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ESD BASICS

BASIC CONCEPTS IN ELECTROSTATIC DISCHARGE (ESD)

Introduction

ESD Control Training

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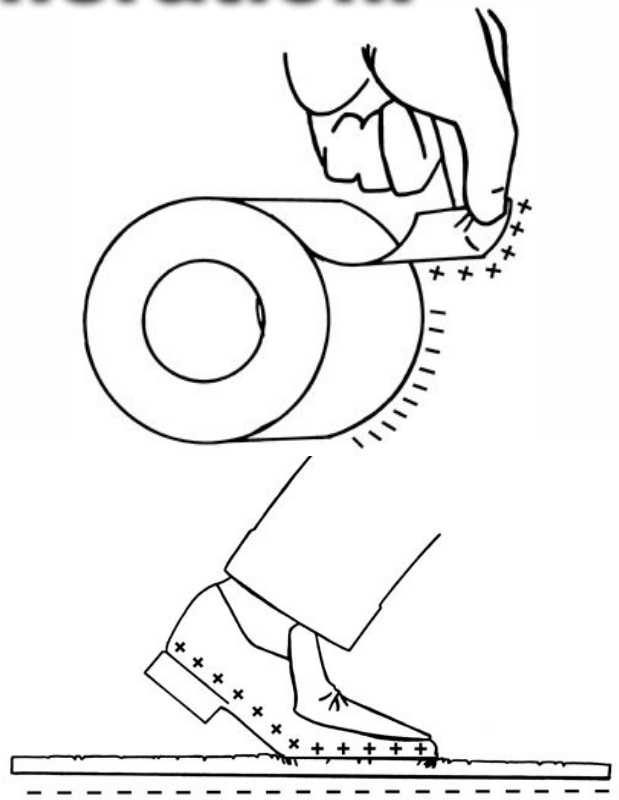
All Materials Tribocharge

ElectroStatic Charge Generation:

- When 2 Surfaces in Contact then Separate
- Some Atom Electrons Move Causing Imbalance



One Surface Has Positive Charge & One Surface Has Negative Charge

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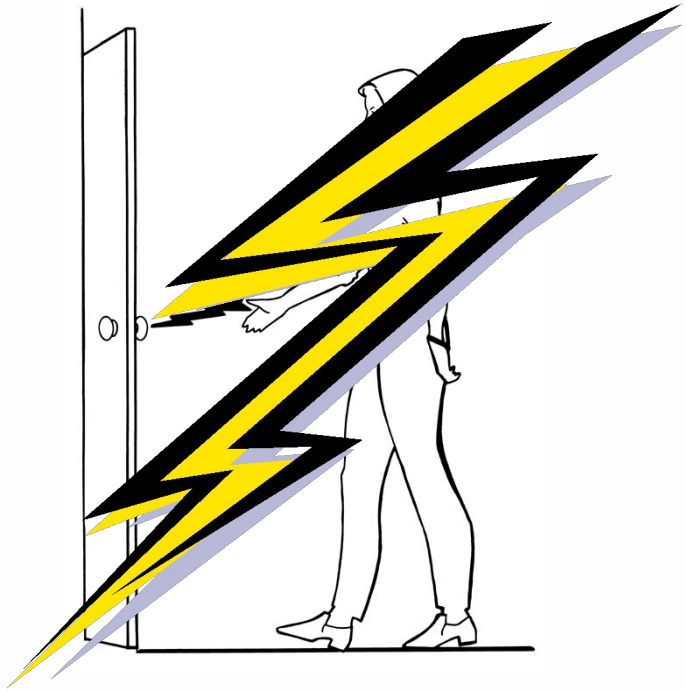
Examples Of Electrostatic Discharge or ESD

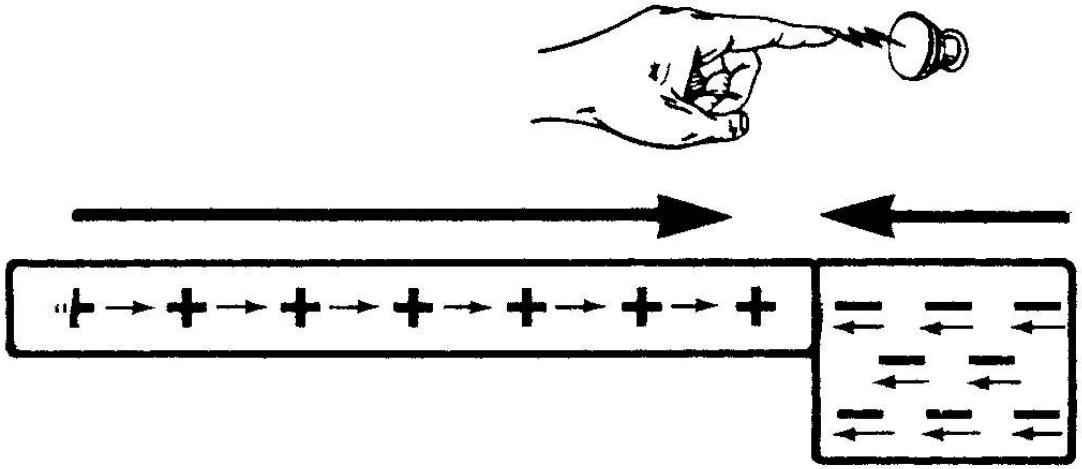
- Lightning



- Zap from a door

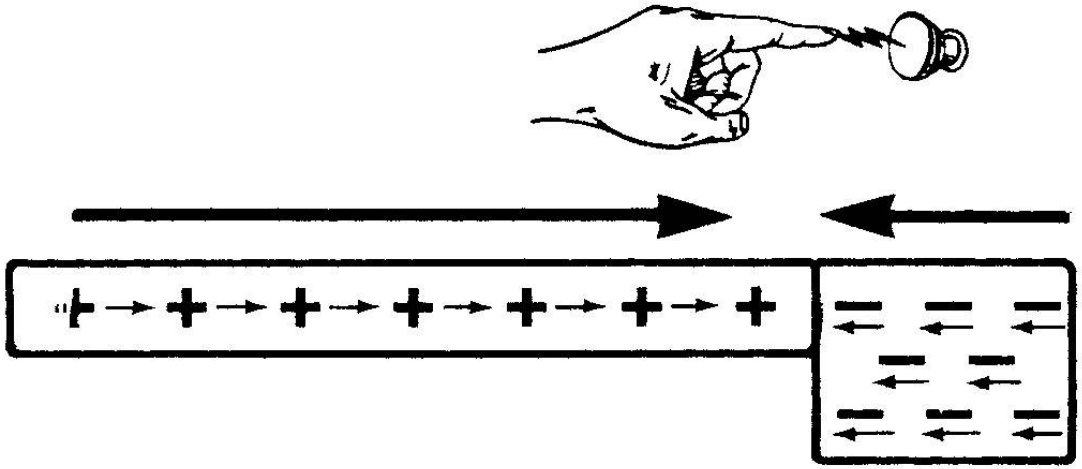
ESD or ElectroStatic Discharge

- Charges Seek Balance
- Discharge is Rapid
- Creating Heat



Two Types of Materials Conductors

- Electrical Current Flows Easily
- Can be Grounded
- Can Discharge
- Examples: Metals and People



Two Types of Materials Insulators

- Electrical Current Does Not Flow Easily
- Cannot be Grounded
- Example: **Plastics**

Typically very high charging

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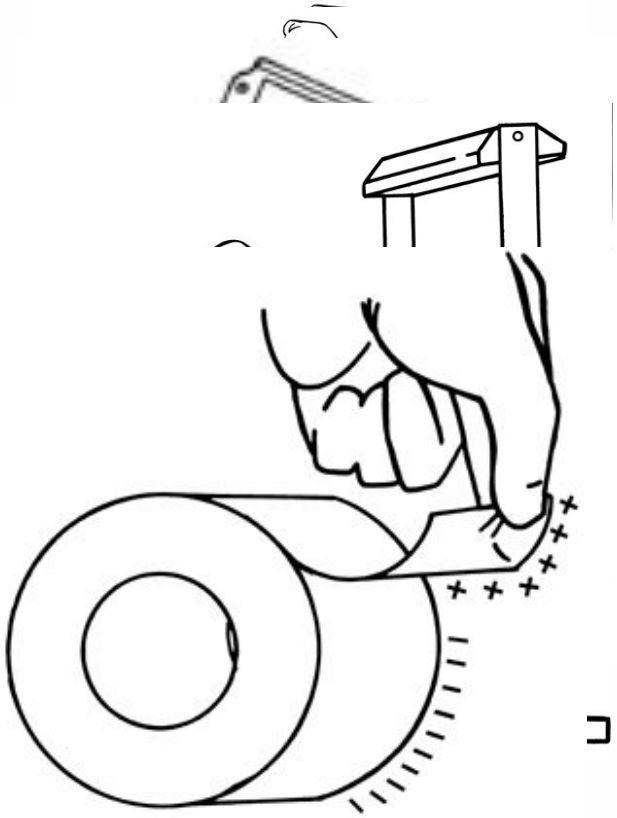
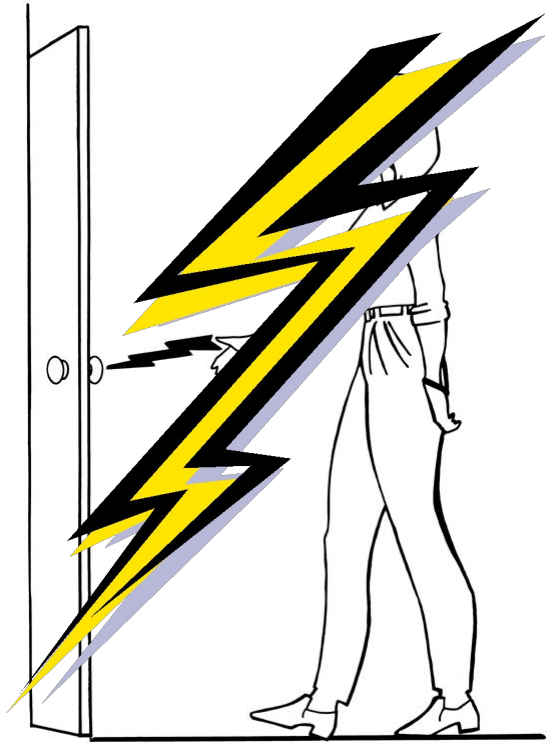
Large Charges Generated All The Time

- **Walking across a carpet:**
  1,500 - 35,000 volts
- **Walking over untreated vinyl floor:**
  250 - 12,000 volts
- **Vinyl envelope used for work instructions: 600 - 7,000 volts**
- **Worker at a bench:**
  700 - 6,000 volts
- **Unwinding regular tape:**
  9,000 - 15,000 volts



People Discharge Frequently

But To feel a Discharge it must be about 3,000 volts



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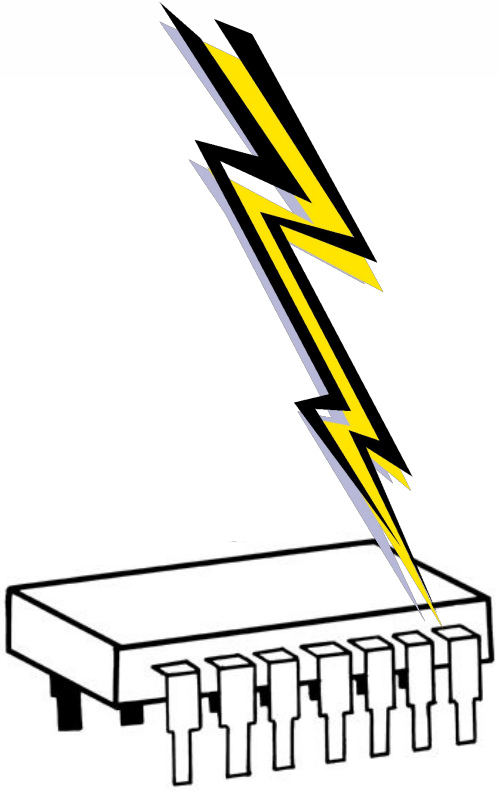
ESD That A Person Can't Feel Can Easily Damage Electronic Comonents

100 volts or less can damage components!



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Electronic Component ESD Sensitivity (ESDS)

Human Body Model (HBM) per ANSI/ESD STM5.1

- **ESD Class 0:** **Damage you can't feel:** **< 250 Volts**
  Device Names: SAW, JFETS, CCDs, Precision voltage regulator diodes, OP AMP, Thin film resistors, Integrated circuits, Hybrids utilizing class 1 parts, VHSI, CSCRs

- **ESD Class 1:** **Damage you can't feel:** **250 to 1,999 Volts**
  Device Names: SAW, JFETS, CCDs, Precision voltage regulator diodes, OP AMP, Thin film resistors, Integrated circuits, Hybrids utilizing class 1 parts, VHSI, CSCRs

- **ESD Class 2:** **Damage you might feel:** **2,000 to 3,999 Volts**
  Device Names: JFETs, Ics, VHSIC, Precision resistor networks (type RZ), Hybrids utilizing class 2 parts, Low power bipolar transistors

- **ESD Class 3A:** **Damage you can probably detect as spark with your own body:** **4,000 to 7,999 Volts**
  Device Names: JFETs, OP AMPS, Ics, VHSIC, All other microcircuits not included in class 1 or class 2, Small signal diodes, General purpose silicon rectifiers, Opto-electronic devices (LEDs, phototransformers, opto couplers), Resistor chips, Piezo electric crystals, Hybrids using Class 3 parts

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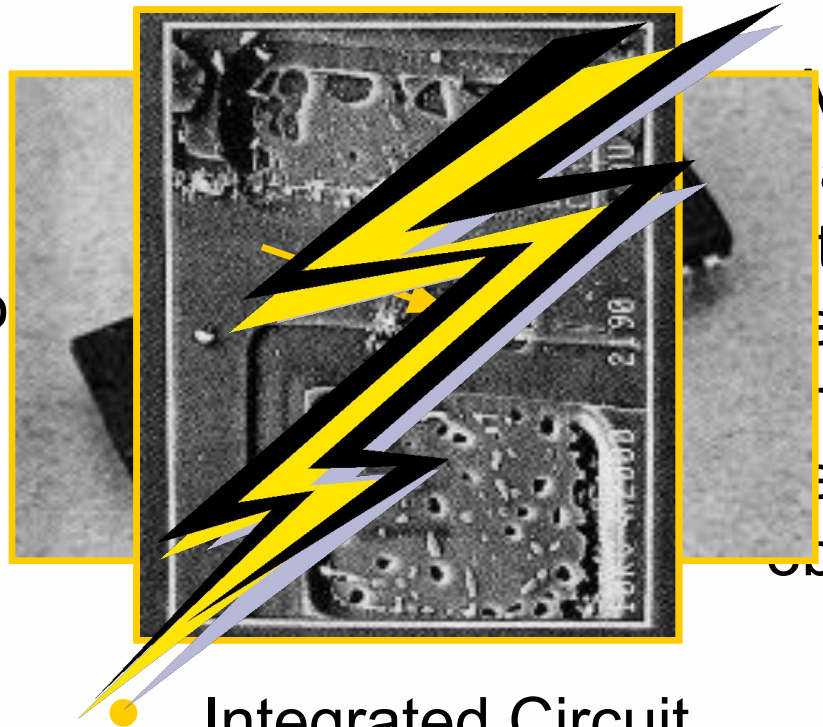
Tiny Conductive Paths Can Easily Be Damaged

Smaller components mean greater sensitivity to ESD. Damage to these components can not be detected by the naked eye.

- At this magnification we see that 1/2 of the width o the material has been destroyed



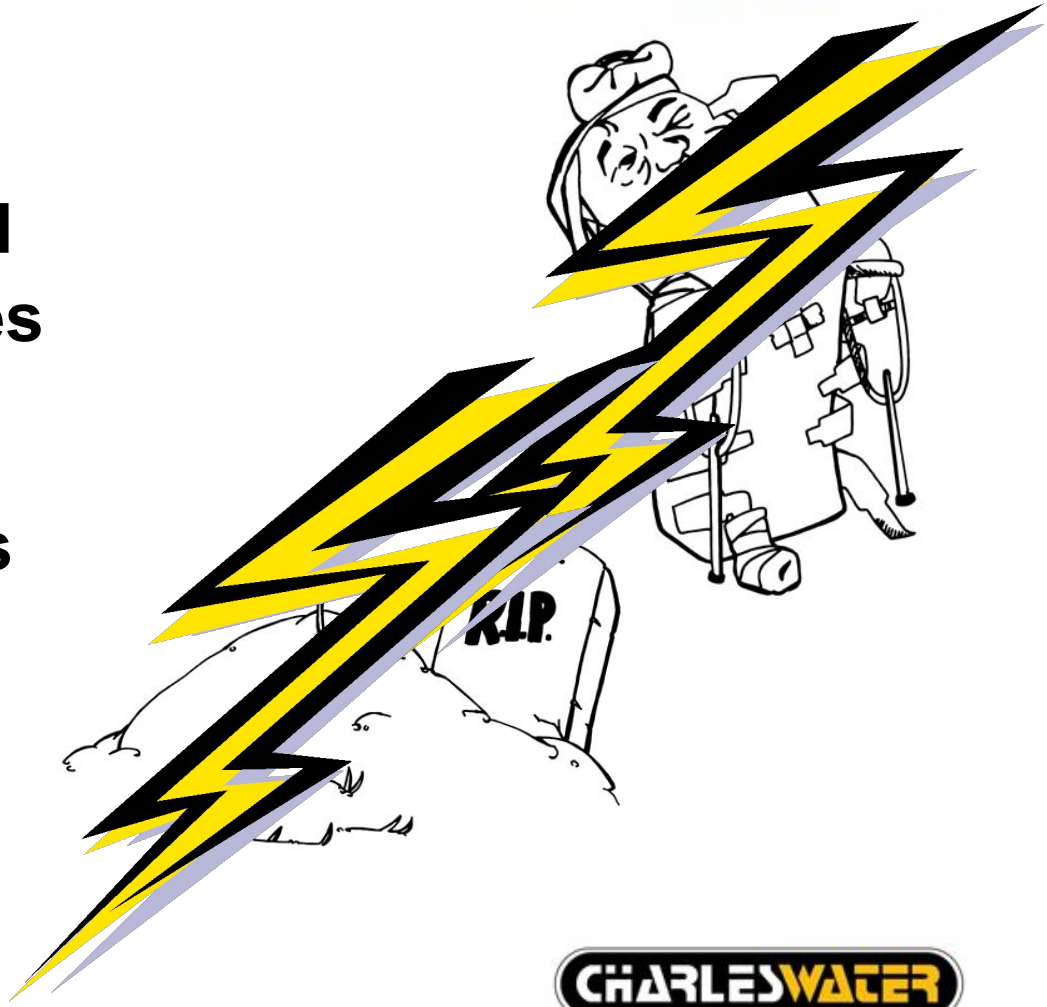
Integrated Circuit

t higher agnification, t in the area etween the base nd emitter ecomes more bvious

Types Of ESD Device Damage

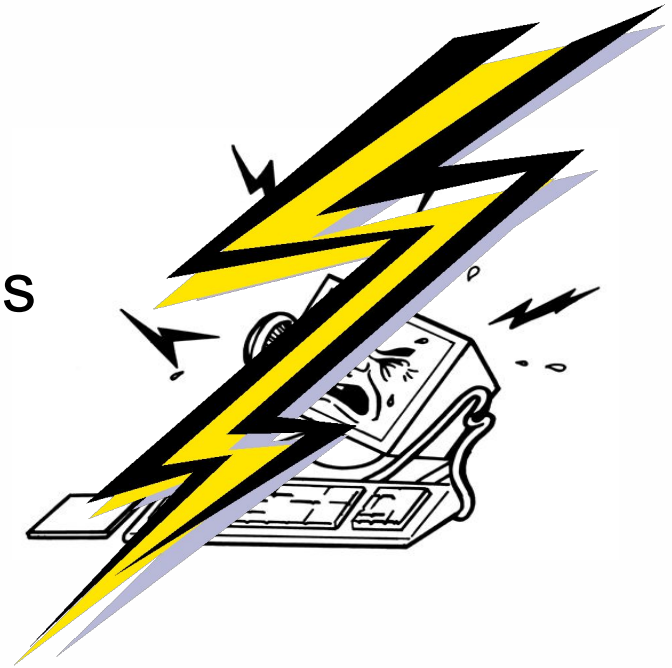
- **Latent Defect**
  Component wounded
  But Inspection Passes

- **Catastrophic Failures**
  Inspection
  Able to detect



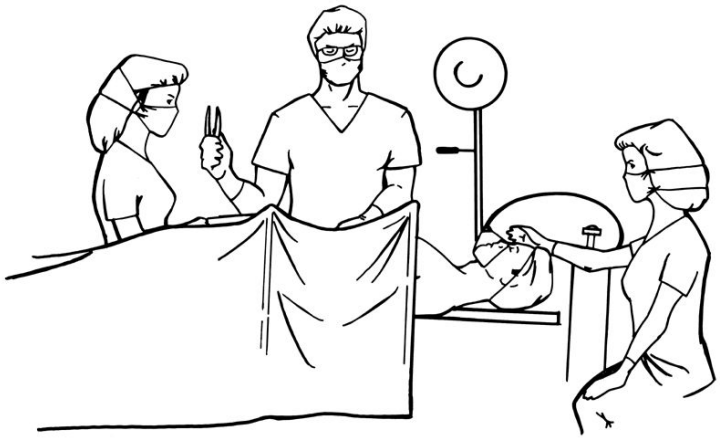
Latent Defects More Costly

- Sub Assembly passes inspection
- Assembly passes inspection
- Product passes inspection
- Works a while for customer
- Then Upsets & Mysterious Problems
- More Returns
- More Warranty Costs
- Lower Customer Satisfaction



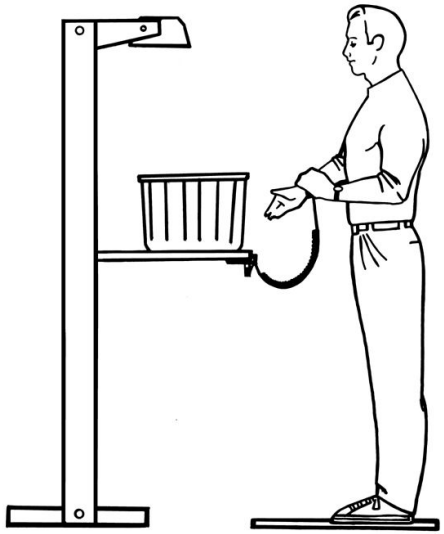
Like Germs, ESD Is The Hidden Enemy

Control Germs



We are aware of sterilization in medicine

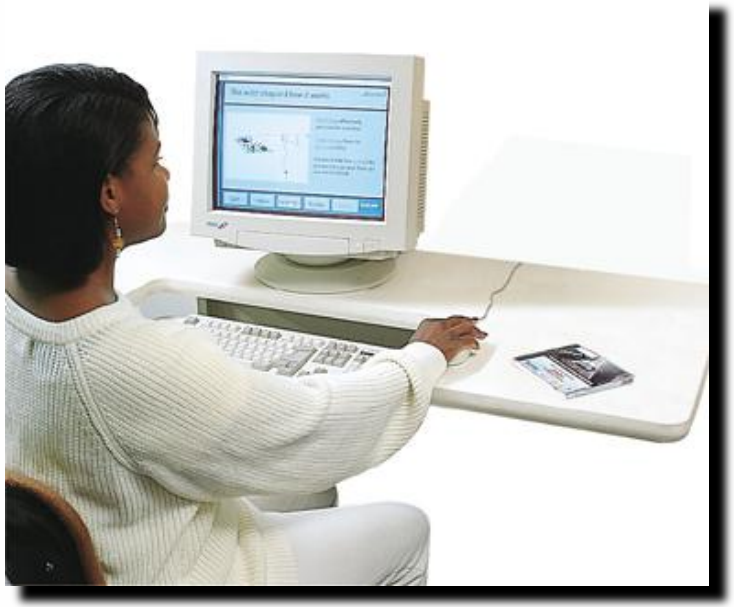
Control ESD



We should develop the same attitude about ESD

The Prerequisites of ESD Control

- Identify ESD Area
- Identify ESD sensitive items
- Provide ESD control training



The Basics Of ESD Control

- Ground Conductors

- Neutralise insulators with ionisers

- Shield ESDS
  When store or transport outside EPA

Ground Conductors Including People

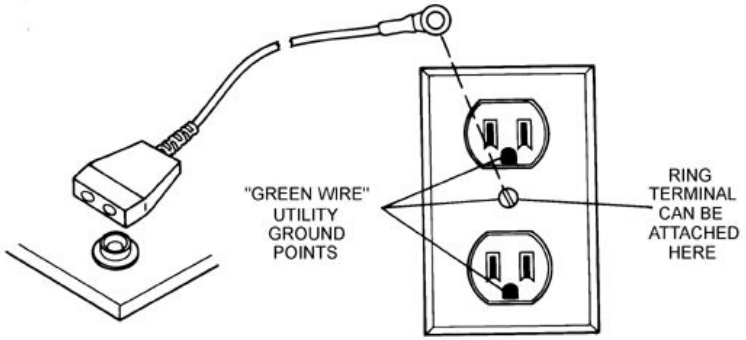
- Wrist Straps

- Must work, so
  test wrist strap daily

- Foot Grounders

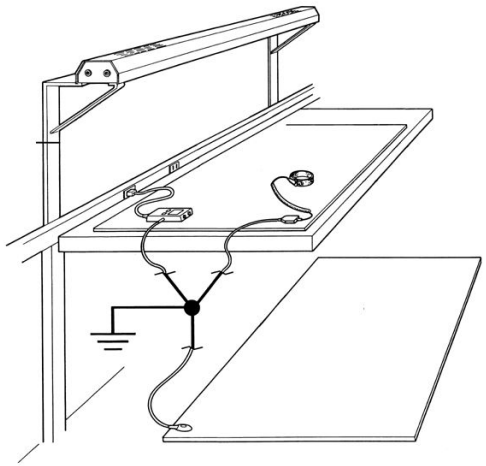
- Must work, so
  test foot grounder daily

Ground All Conductors in ESD Protected Area



- **Dissipative WorkSurfaces**
  - Ground ESD worksurface via ground cord to common point ground to equipment ground

- **Conductive Floor Mats**
  - Ground ESD floor mats via ground cord to equipment ground



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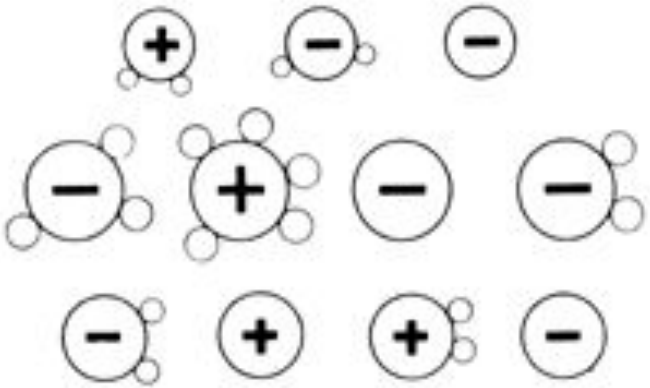
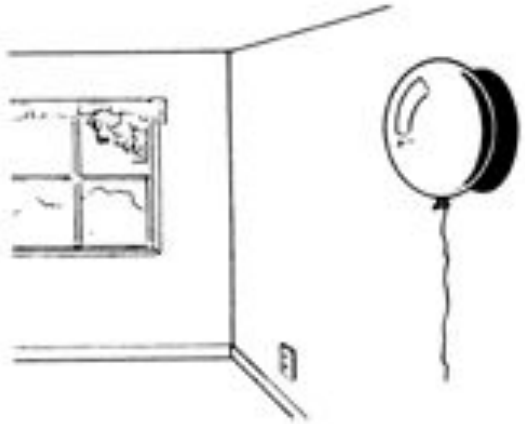
Neutralise Insulators Via Ionisers

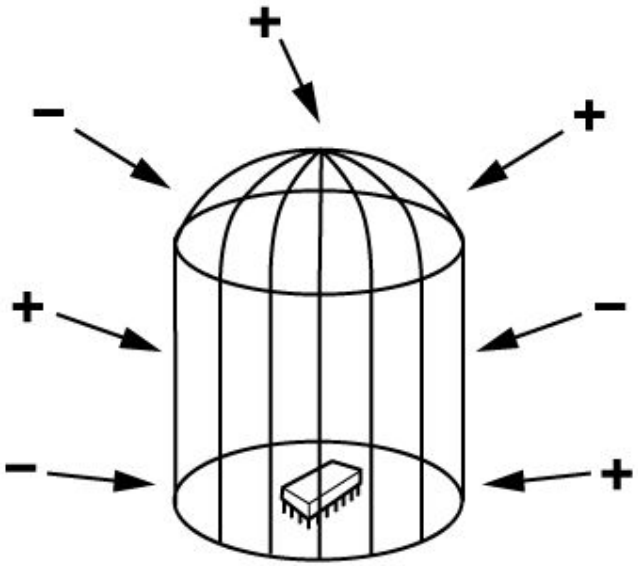
- Charged Insulators Cannot be grounded
  - Ioniser air flow floods area with Ions - Neutralising Charge





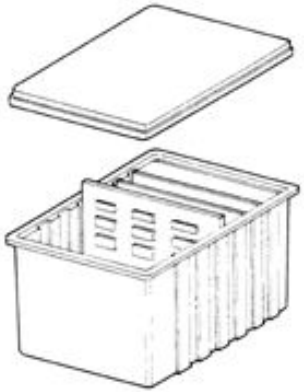
Shield ESD Sensitive Items Outside Protected Area

Faraday Cage



Charges Kept on Outside of Package:

- Closed Metallised Shielding Bag
- Covered conductive tote box



ESD Protected Products Regular Versions changed to be Low Charging and/or Groundable

Remove Insulator or Change to ESD Version

- ESD Smocks and Gloves
- Conductive Foam & Shunt Bars
- Antistatic or Low Charging Tape
- Dissipative Binders & Document Protectors
- Dissipative Floor Finishes
- Conductive & Dissipative Flooring

You Are On The Front Lines Fighting The Hidden Enemy

- Test Wrist Straps & ESD Footwear daily
- Keep wrist band snug, foot grounder grounding tab in shoe, & ESD Smocks buttoned up
- Only trained or escorted people allowed in ESD Protected Area

You Are On The Front Lines Fighting The Hidden Enemy

- Keep work area clean & clear of insulators
- Handle un-packaged ESD sensitive items only when grounded
- Visually check all grounding cords to make sure they are connected

You Are On The Front Lines Fighting The Hidden Enemy

- Make sure Ionisers are maintained and air flow is not blocked
- Use shielded packaging for shipping or storing ESD sensitive items outside the ESD Protected Area

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The Basics Of ESD Control

- Ground Conductors including people
- Neutralise insulators with ionisers
- Shield ESDS when store or transport outside EPA

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