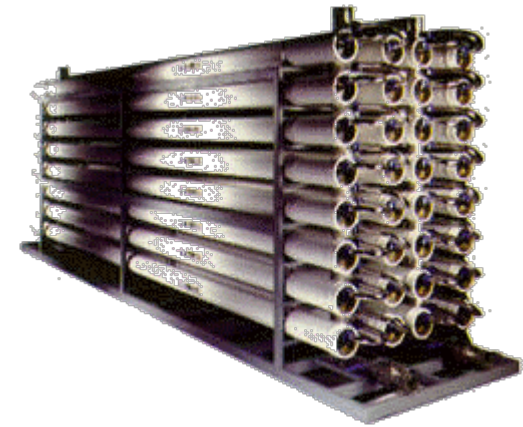


Ultra Pure Water (UPW)

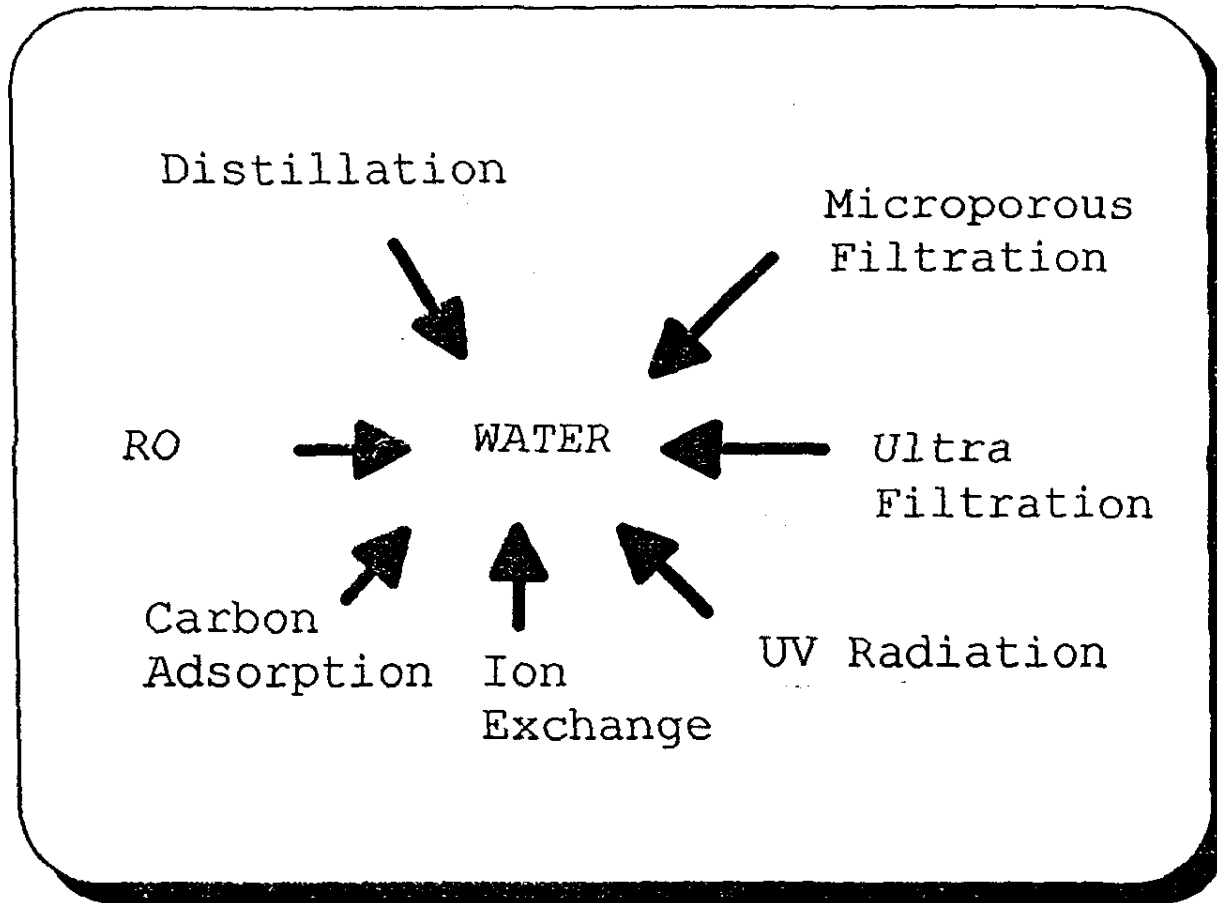
Water cleanness is a complex and costly process. City water contains unacceptable amounts of the following contaminants:

- Particulates (Silt, Colloids, Pipe debris)
- Dissolved Organics
- Dissolved Inorganics
- Micro-organism (Bacteria, Virus, Fungus)
- Pyrogen (Dead or Injured bacteria)



Ultra Pure Water (UPW)

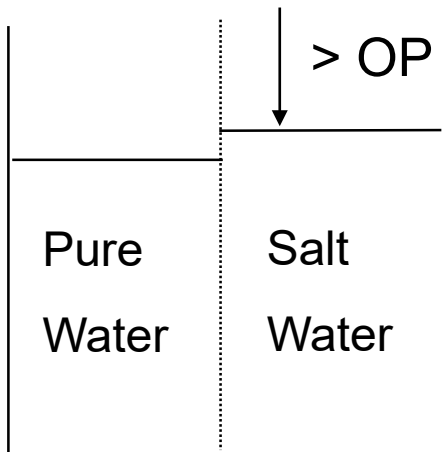
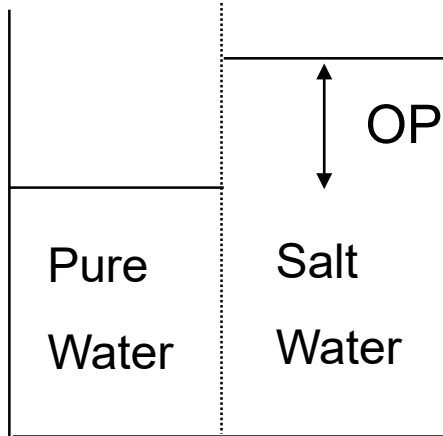
Technologies used to purify water



Filtration:

- Remove particulates.
- Nominal filters for pre-treatment.
- Absolute filters for post-treatment (0.22um).
- Micro-porous membrane filters removes even micro-organism but costly & not re-generable.
- Adsorption filters (Long Life) or Activated Carbon adsorption filter to trap dissolved organic but not particles, dissolved inorganic and bacteria, mainly to remove chlorine but bacteria build up in the line when Cl removed

Ultra Pure Water (UPW)



Reverse Osmosis:

- Osmosis is movement of solvent from dilute solution to concentrated solution until equilibrium where an osmotic pressure (OP) exists.
- Reverse osmosis is applying pressure to overcome the osmotic pressure so that solvent will flow from concentrated solution to dilute solution through a membrane.
- Membranes: Cellulose acetate, Polysulfone & Polyamides.

Ultra Pure Water (UPW)

Reverse Osmosis:

- % removal technology (not absolute) and Gases not removed.
- Removes Particles, Organic (large molecular weight easily removed), 99% Bacteria and Pyrogens.
- Polyvalent ions (99%), Monovalent ions (Sodium, 90%)
- Factors: Temperature, PH, Bacteria, Chlorine and Scaling Tendency of water
- Minimum maintenance

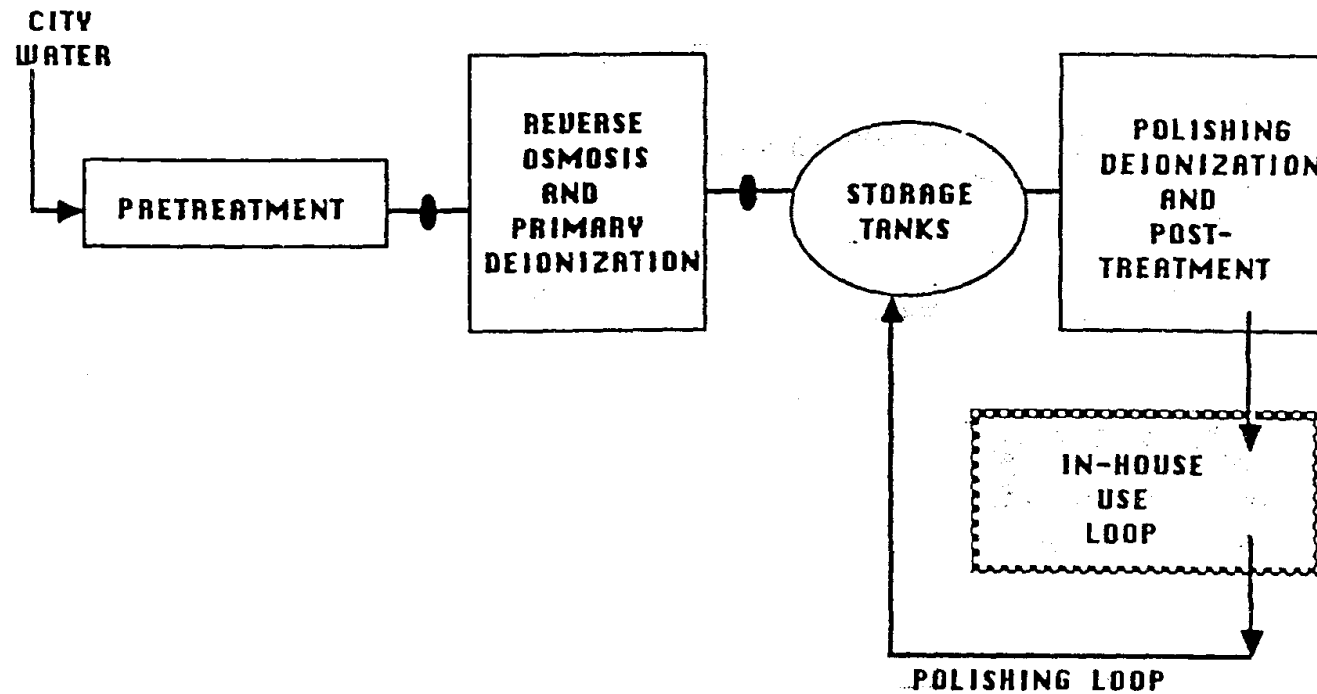
De-Ionization (DI):

- Removes dissolved inorganics/minerals, ionized salts by Ion Exchange with synthetic resin.
- Does not remove particles, pyrogens and bacteria instead can even generate particles and culture bacteria.
- Purity of water measured by specific resistance (>18M).
- Current technology includes Electrodeionization (EDI) & Capacitive Deionization (CDI).

Ultra Pure Water (UPW)

UV Treatment:

- Eliminate trace organic: TOC (Total Organic Count) reduction.
- Post-Treatment or combine with DI to control bacteria or even better Point of Use.



Typical conventional ultrahigh purity water treatment system.

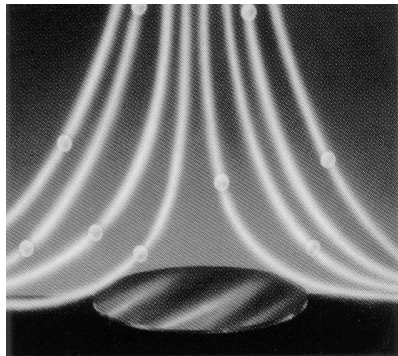
Electrostatic Discharge (ESD) Control

A surface transfer of electrostatic charge between objects at different potentials caused by direct contact or induced by electrostatic field.

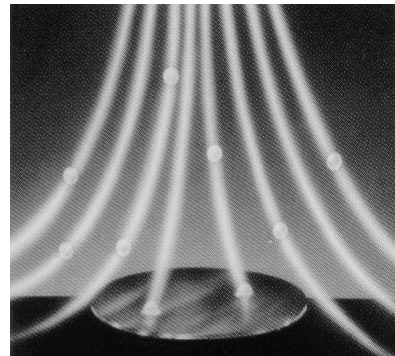
Type of ESD Failures:

- Thermal (avalanche) breakdown
- Dielectric breakdown
- Metallization Melt

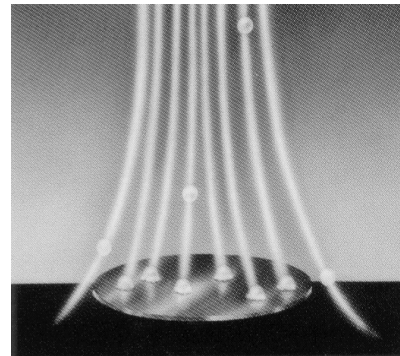
Another problem: Attraction of Particles by Charged Surface



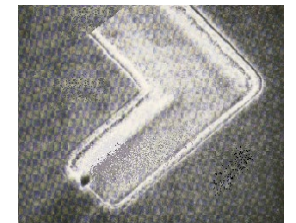
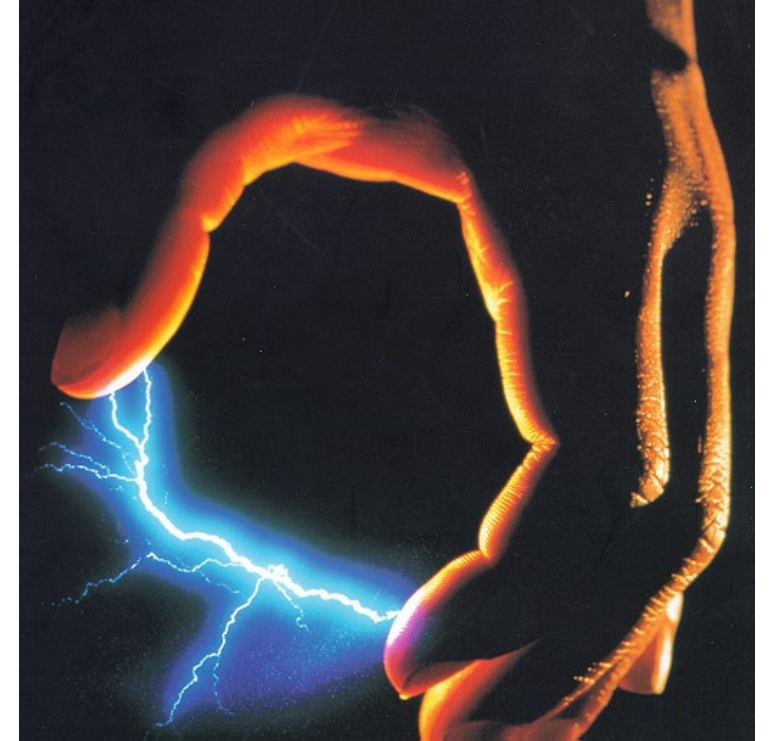
Without static charge



Wafer charged to 500V



Wafer charged to 4000V



Proofs of ESD damage to IC

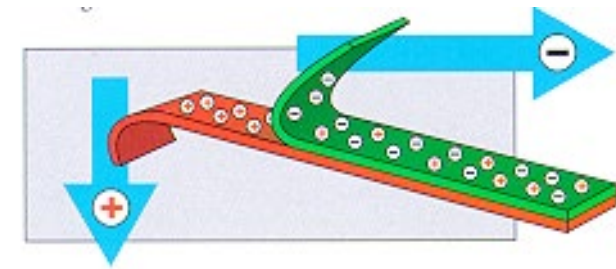
Electrostatic Discharge (ESD) Control

Presence of charge & therefore the voltage as a result of the electric field from the charged surface is caused by:

- Triboelectric charging
- Changes in capacitance
- Induction

Triboelectric Charging:

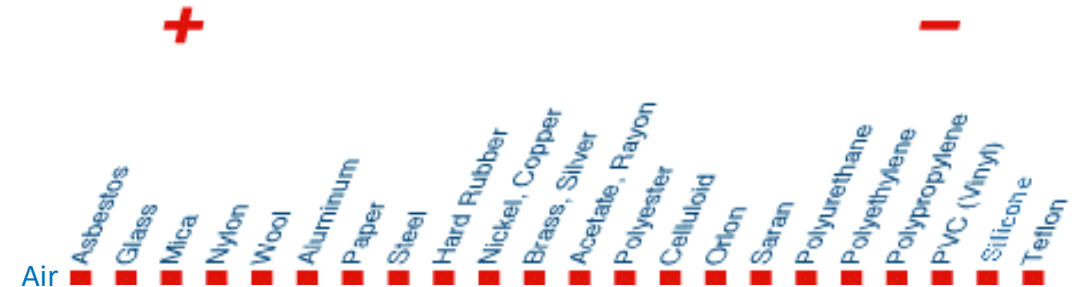
- The electrification of dissimilar materials through physical contact and separation, and the positive and negative charges so formed.
- Static Charge on contacting surfaces can be increased with addition of friction or rubbing.



TRIBOELECTRIC SERIES

INCREASINGLY POSITIVE

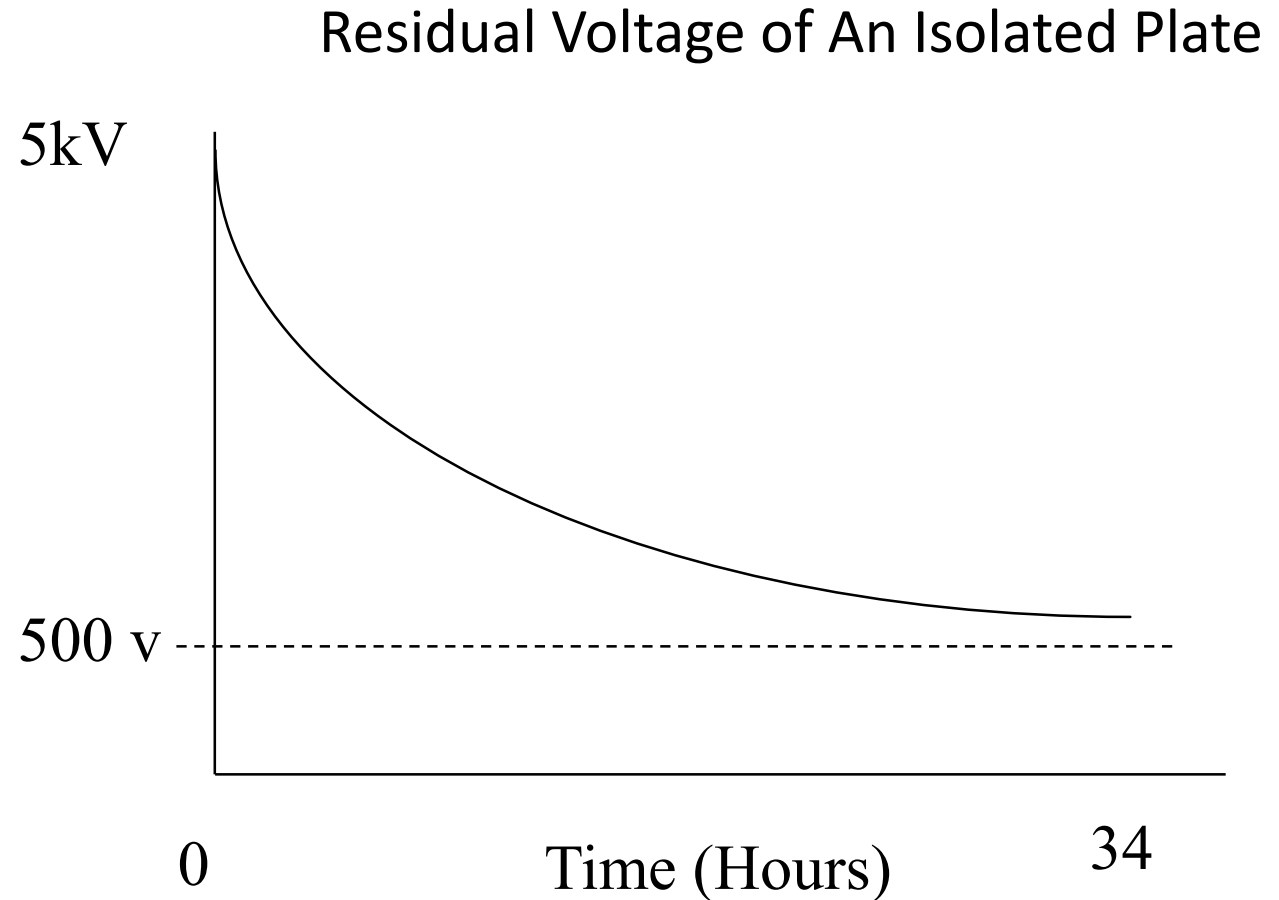
INCREASINGLY NEGATIVE



Electrostatic Discharge (ESD) Control

- Silicon Wafers 5kV
- Teflon Boots 5kV
- Plastic Walls 35kV
- Acrylic Covers 15kV
- Quartz Carriers 15kV
- Plastic Film 40kV
- Alumina 1kV

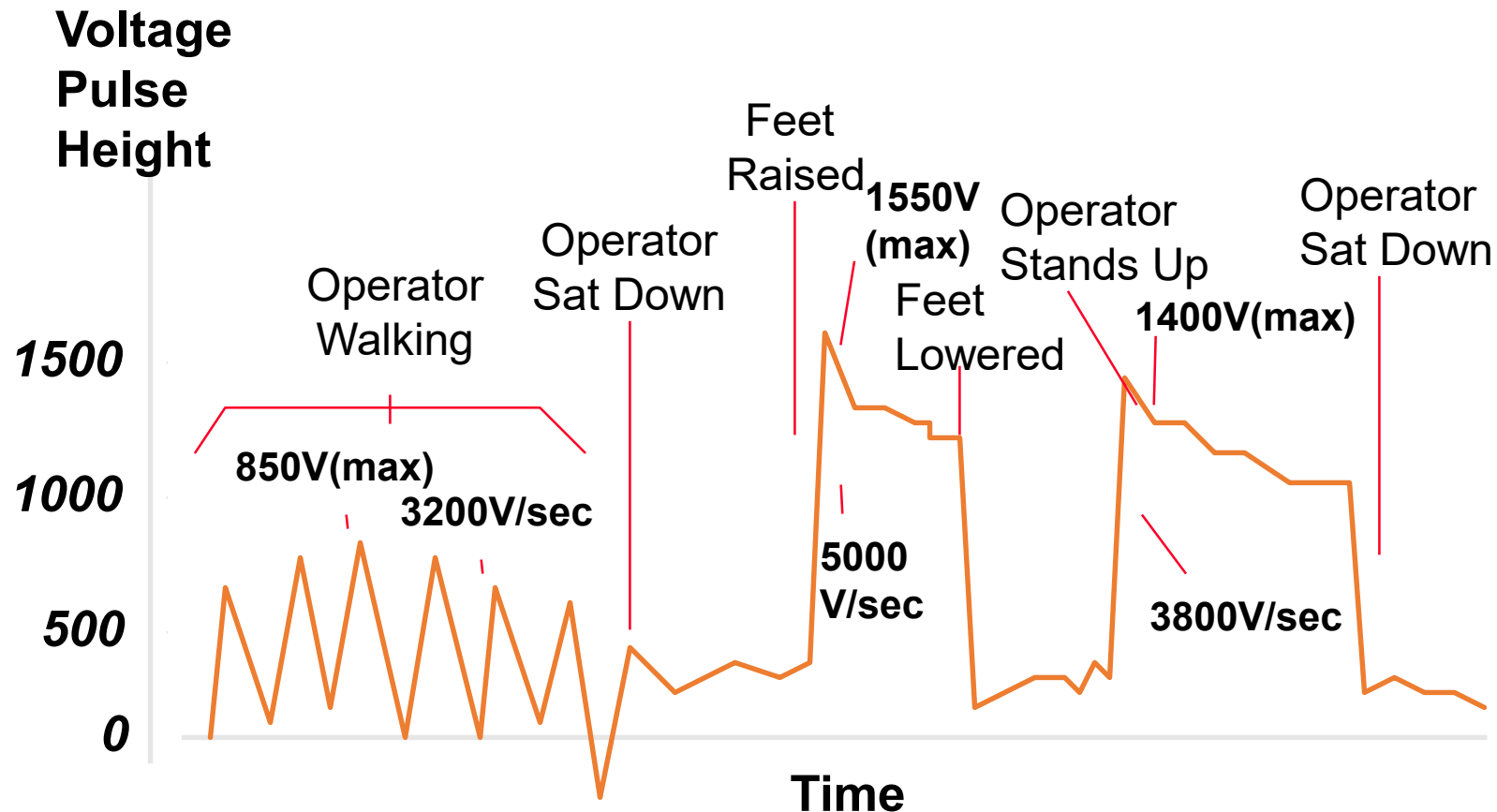
Insulator material gets charged to a higher voltage & stay charge for a longer time.



Electrostatic Discharge (ESD) Control

Changes in Capacitance:

- Voltage on an object is greatly affected by the capacitance of the object.
- Capacitance can change in the environment due to position of the object relative to other objects in the area, for example human movements of sitting & standing.



Electrostatic Discharge (ESD) Control

Induction:

- Process of producing charges on a material through space at a distance by the influence of an electric field.

ESD Control through:

- Prevention:
 - ✓ ESD Safe material to reduce generation.
 - ✓ Humidity level 40% to 50% (Too dry ESD, Too humid Oxidation problems)
- Protection:
 - ✓ Education of personnel on movements that can create high voltages.
 - ✓ Faraday Cage shielding during storage and transport to protect against charging by Induction.
- Elimination:
 - ✓ Grounding for charge to migrate from conductive objects/human to ground.
 - ✓ Neutralization of charge on insulators and isolated conductive objects by Ionizers.

Electrostatic Discharge (ESD) Control

Insulator (10^9 ohms to infinity)

- material that prevents or limits the flow of electrons

Conductive (0 to 10^6 ohms)

- material that allows electrons flow easily

Static Dissipative (10^6 to 10^9 ohms)

- material that behave in-between insulator and conductive, it permits electrons flow but at a slower rate than conductive material

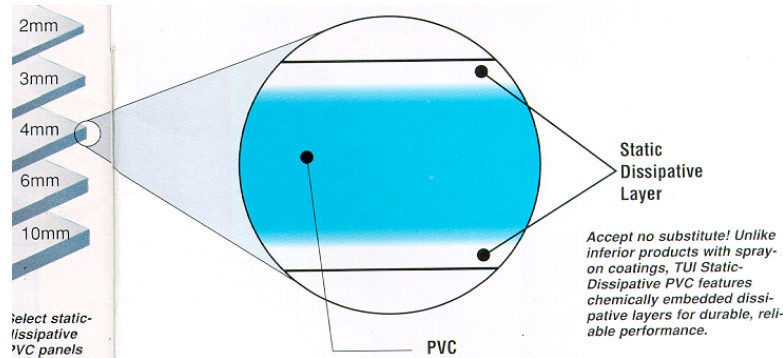
Antistatic material refers to the property of material that inhibits triboelectric charging & shall not triboelectric charge to greater than +/- 200 volts under normal/intended usage.

A material's antistatic property does not necessarily correlate to resistivity or resistance.

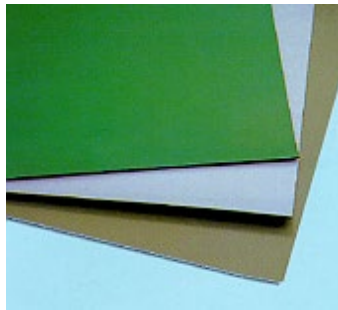
Static Dissipative materials are naturally Antistatic & is the material used to control ESD by reducing charge production & for the ease of elimination.

Electrostatic Discharge (ESD) Control

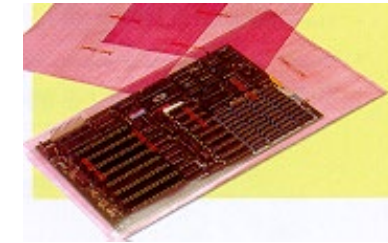
Examples of ESD Control using Static Dissipative materials at the surface:



Static Dissipative paper & tape



Static Dissipative mats & foams



Static Dissipative Bags



Static Dissipative cleanroom apparel, chair & raised floor

Electrostatic Discharge (ESD) Control

- Shielding is used to protect electrostatic susceptible items when they are being transported between Static Protected Areas.
- Shielding is a requirement for the most sensitive classes of components in Military contracts and many commercial specifications.
- A Static Shield can attenuate an electrostatic field & must be conductive (Faraday Cage).



Conductive Shielding Bags

Construction of ESD Safe Bags:

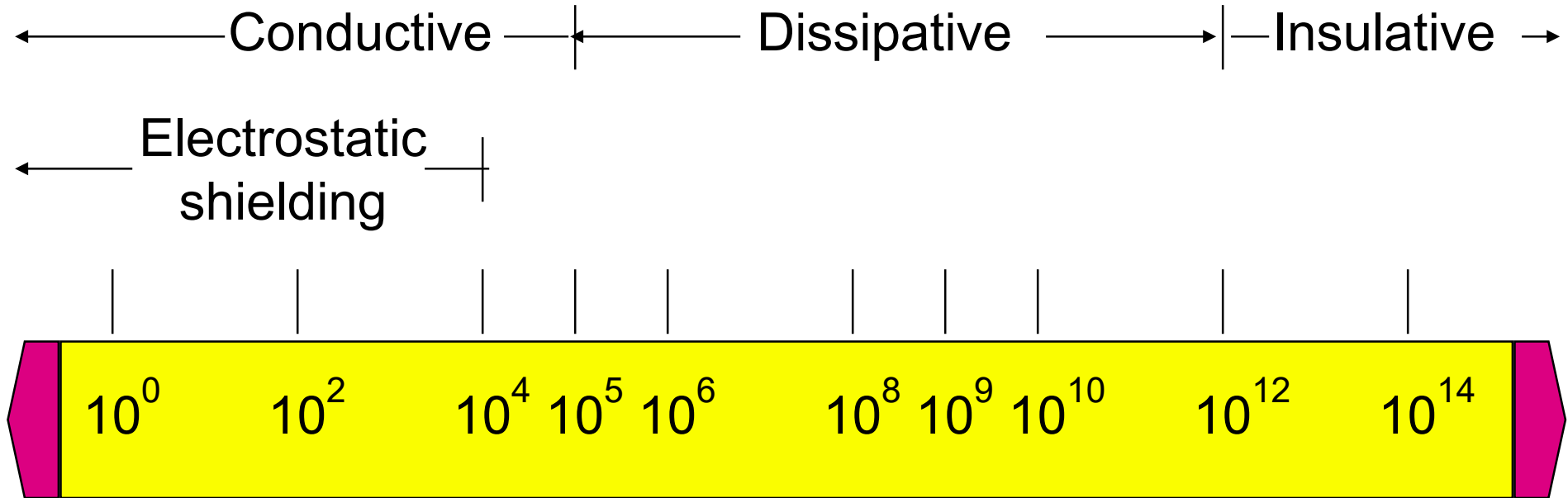
	METAL-OUT BAGS	METAL-IN BAGS
	DY3816	DY3650 / DY3660
	Aluminium	Antistatic Polyester
	Polyester	Aluminium
	Antistatic Polyethylene	Antistatic Polyethylene

Multi Layer Conductive Shielding & Static Dissipative Bags possible



Conductive box for transport

Electrostatic Discharge (ESD) Control



Electrostatic Discharge (ESD) Control



Wrist straps & heel straps (non cleanroom) grounding to eliminate static charges.

- Grounding insulators neither removes nor prevents surface charges.
- There should not be any Insulator material used in the first place.
- But this is impossible, for example computer body or insulator on electrical wires.
- Ionizers are used.



Local area air ionizer



Ionizing air gun



Laminar flow workstation ionizer