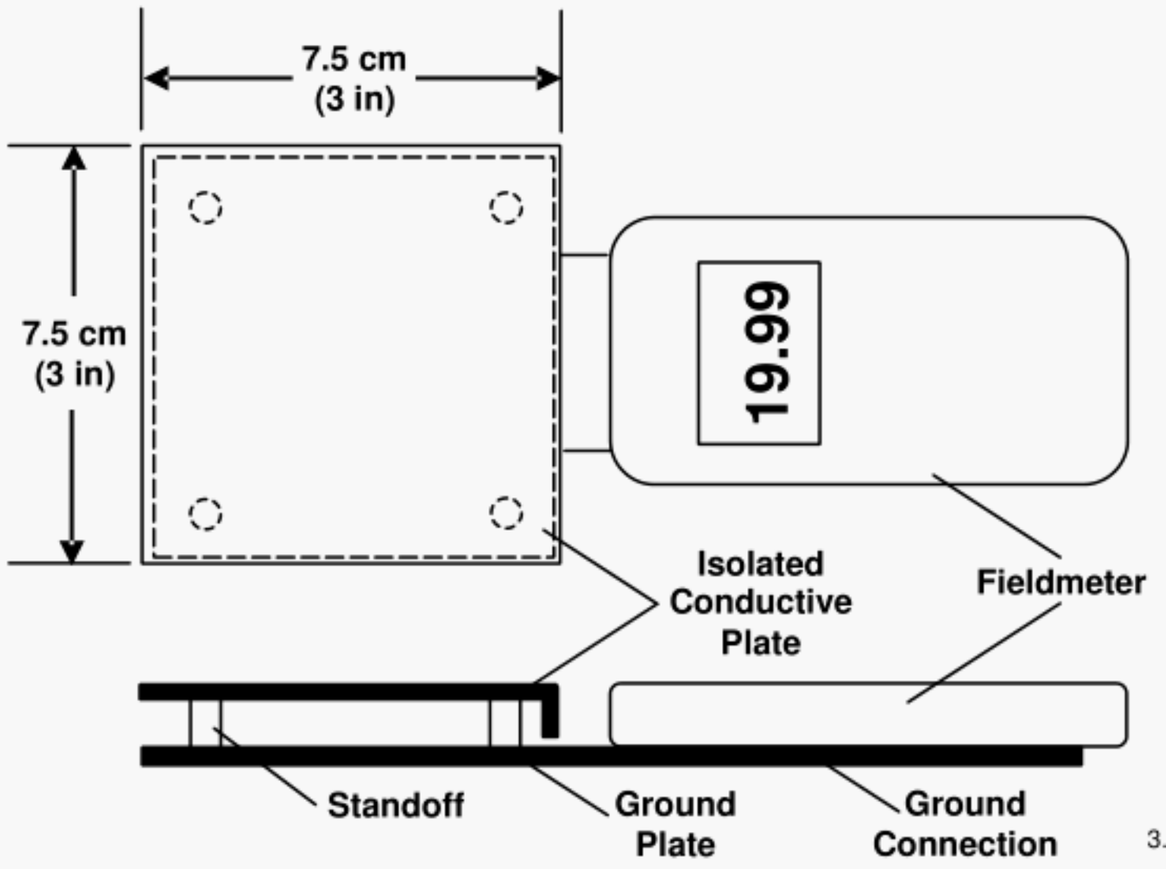


Figure 2: Example of a Test Fixture with 7.5 cm x 7.5 cm (3 inch x 3 inch) Plate

6.0 GENERAL MEASUREMENT PROCEDURE

Each ionization application or installation may require a different measurement procedure. Initial and final test voltages should be documented and may be changed if required. The actual measurement procedures and parameters (i.e., equipment, test voltages, test fixture distance and location, air velocity, fan speed settings, compressed gas pressure) should be documented and attached to the test data for use during subsequent periodic verifications. Procedures should be a part of the initial acceptance process to provide baseline data for comparison with future measurements. A schedule should be established for performing periodic verification.

The following test steps are common elements to the periodic verification of all types of ionizers.

6.1 Setup

Assess the test area after initial ionizer installation. Metal objects or obstructions to airflow are to be noted, but are not to be removed from the test area. The documented test parameters and test results from initial testing will be used for comparison during subsequent periodic verification.

The test fixture may be installed within the area to be measured, or it may be held by a grounded test technician. Ground the test fixture per the manufacturer's instructions.

6.2 Discharge Time

The isolated conductive plate shall be momentarily grounded to remove any residual charge and to verify zero of the voltage monitoring device. Charge the isolated conductive plate to a value greater (e.g., ± 1,200 to 1,500 volts) than the initial test voltage (e.g., ± 1,000 volts) and allow it to discharge to the final test voltage (e.g., ± 100 volts) while in the presence of ionization. Monitor and record the time required.

The discharge time measurement begins when the isolated conductive plate voltage has decayed to the initial test voltage and stops when the isolated conductive plate voltage has decayed to the final test voltage. A timer or other suitable device should be used for the discharge time measurement.

Repeat the discharge time measurement for the opposite polarity.

NOTE: For the purpose of making measurements that correlate to those made with a CPM as described in ANSI/ESD STM3.1, alternative initial and final test voltages may be used.

6.3 Offset Voltage

The isolated conductive plate shall be momentarily grounded to remove any residual charge and to verify zero of the voltage monitoring device. The isolated conductive plate is placed within the ionized environment and monitored until the reading stabilizes or achieves an average value (for non-pulsed ionizers). Record the offset voltage.

In the case of pulsed ionizers, measure and report offset voltage in peak values for both polarities.

7.0 SPECIFIC PERIODIC VERIFICATION PROCEDURES FOR IONIZERS

The following sections recommend test locations and test procedures for the ionizers described in ionization standard test method ANSI/ESD STM3.1.

7.1 Room Ionization

Example test setups for performing periodic verification of room ionizers are shown in Figures 3 and 7 (AC Grid Ionizers), Figures 4 and 7 (AC, Steady DC or Pulsed DC Bar Ionizers), Figures 5 and 7 (Discrete Emitter DC Ionizers), and Figures 6 and 7 (Pulsed DC Ionizers).

Measurements should be made under the ionizer at normal work height (e.g., 90 cm [36 inches], see Figure 7), as appropriate. When establishing the measurement location, consideration should be given to the location of critical processes and product placement in relationship to the ionizer source. Offset voltage should be measured after reading stabilizes (maximum 5 minutes).

NOTE: When long ionizer stabilization times are anticipated (e.g., with low airflow room ionization systems), the self-decay time of section 6.2 should be correspondingly longer, or it is recommended that the CPM of STM3.1 be used for making periodic verification measurements.

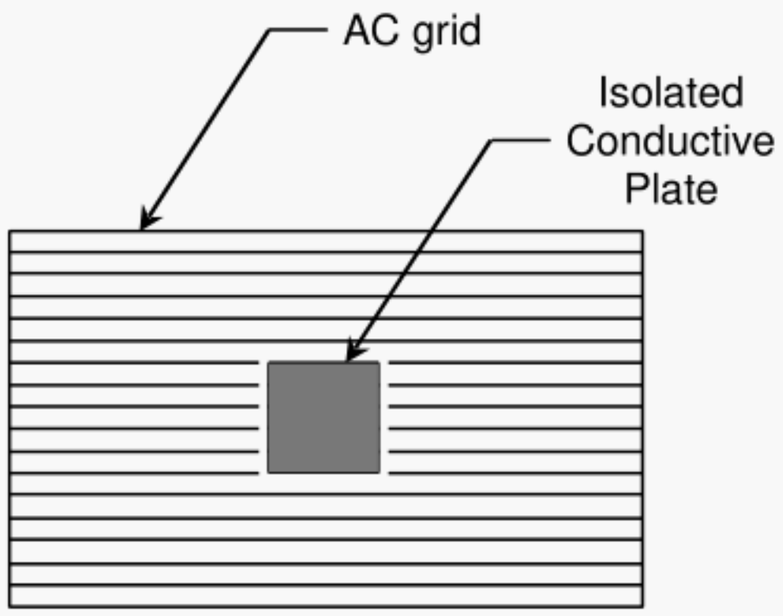


Figure 3: Room Ionization – AC Grid Ionizer

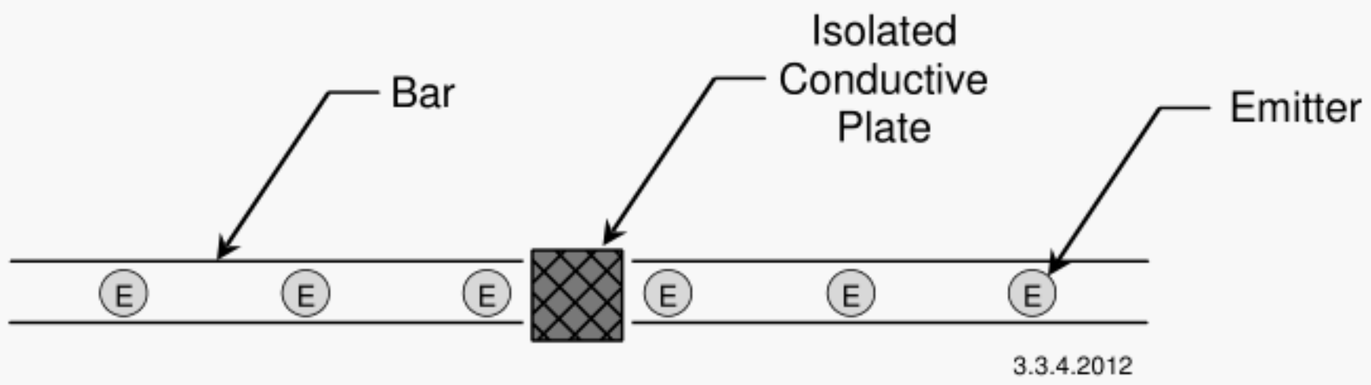


Figure 4: Room Ionization – AC, Steady DC, or Pulsed DC Bar Ionizer

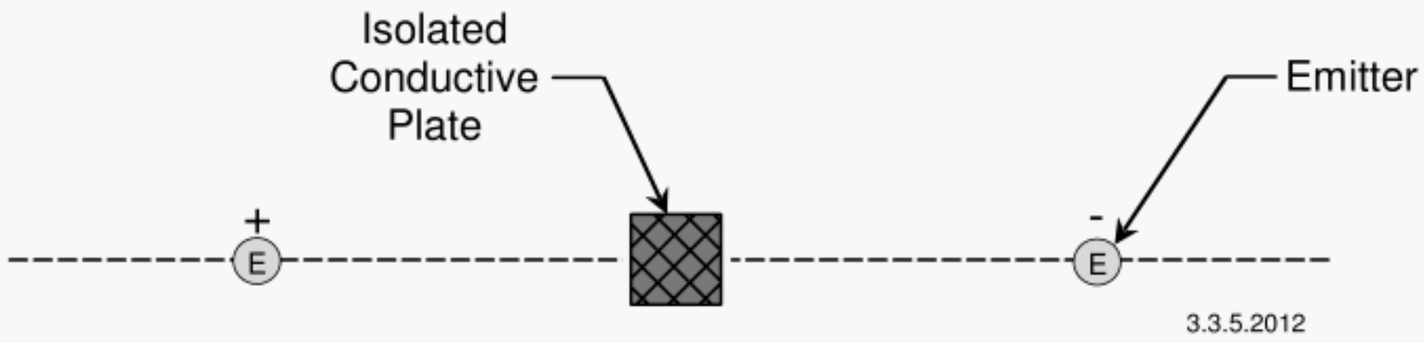


Figure 5: Room Ionization – Discrete Emitter DC Ionizer

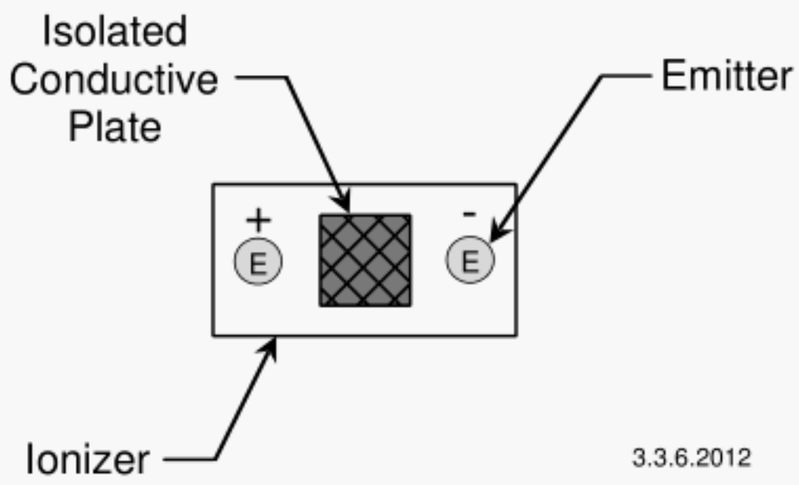


Figure 6: Room Ionization – Pulsed DC Ionizer

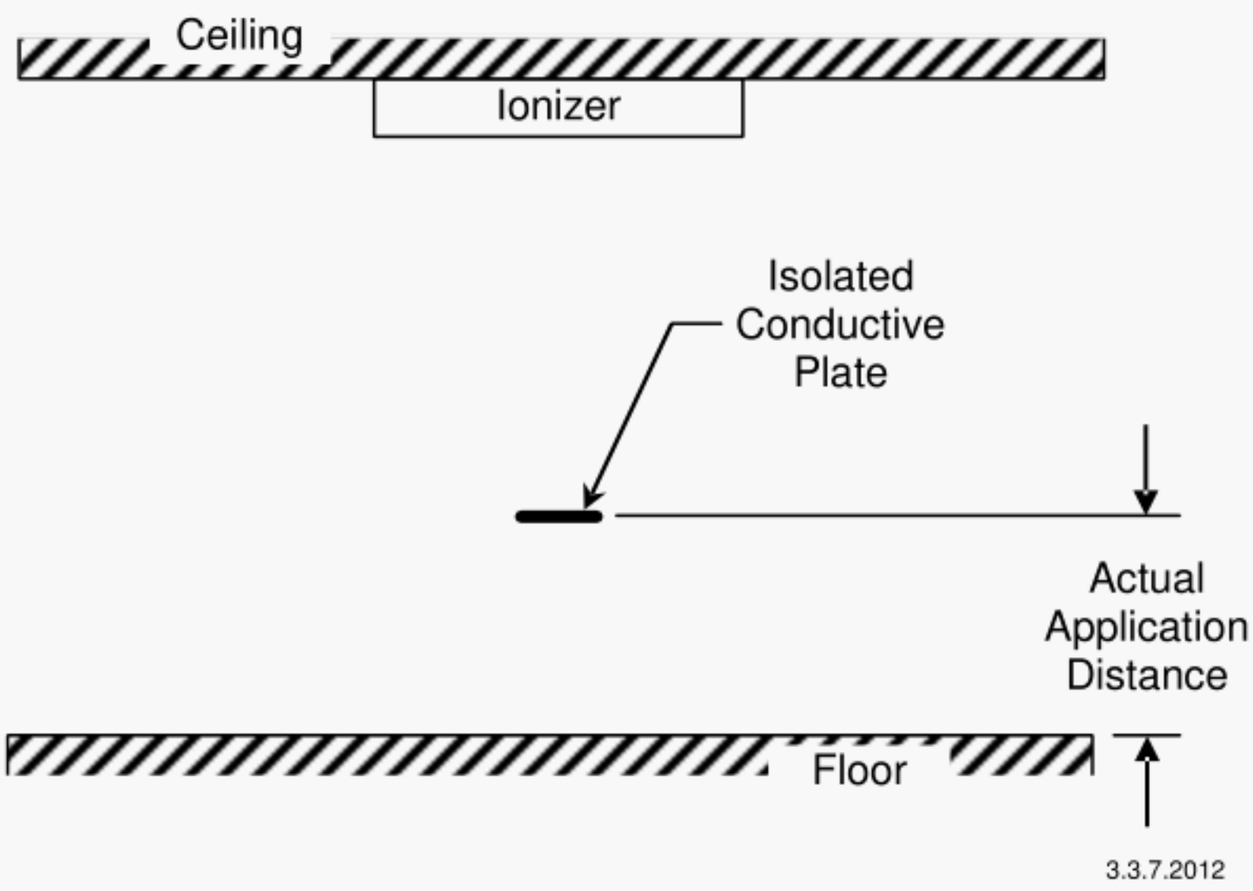


Figure 7: Room Ionization – Typical Side View

7.2 Laminar Flow Hood Ionization

An example of a test setup for performing periodic verification of vertical laminar flow hood ionizers is shown in Figures 8 and 9. An example of a test setup for performing periodic verification of horizontal laminar flow hood ionizers is shown in Figures 10 and 11.

Measurements should be made at the middle of the work area. When establishing the measurement location, consideration should be given to the location of critical processes and

product placement in relationship to the ionizer source. The test fixture should be held above the worksurface at any convenient, repeatable height (e.g., 15 cm [6 inches]).

Offset voltage should be measured after reading stabilizes (maximum 1 minute).

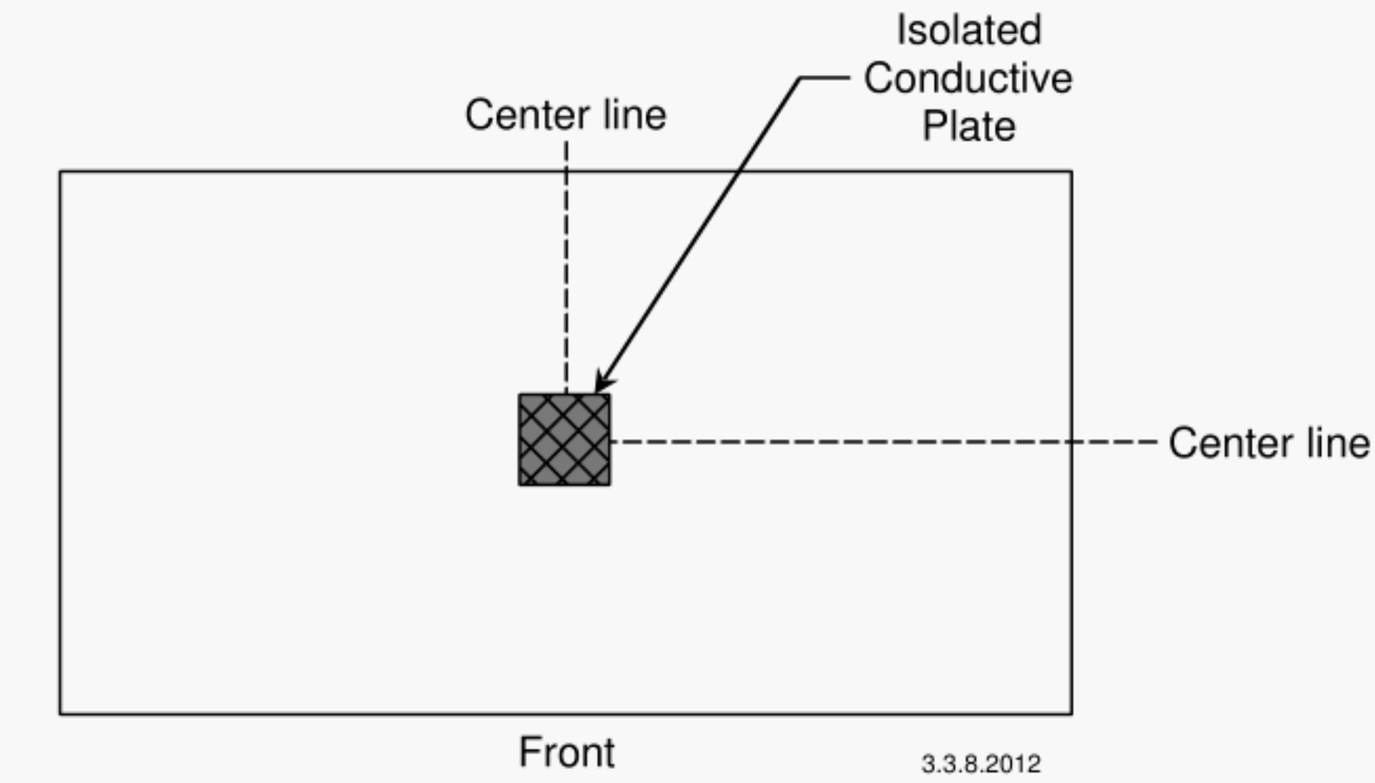


Figure 8: Vertical Laminar Flow Hood Ionization – Top View

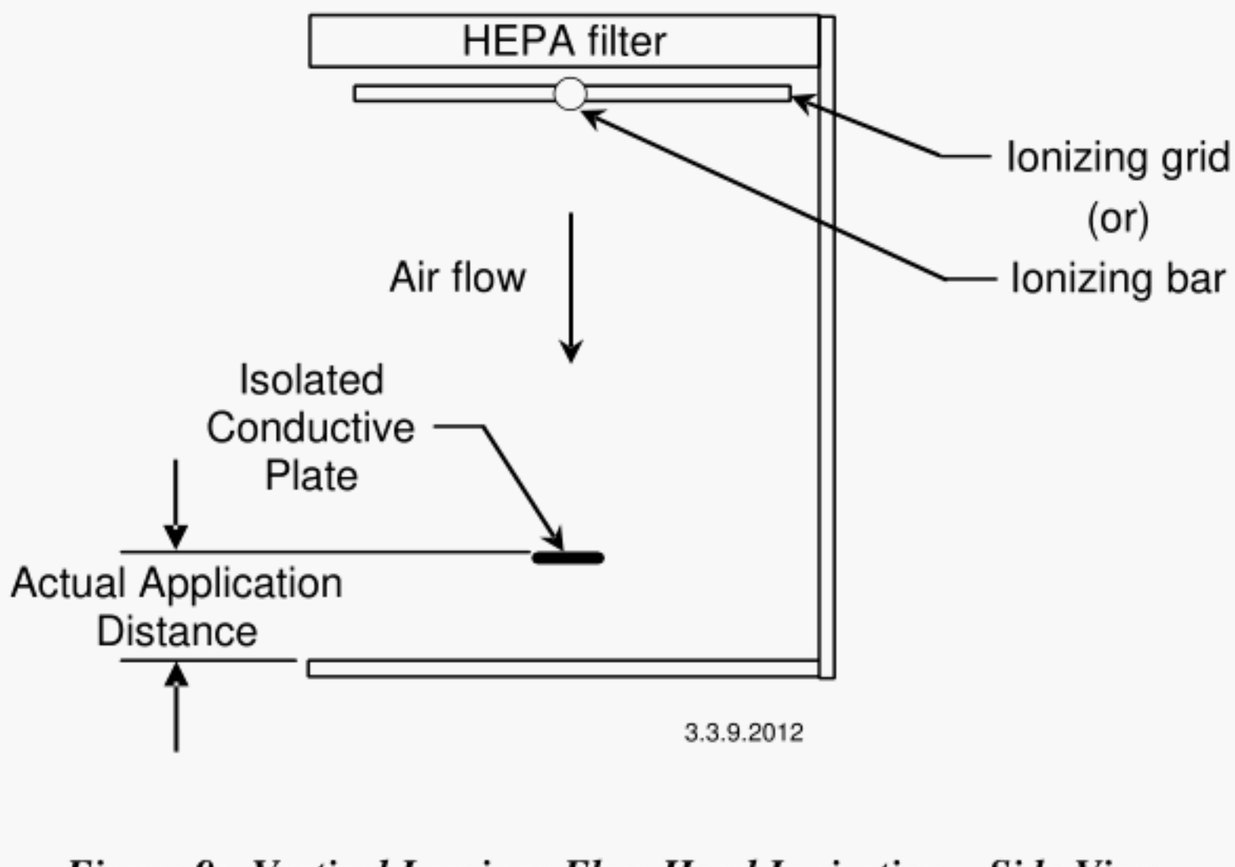


Figure 9: Vertical Laminar Flow Hood Ionization – Side View

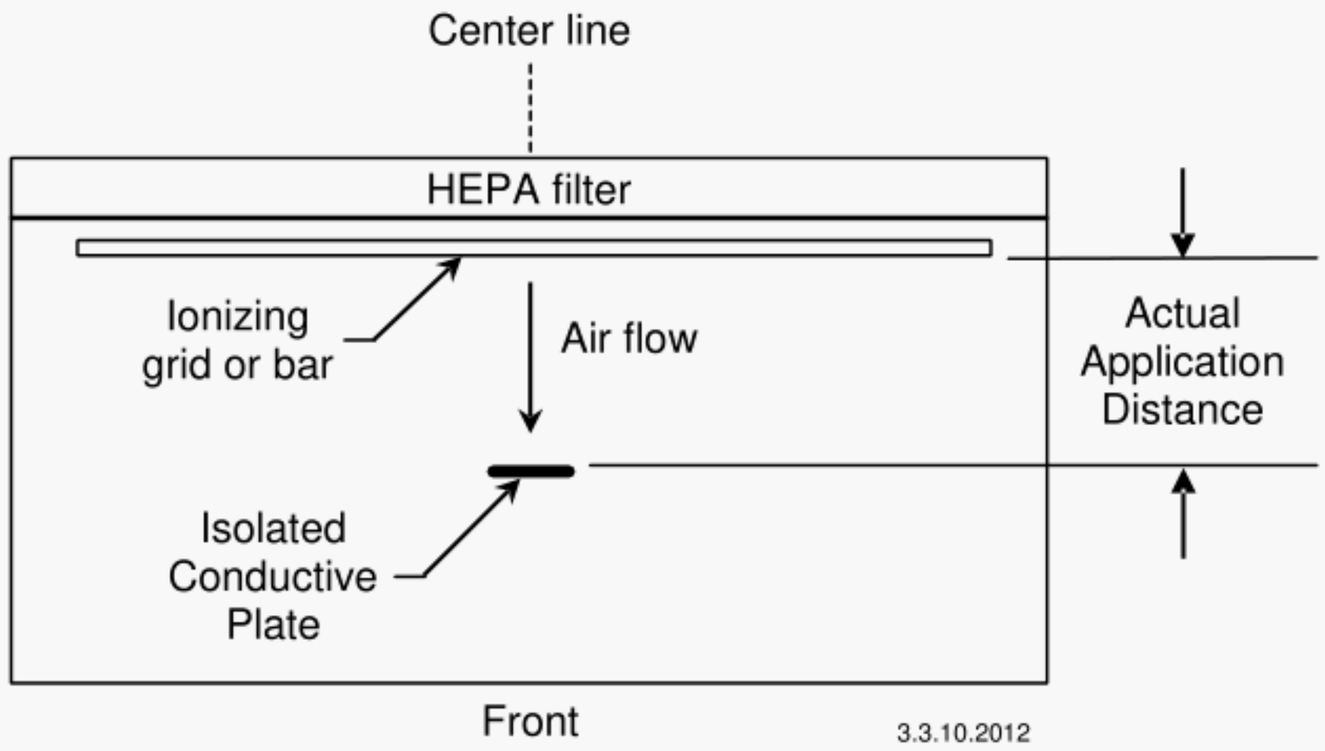


Figure 10: Horizontal Laminar Flow Hood Ionization – Top View

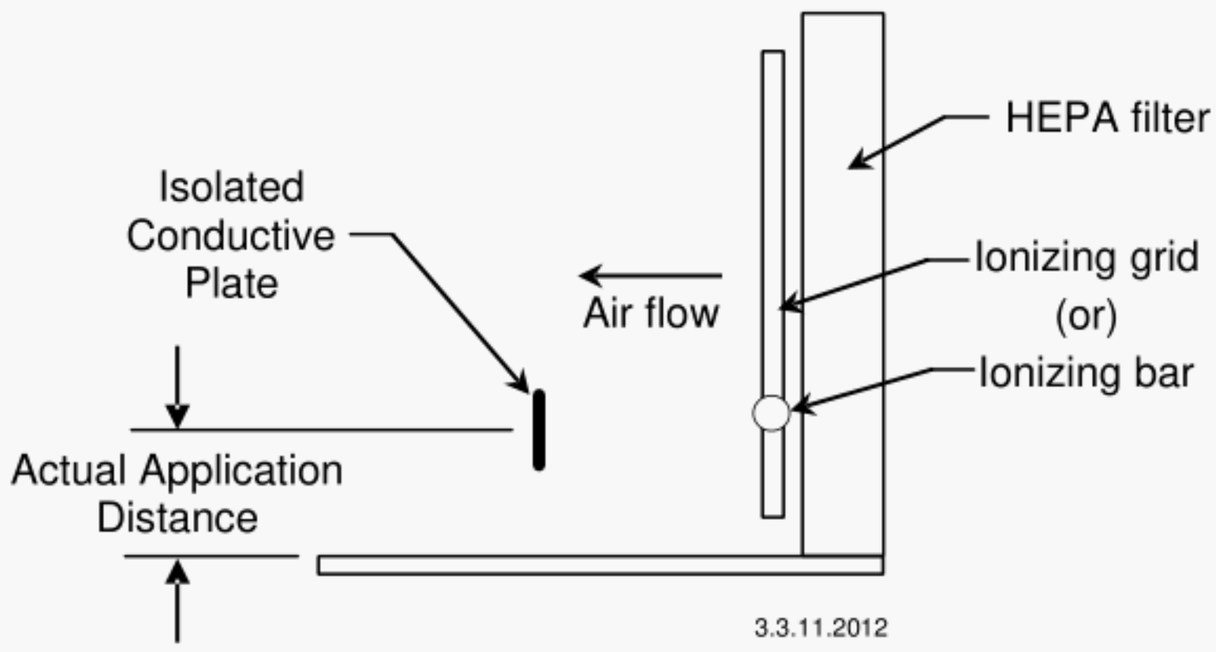


Figure 11: Horizontal Laminar Flow Hood Ionization – Side View

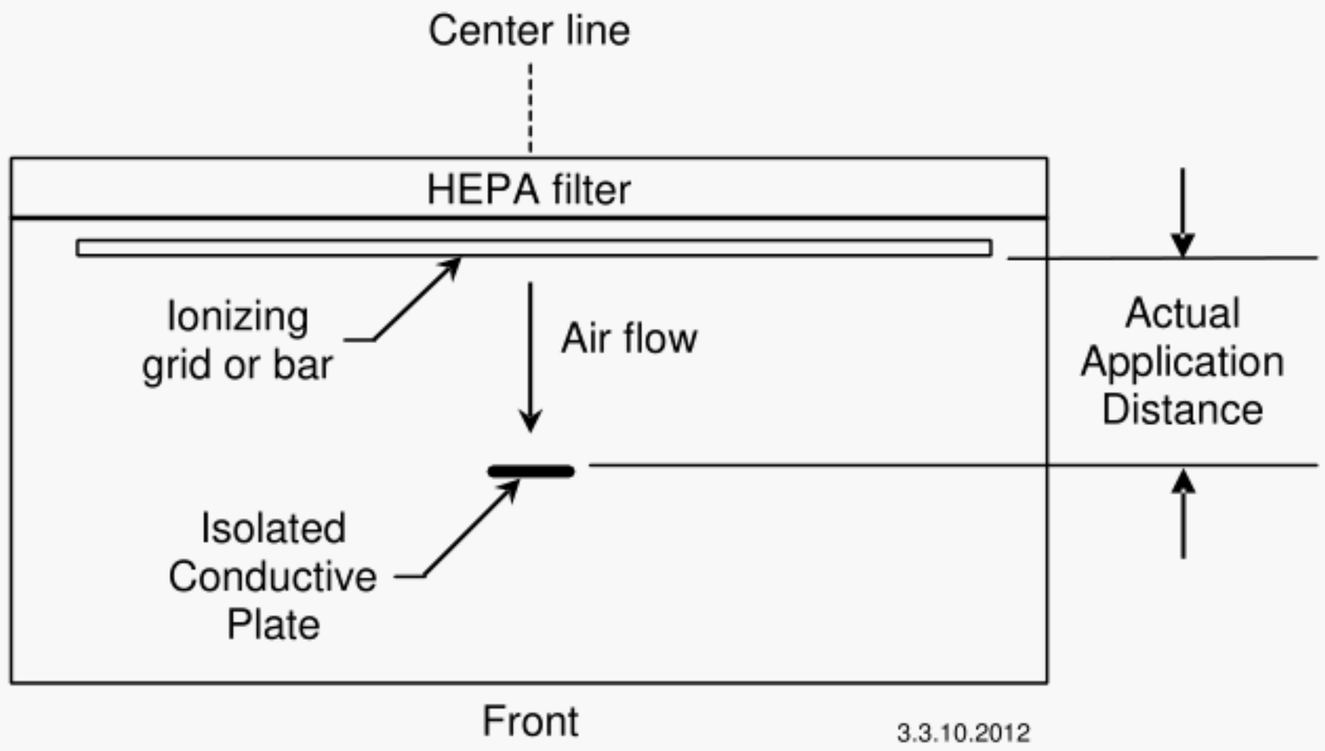
7.3 Worksurface Ionization

An example of a test setup for performing periodic verification of worksurface bench top ionizers is shown in Figures 12 and 13. An example of a test setup for performing periodic verification of worksurface overhead ionizers is shown in Figures 14 and 15.

Measurements of worksurface overhead ionizers should be made under the middle of the ionizer. When establishing the measurement location, consideration should be given to the location of critical processes and product placement in relationship to the ionizer source when establishing the measurement location. The test fixture should be held above the worksurface at any convenient, repeatable height (e.g., 15 cm [6 inches]).

Measurements of worksurface bench top ionizers should be made in front of the ionizer. The distance between the ionizer and the test fixture should be any convenient, repeatable distance (e.g., 60 cm [24 inches]). The test fixture should face the ionizer at a convenient, repeatable height above the worksurface (e.g., 15 cm [6 inches]). Consideration should be given to the location of critical processes and product placement in relationship to the ionizer source when establishing the measurement location.

Offset voltage should be measured after reading stabilizes (maximum 30 seconds).



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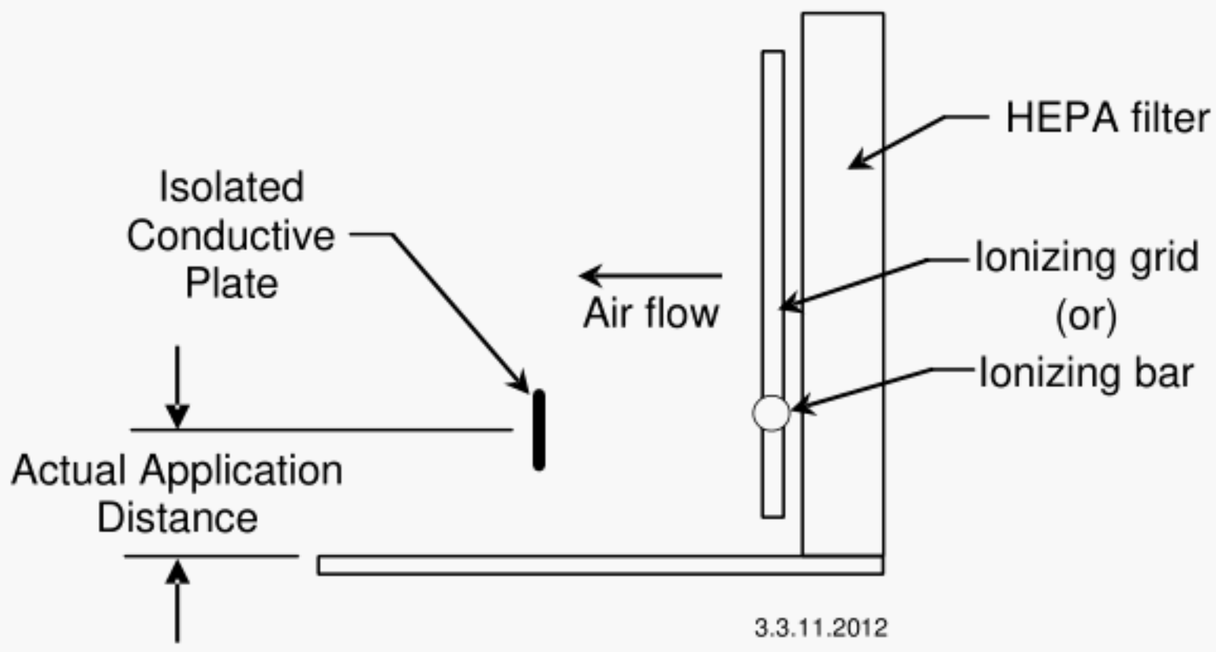

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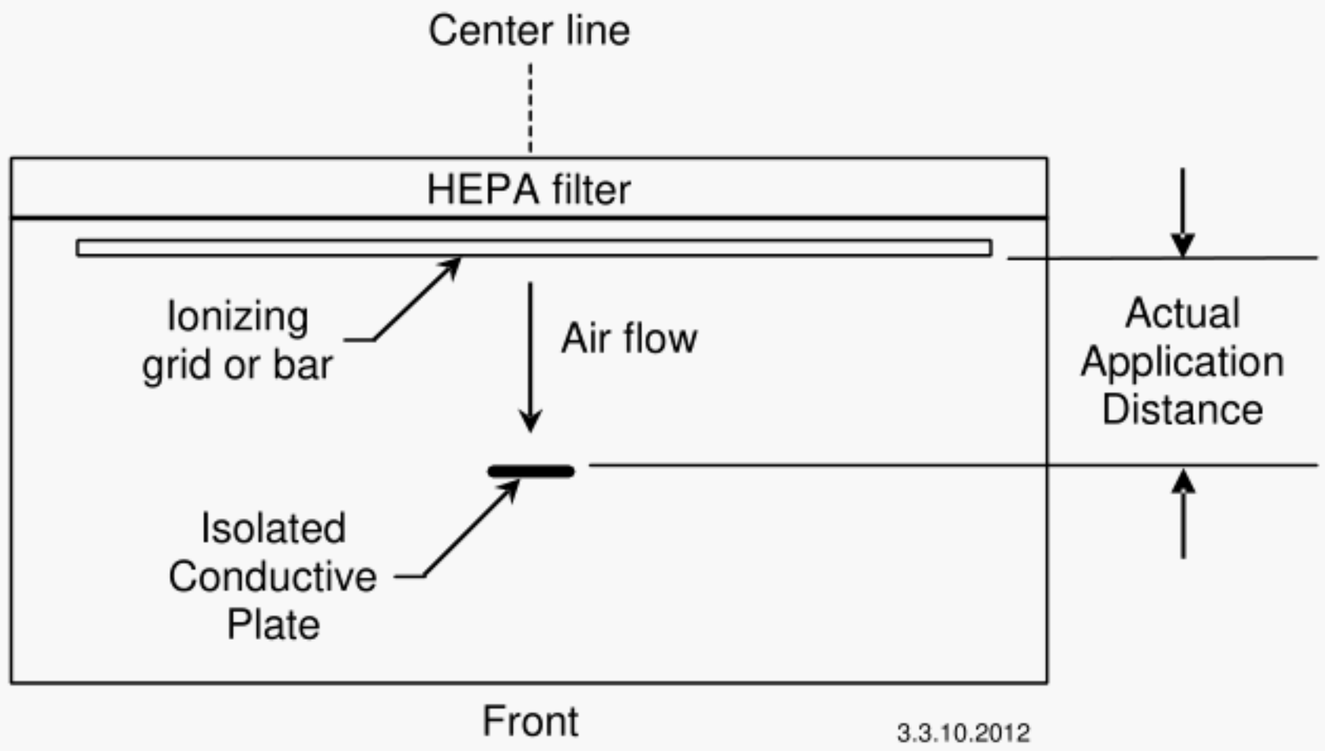

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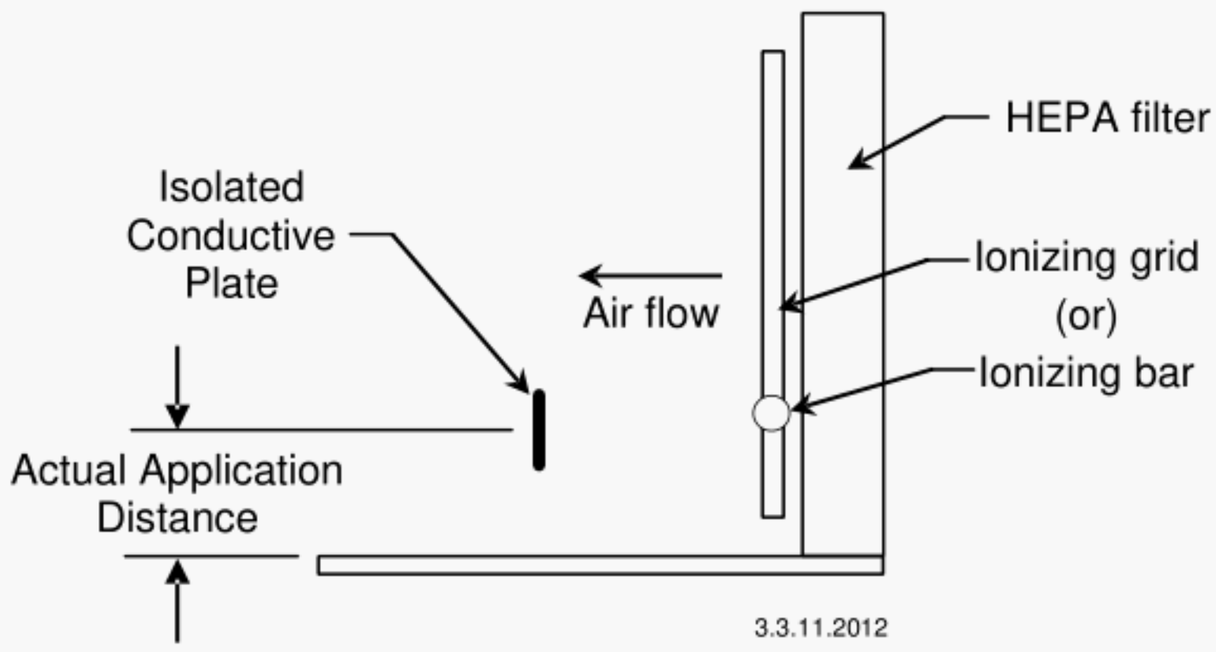

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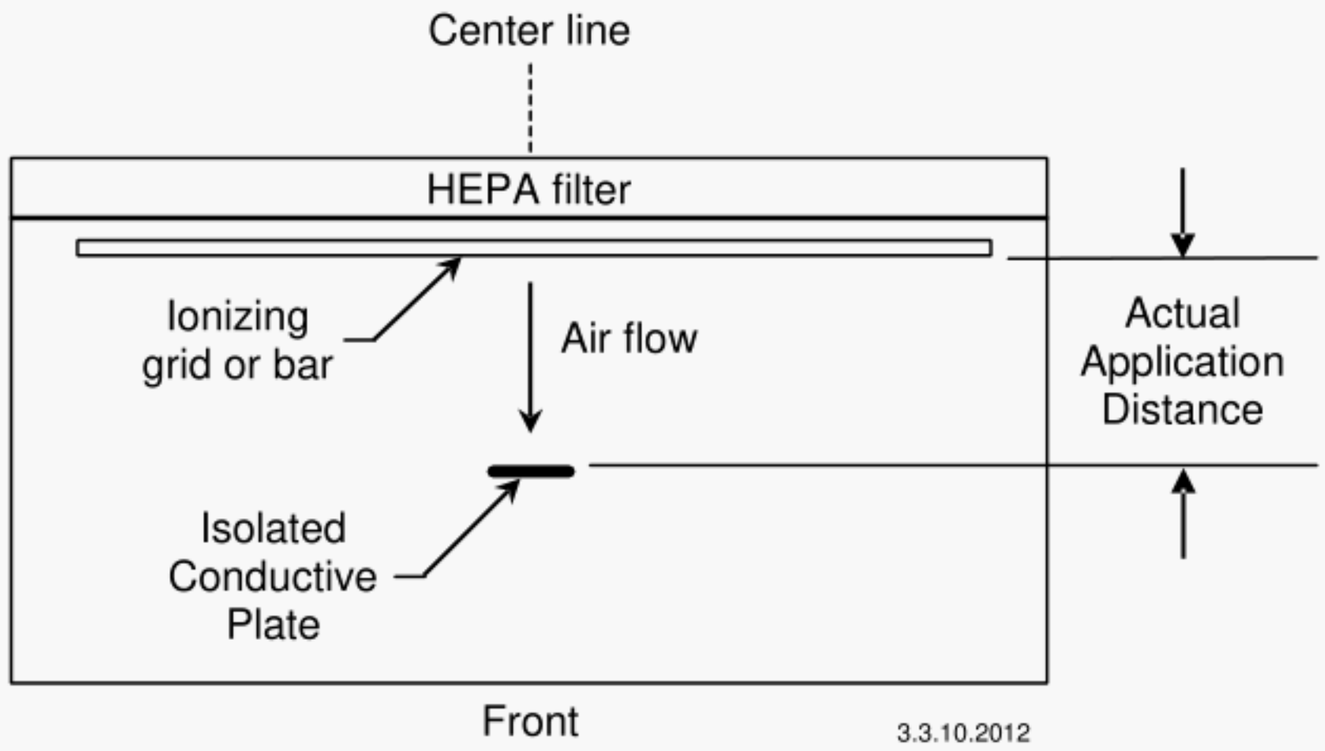

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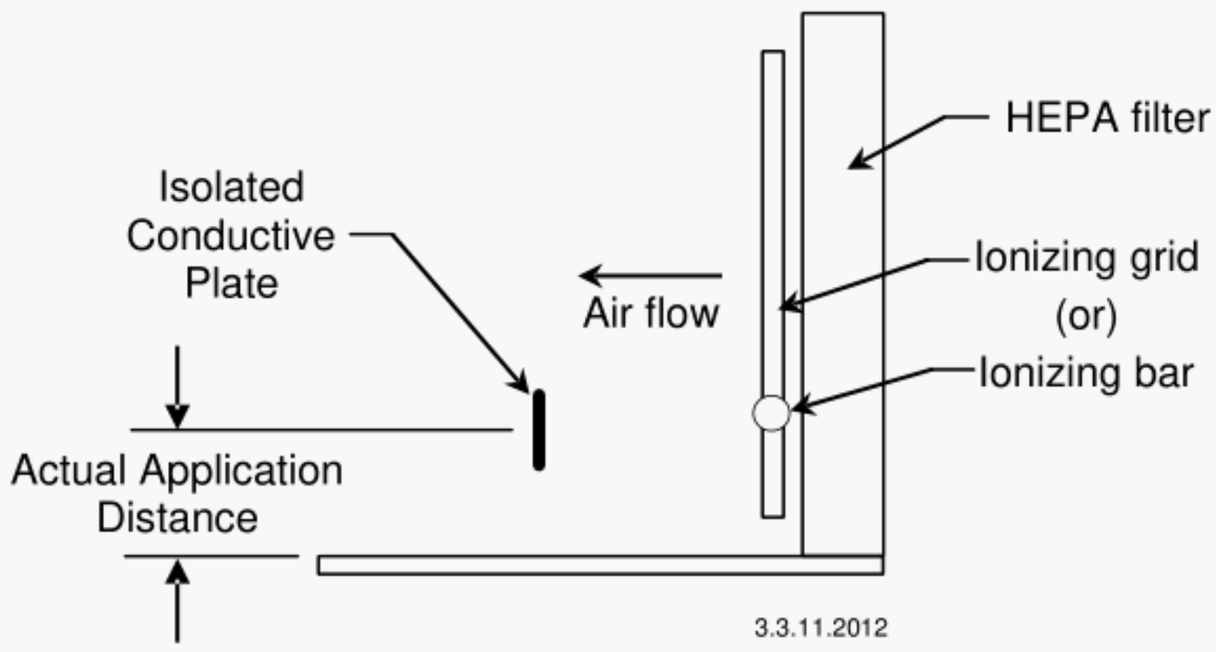

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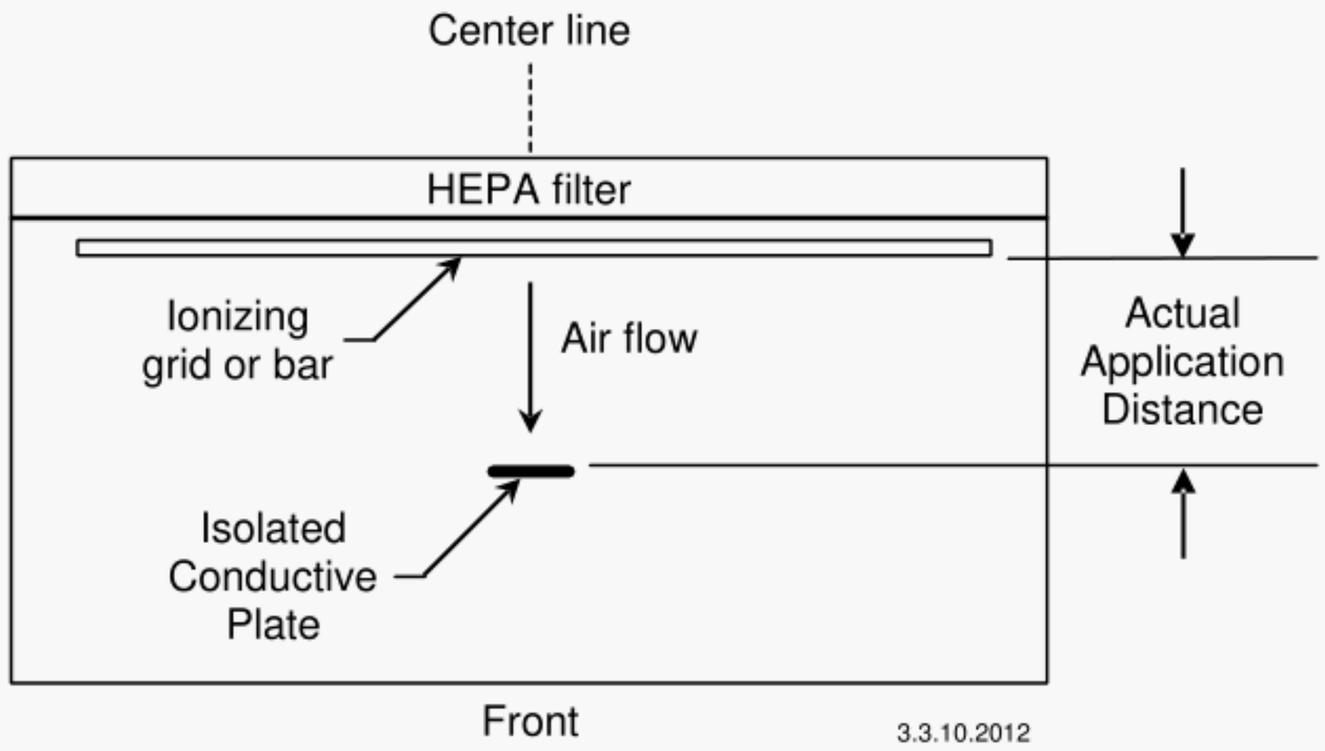

Figure 10: Horizontal Laminar Flow Hood Ionization – Top View

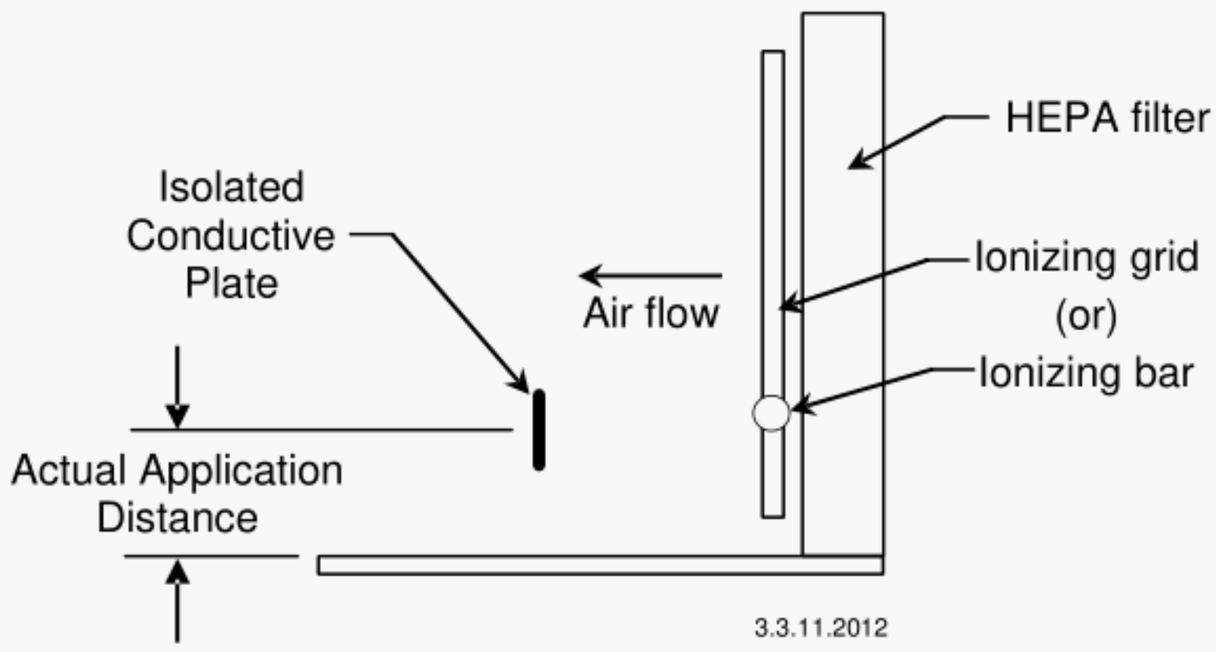

Figure 11: Horizontal Laminar Flow Hood Ionization – Side View

7.3 Worksurface Ionization

An example of a test setup for performing periodic verification of worksurface bench top ionizers is shown in Figures 12 and 13. An example of a test setup for performing periodic verification of worksurface overhead ionizers is shown in Figures 14 and 15.

Measurements of worksurface overhead ionizers should be made under the middle of the ionizer. When establishing the measurement location, consideration should be given to the location of critical processes and product placement in relationship to the ionizer source when establishing the measurement location. The test fixture should be held above the worksurface at any convenient, repeatable height (e.g., 15 cm [6 inches]).

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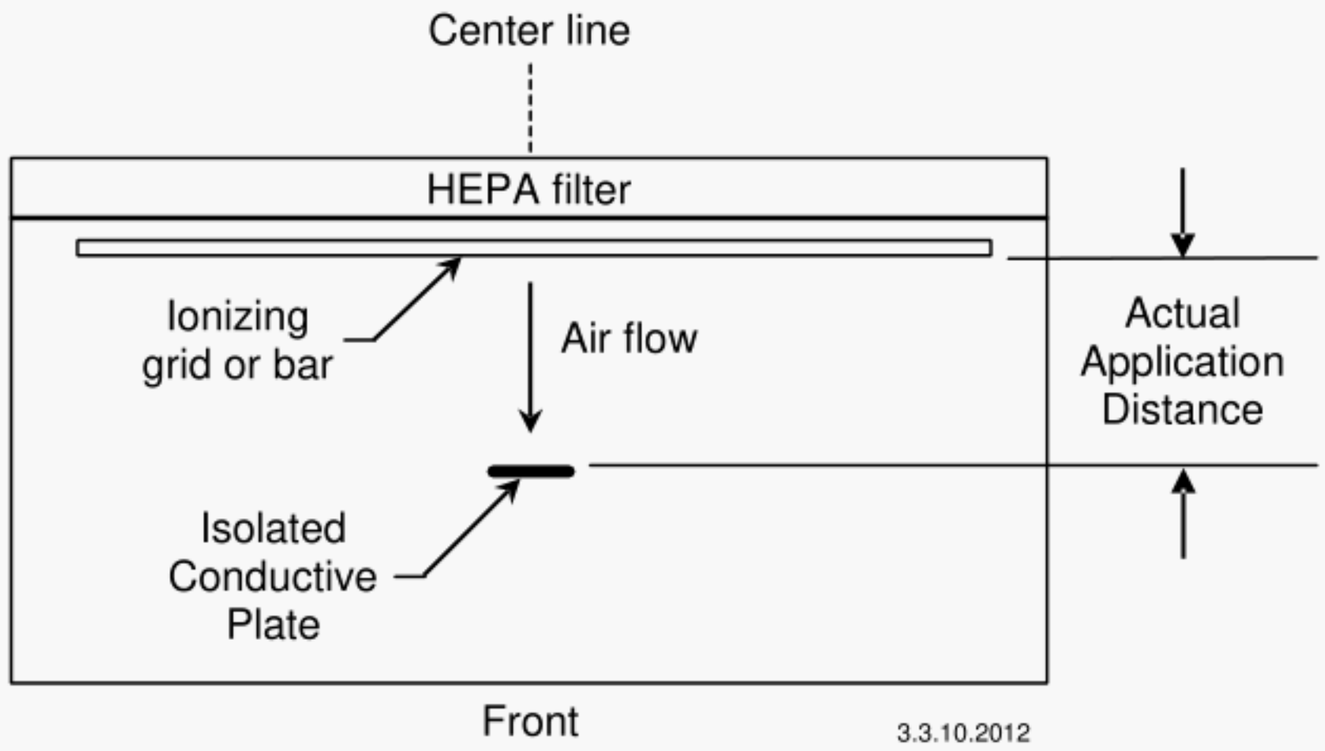

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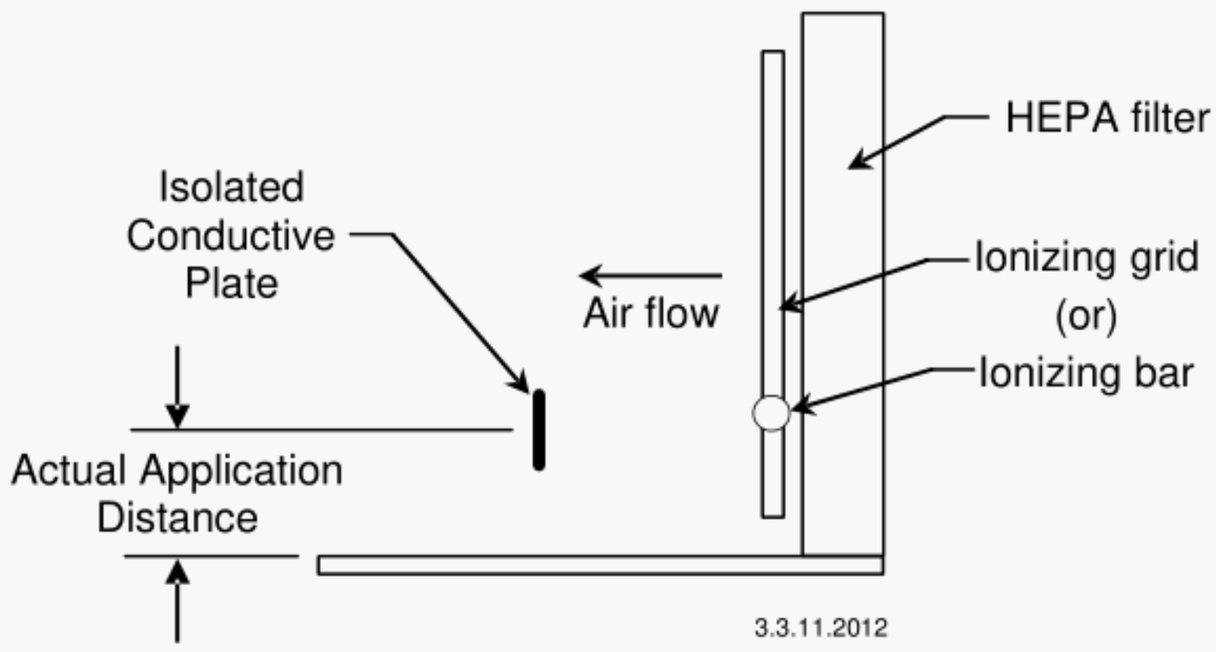

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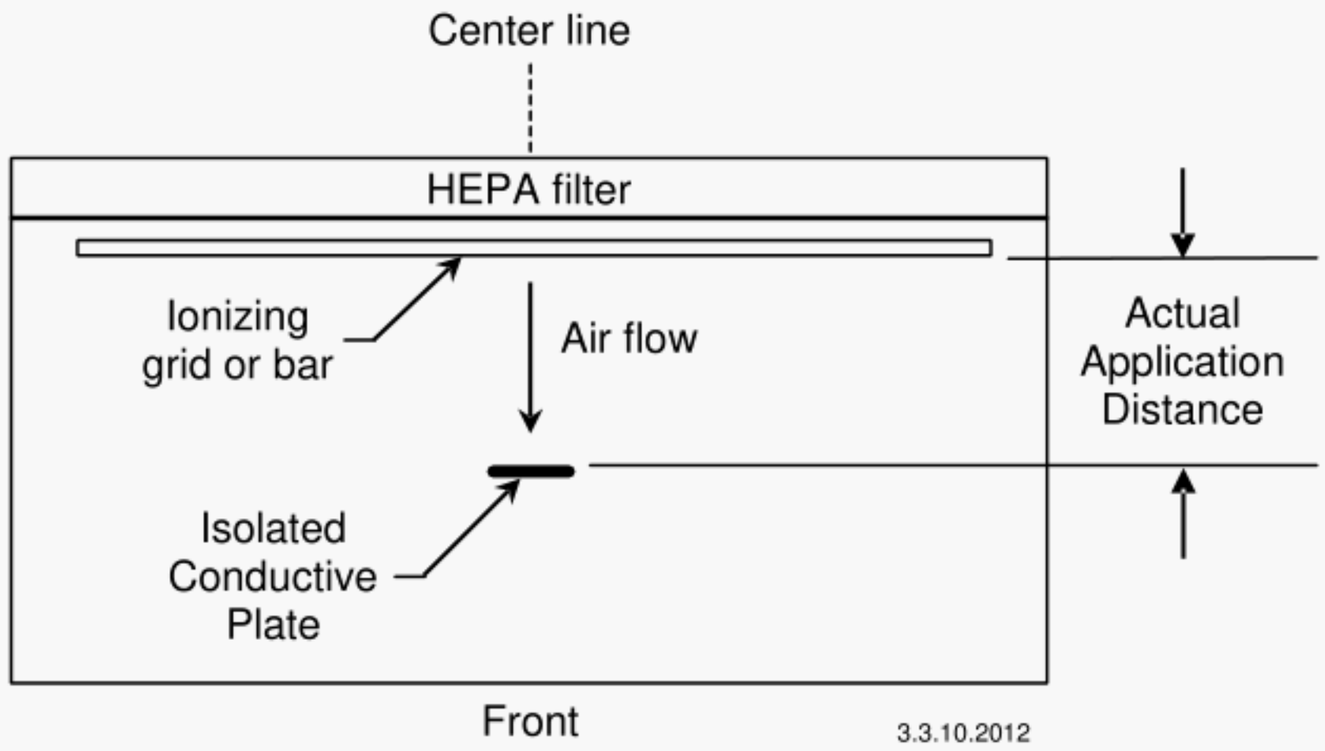

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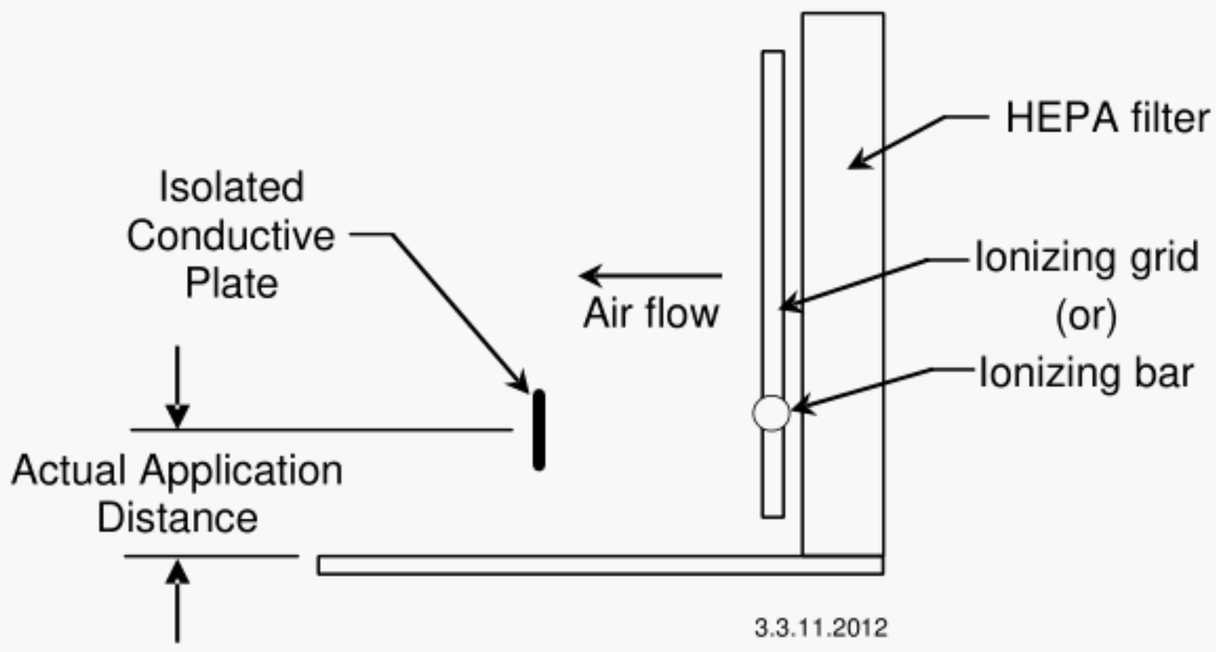

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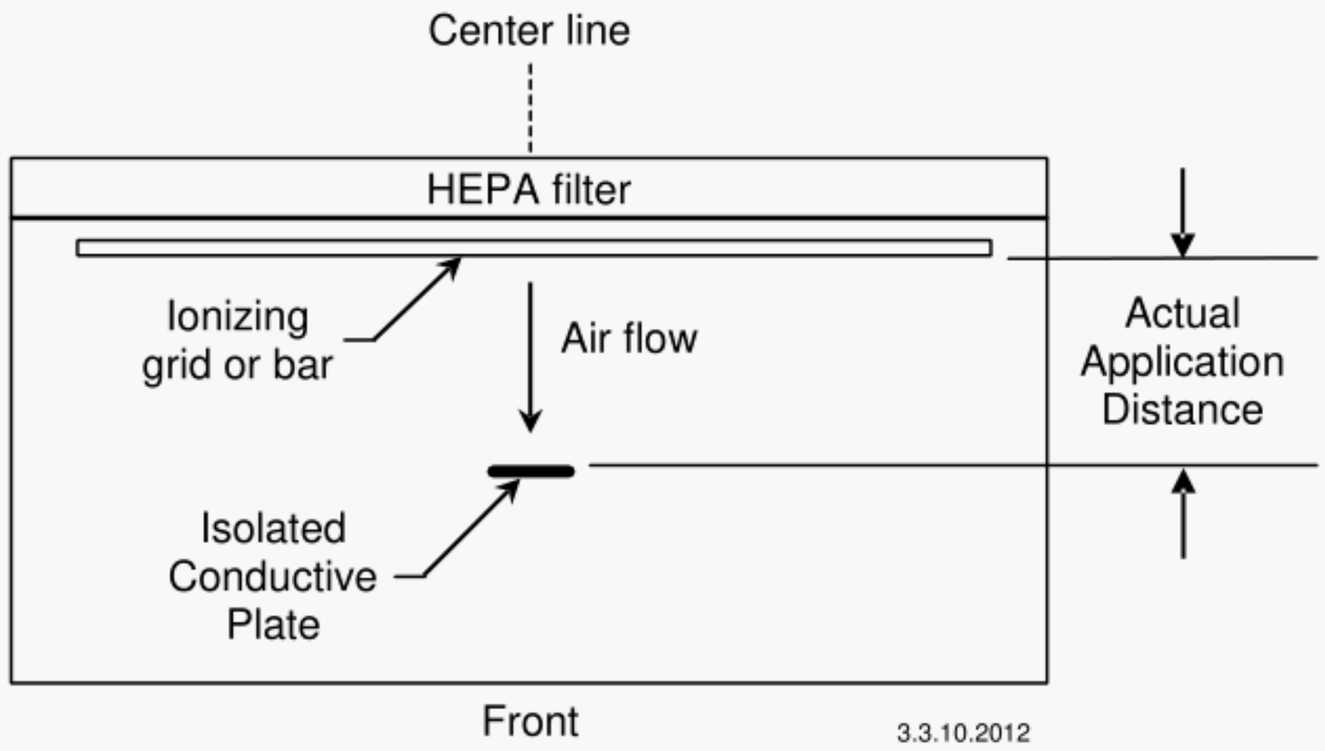

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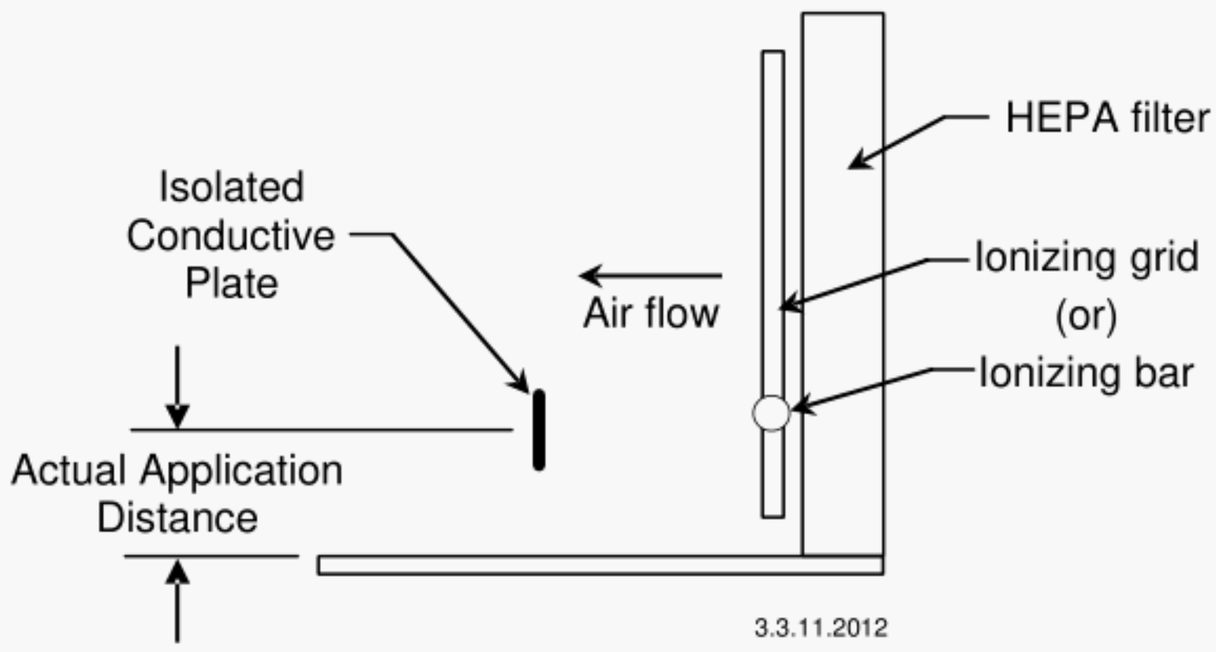

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