Ionization

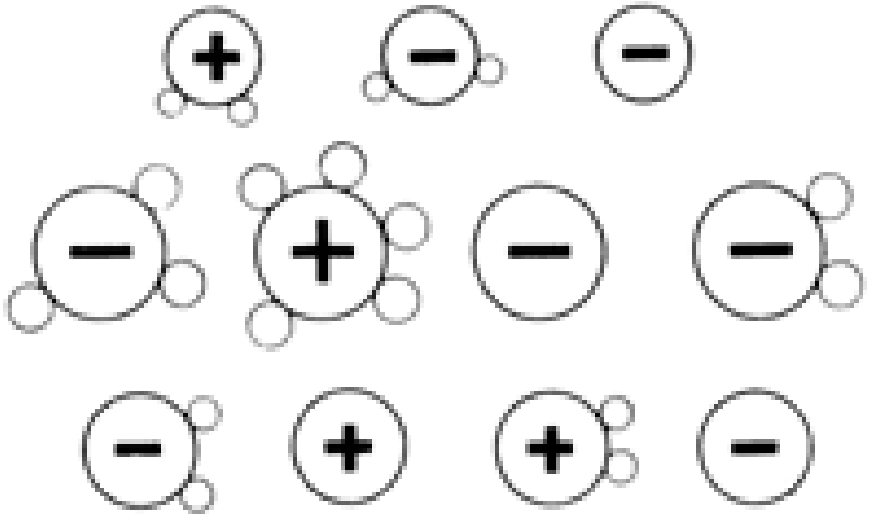
May 2020

Ionization

- What is Ionization (Neutralization)?
- How is Ionization Generated?
- AC Vs DC Ionizers
- Types of Ionizers
- Uses and Applications
- Maintenance

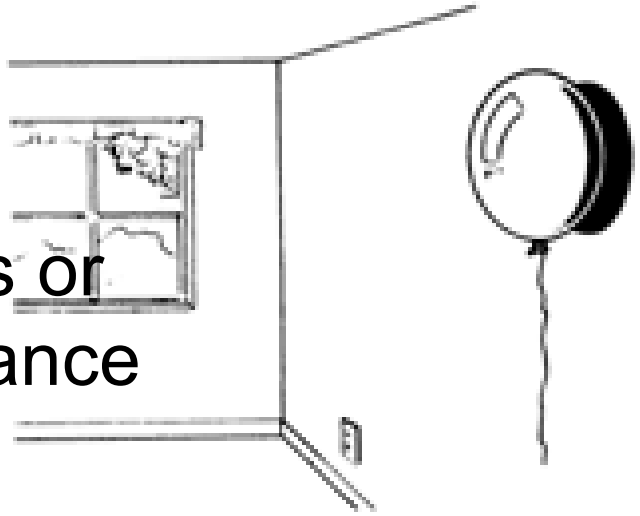
What is Ionization

- A balanced amount of positively and negatively charged ions
- Utilizing airflow to cover the work area
- Ionization can reduce static charges on an insulator or isolated conductors



What is Ionization

- Electrostatic Fields/Attraction : Due to their charge, ions will follow the fields that exist between the ion emitter and nearby grounds or oppositely charged objects at a greater distance



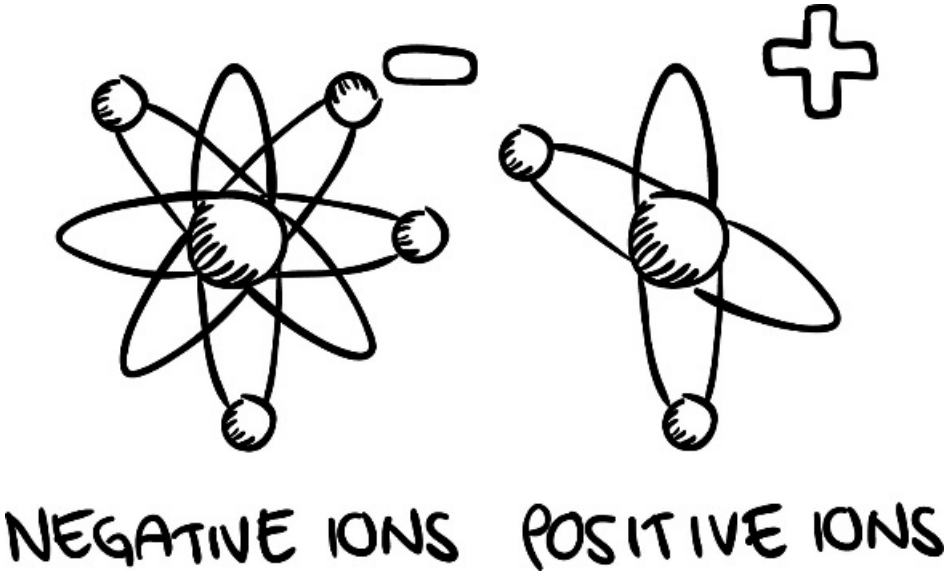
- Diffusion/Repulsion: Like charges repel each other

- Gravity: Ions are heavier than air and tend to settle downward

How is Ionization Generated?

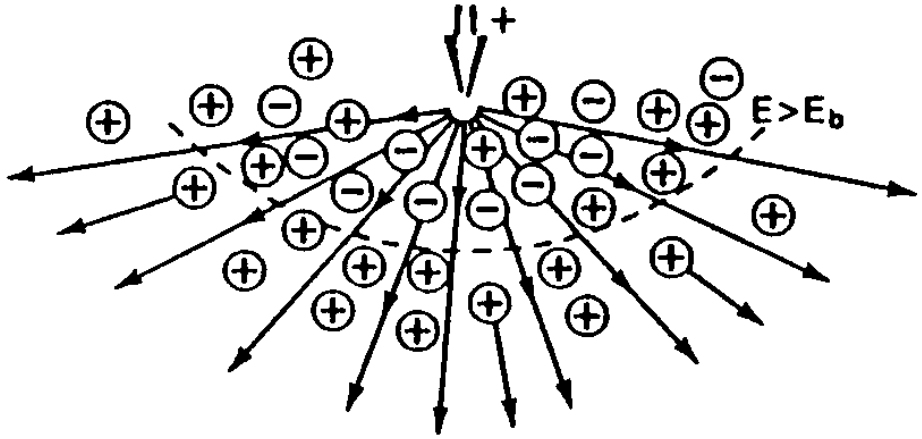
Corona Discharge Ionization

- AC
- Pulsed DC
- Steady State DC



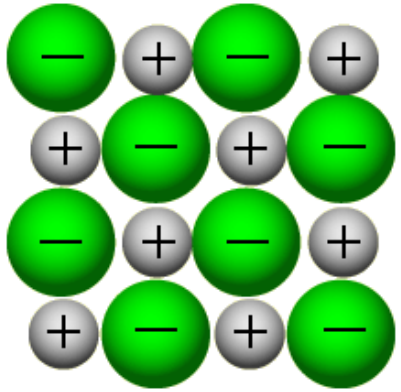
How is Ionization Generated?

- Occurs when high voltage is applied to a sharp point. (High Corona Discharge)
- Can produce negative or positive ions depending on the polarity of applied voltage
- Neutralization of charges on insulators does occur naturally… the process is much too slow for ESD susceptible components



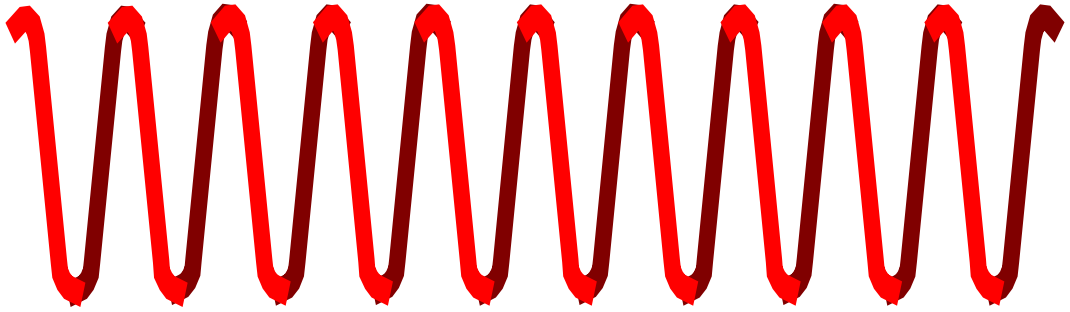
Electrical Types: AC

- AC ionization was the first form of electrical ionizer used. Its use dates back to the 1930's.
- An AC ionization electrode alternates between producing positive and negative ions.
- Ion recombination is high, as both polarities are produced in rapid succession at each emitter point.
- AC systems are often mounted at the output of an air delivery system."



AC Ionization

Approximately 4 KV



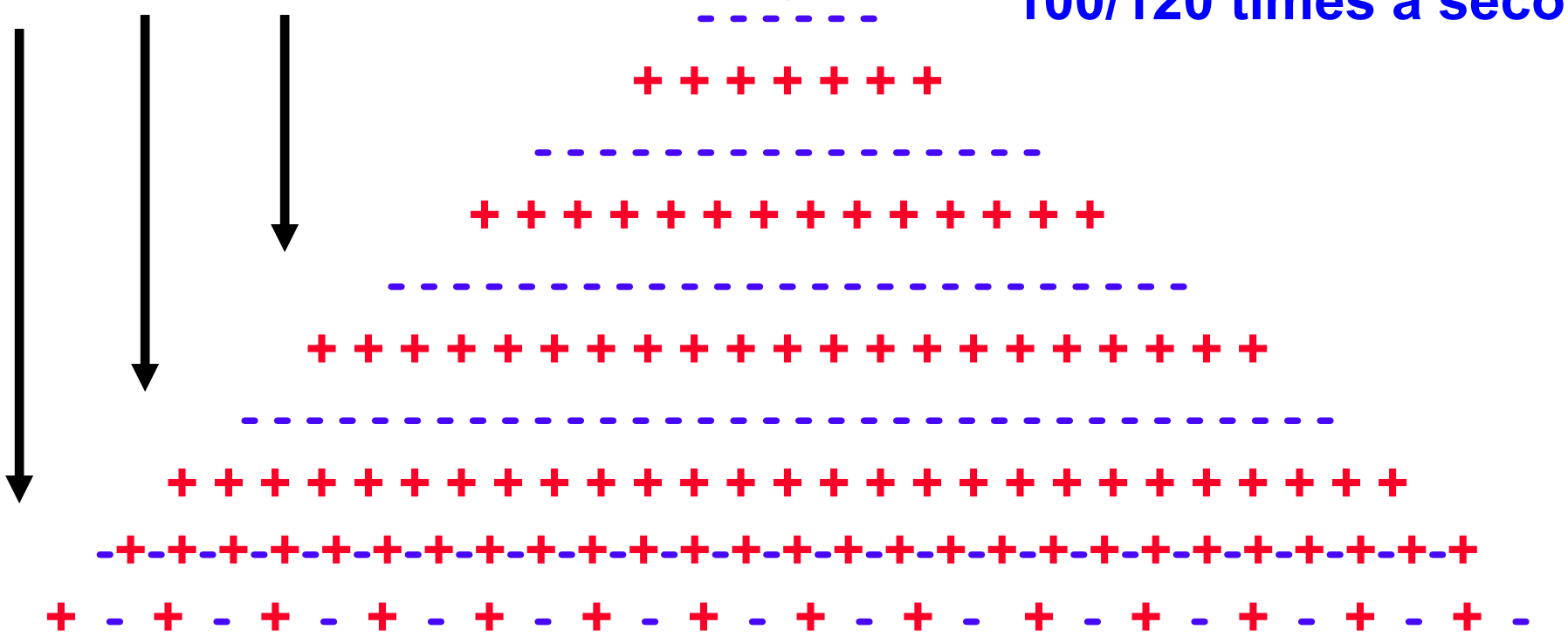
50/60 Hz

Electrical Types: AC

High air flow needed to deliver ions

HVAC

Polarity changing 100/120 times a second



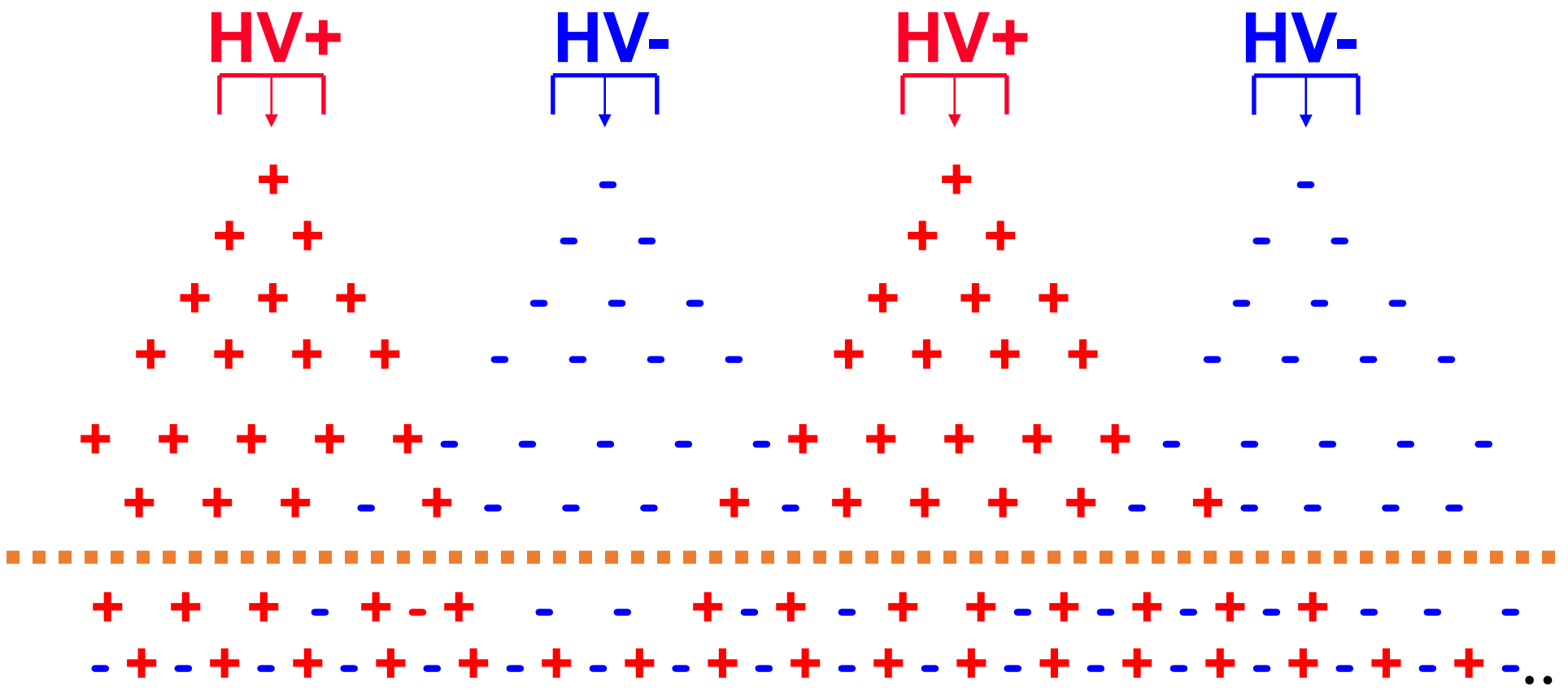
Rapid change of polarity causes high ion recombination

Examples of AC Ionizers

Electrical Types: Steady State DC

- In steady state DC ionization both polarities of ion are generated simultaneously.
- Steady State DC ionization utilizes separate electrodes for positive and negative polarities.
- Steady State DC ionization can deliver fast decay times with very low offset voltages particularly when used in local ionization.
- Proximity to ionizer of product plays a part in Steady State DC ionization application as well.

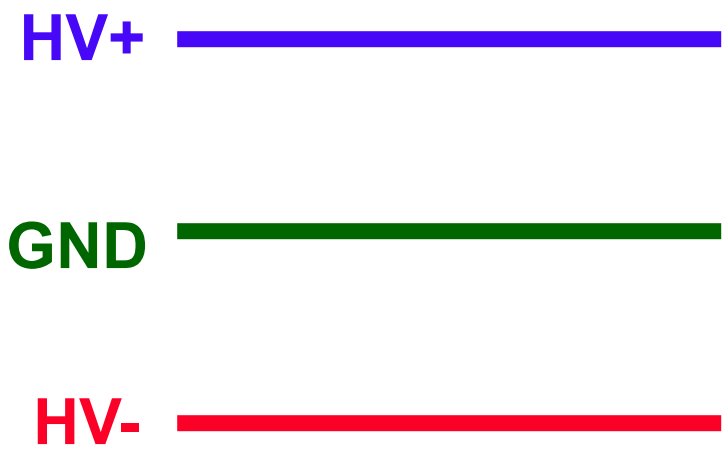
Electrical Types: Steady State DC

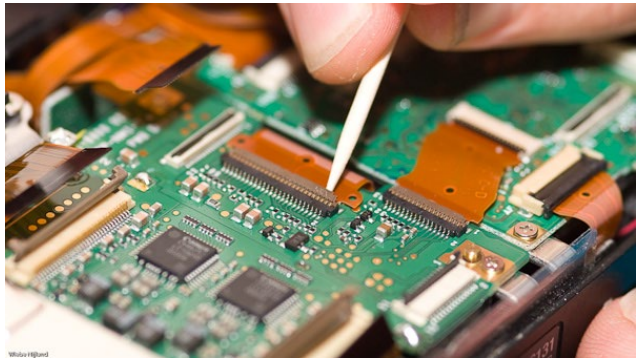


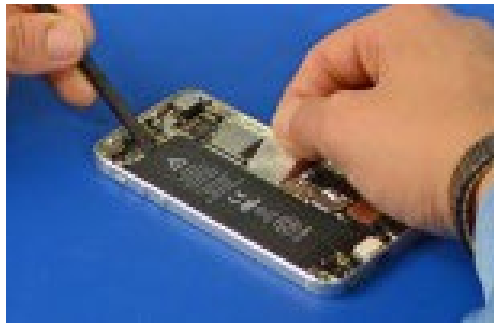
As the ions move down from the emitters they diffuse and create an ion cloud with both positive and negative ions

Electrical Types: Steady State DC

- Low offset voltages
- Best ionization to use with sensitive devices
- Ion recombination is minimal







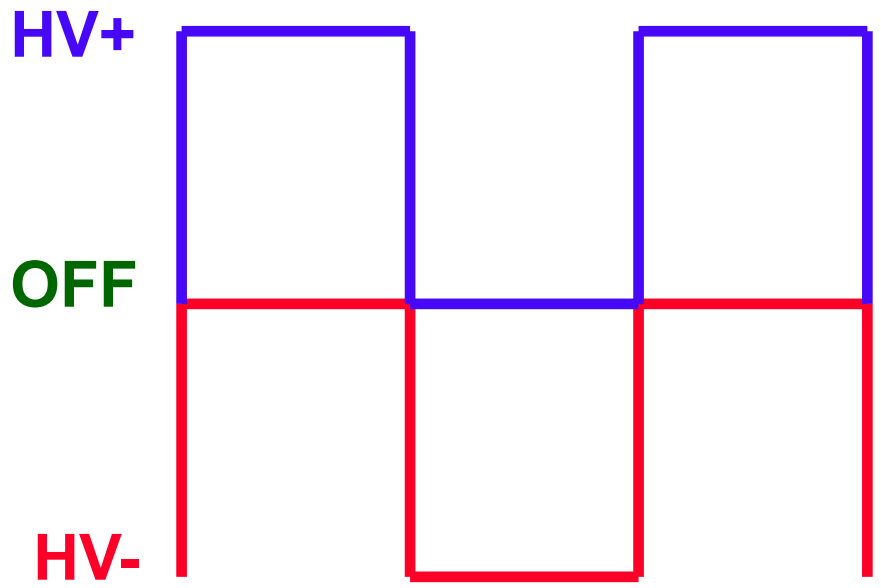
Examples Steady State: DC Ionizers

Electrical Types: Pulse DC

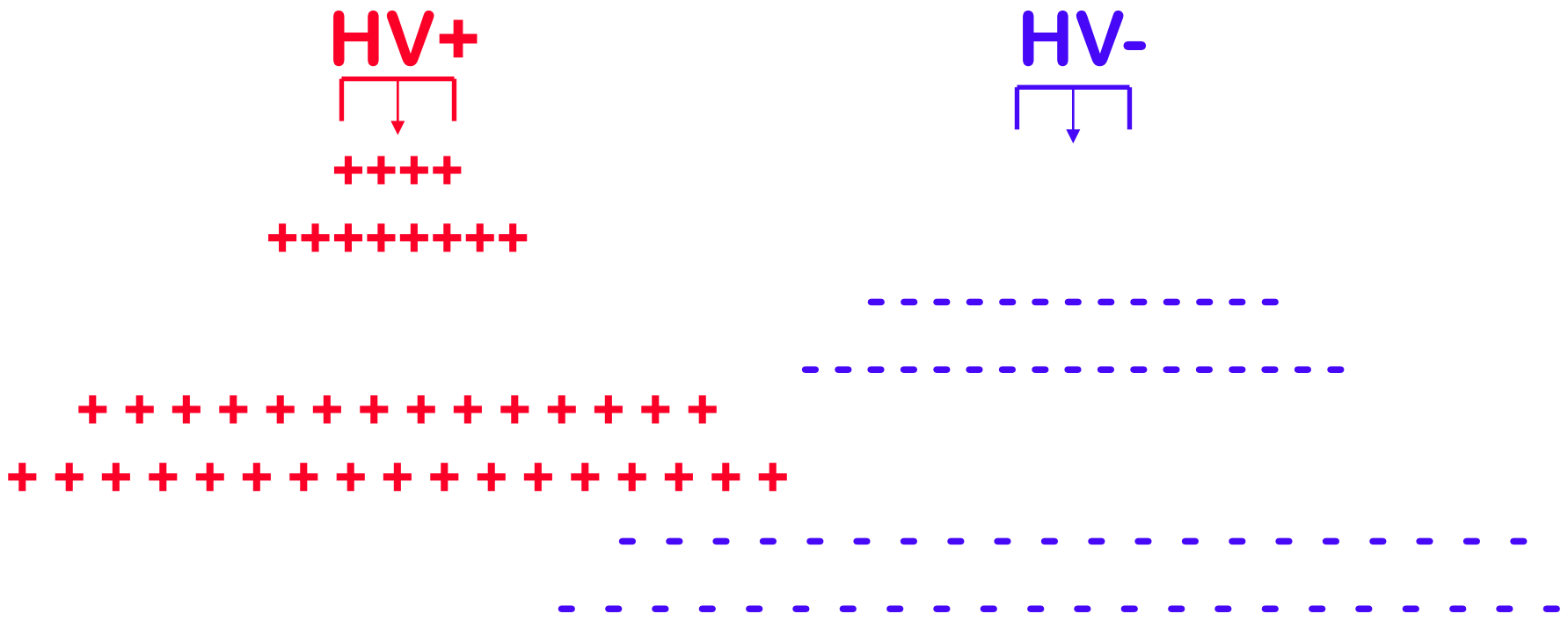
- Pulse DC Ionization is where the polarities of the ionization are alternated.
- Pulse DC Ionization normally has separate electrodes for positive and negative polarities. Some older systems used the same electrodes for both polarities.
- Due to the long periods of single polarity ionization Pulse DC Ionization can generate high offset voltages and this needs to be taken into consideration when adjusting these systems.

Electrical Types: Pulse DC

- Fast Decay Times
- Best ionization to use in low air flow applications. (Room Systems, Laminar Flow)



Electrical Types: Pulse DC



The total ionized area is flooded with alternating positive and negative clouds of ions.

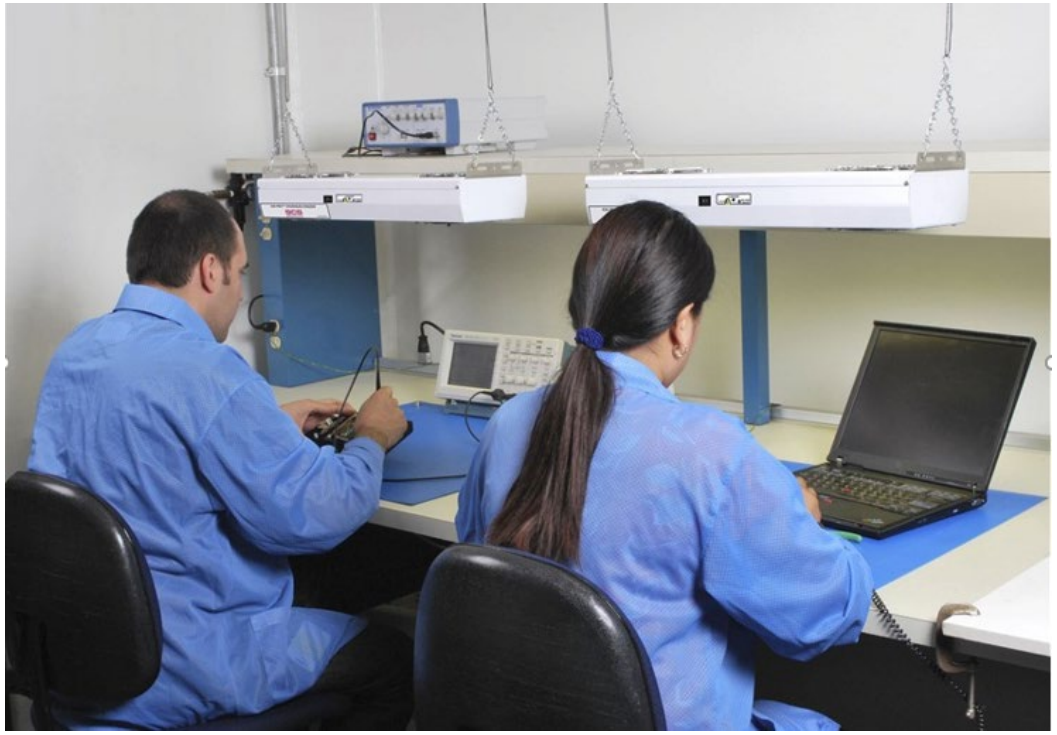
Examples Pulse: DC Ionizers

Ionization Applications

- Incoming inspection
- Work Benches (Stations)
- Work Areas (Solder)
- Handlers, Testers
- Assembly Lines
- Conveyor Transfers
- Packing, Shipping
- Clean Flow Benches
- Mini-Environments
- Particulate Removal
- Clean Rooms
- Taping Applications

Designs

- Benchtop Blowers
- Overhead
- Blow-off Guns and Nozzles
- Laminar Flow Bars (Mini-environments)
- Ceiling (Room) Systems



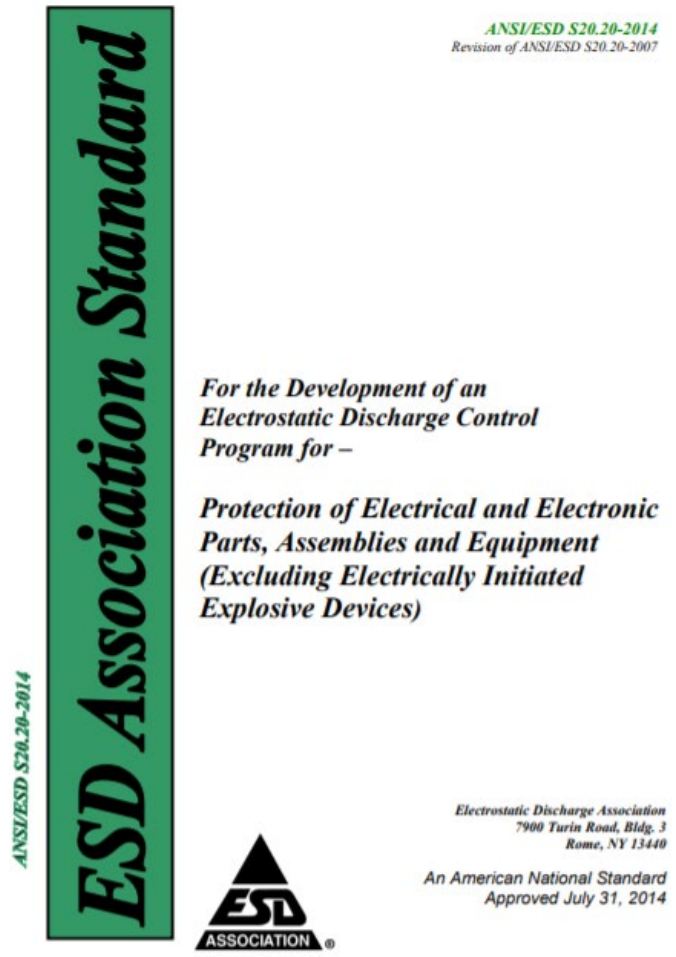
Discharge Times (1000V to 100V)

• No Ionization 60% RH	45,000 seconds
• Laminar Flow Hood	5-20 seconds
• Clean Room	15-60 seconds
• Overhead/Bench Top	1-10 seconds
• Compressed Gas	1-2 seconds

Note: Decay times vary by ionizer performance and location

Maintenance and Verification

- Per ESD Association ESD Handbook ESD TR20.20 section 5.3.6.7
- Maintenance / Cleaning “All ionization devices will require periodic maintenance for proper operation.
- Routine service is typically required to meet quality audit requirements.



Maintenance

- ESD Association www.esda.org
- ESDA S20.20-2014 Document
- Table 3 ESD Control Item – Product Qualification/Compliance Verification

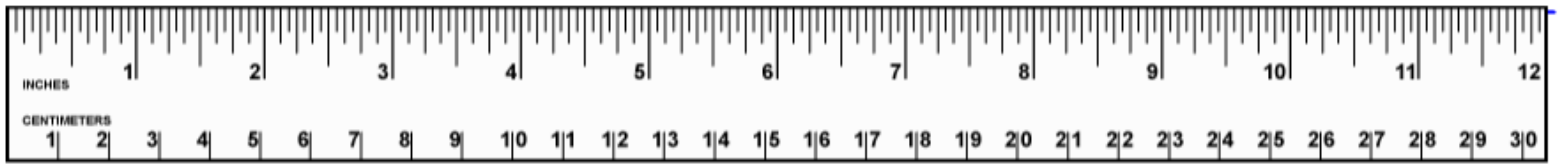
ESD Control Item	Product Qualification([7])		Compliance Verification	
	Test Method	Required Limit(s) ([8])	Test Method	Required Limit(s)
Ionization	ANSI/ESD STM3.1	Discharge Time User defined Offset Voltage $-35 < V_{offset} < 35$	ESD TR53[(11)] Ionization Section	Discharge Time User defined Offset Voltage $-35 < V_{offset} < 35$

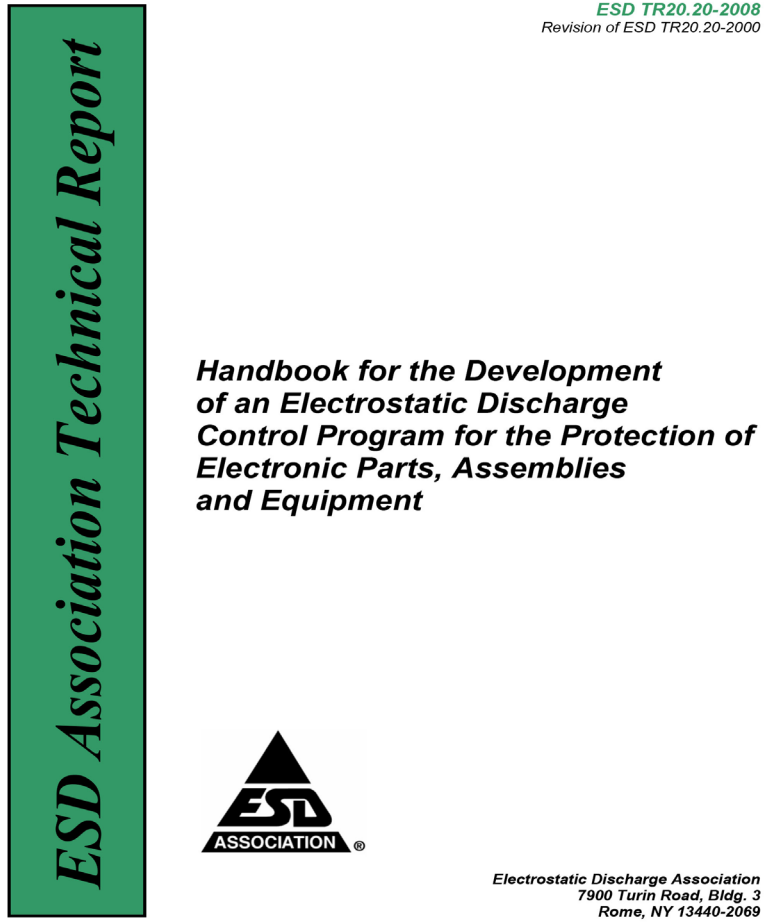
ESD TR20.20-2016

If the field measured on the process required insulator is **greater than 2000 volts/inch** and the process required insulator is **less than 30 cm (12 inches) from the ESDS item**, steps shall be taken to either:

Separate the required insulator from the ESDS item by a distance of greater than 30 cm (12 inches); or

Use ionization or other charge mitigating techniques to neutralize the charge.



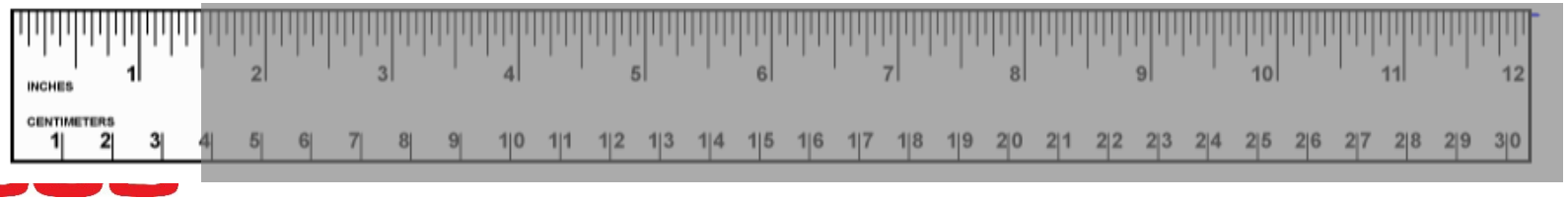


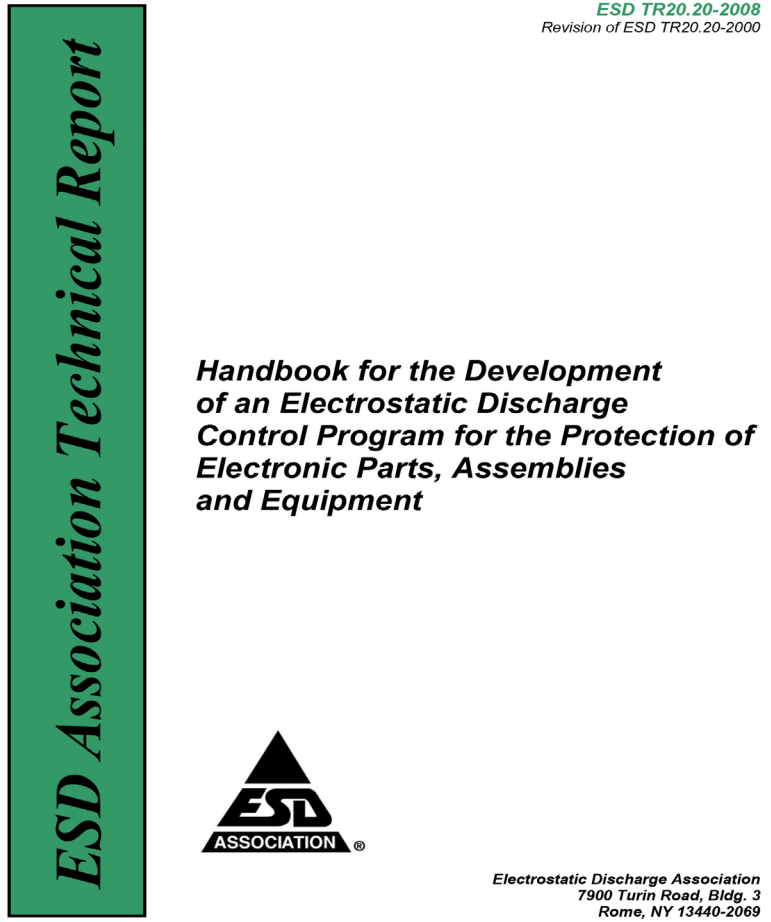
ESD TR20.20-2016

If the field measured on the process required insulator is **greater than 125 volts/inch** and the process required insulator is **less than 2.5 cm (1 inch) from the ESDS item**, steps shall be taken to either:

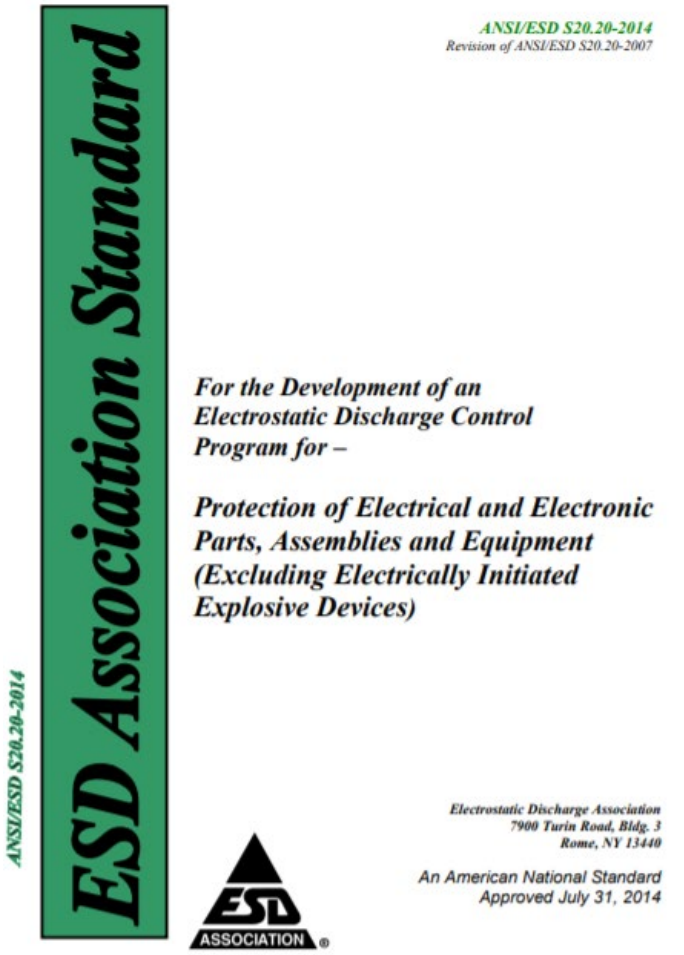
Separate the required insulator from the ESDS item by a distance of greater than 2.5 cm (1 inch); or

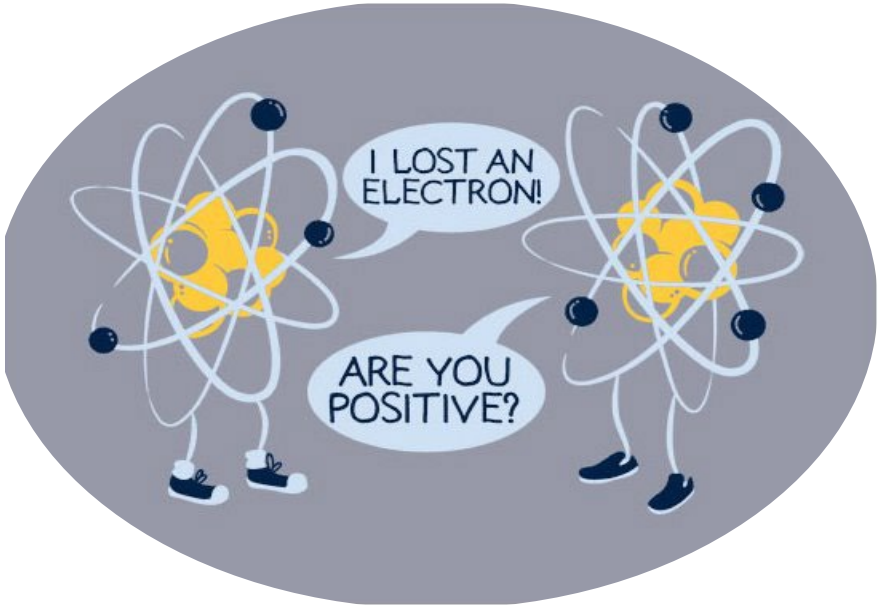
Use ionization or other charge mitigating techniques to neutralize the charge.





Questions?


ESD Association Standard
ANSI/ESD S20.20-2014
Revision of ANSI/ESD S20.20-2007
For the Development of an Electrostatic Discharge Control Program for –
Protection of Electrical and Electronic Parts, Assemblies and Equipment (Excluding Electrically Initiated Explosive Devices)
ANSI/ESD S20.20-2014
ESD ASSOCIATION
Electrostatic Discharge Association
7900 Turin Road, Bldg. 3
Rome, NY 13440
An American National Standard
Approved July 31, 2014


I LOST AN ELECTRON!
ARE YOU POSITIVE?