CAROLINA INDUSTRIAL

ESD Materials

Static electricity

Natural phenomenon that exists in the environment which manifests itself as a momentary electrical discharge (**Electro Static Discharge**) between two elements when the appropriate conditions exist for its generation. Ambient temperature, movement or manipulation among others, favor electrification by friction (**Triboelectrification**).

Requirements and regulations

· Any organization that complies with **ANSI/ESD S20.20-2014** must have a documented packaging plan that addresses the packaging requirements for Sensitive Electronic Devices (**SED**).

· Transport of **SED** items requires packaging that provides protection against electrostatic hazards in the **handling, transport or storage system. ESD protection needs will be defined based on the characteristics of each component.**

Segmentation and ESD applications

Property	Feature	App Automotriz
Antistatic	Materials that inhibit tribo electrification; its electrical resistance is not necessarily associated with this characteristic.	Dunnage in close contact with the ESDS
Dissipative	They prevent the accumulation of charges, conducting them slowly thanks to their range of electrical resistance.	Dunnage in close contact with the ESDS
Conductive	Their electrical resistance is very low and consequently they do not allow the accumulation of charges. The loading speed is very fast.	Containers without intimate contact with ESDS
Insulating	Its electrical resistance is so high that it does not conduct electricity.	TBD

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Triboelectric charge

It is the generation of electrostatic charge (**ESD**) produced when two materials come into contact or rub against each other and then separate.

Electric resistance

· It is the opposition to a flow of electric current (voltage) of a material, its unit of measurement is the **ohm.**

· Reducing the electrical resistance of a packaging material provides a path for charge to be removed from it.

· Specific values of electrical resistance are useful for different purposes:

Resistance ranges and test methods

Test methods and limits for electrostatic protective packaging

Property	Test method	Method description	Limits	Marina Coating option
Low charge	ESD ADV11.2	Tribocharging of tubes, flat materials, bags, unit packages (vibration)	User defined	Plastilona Anti-Dust 18 Plus, Cortilona Anti-Dust 13, RipStop Anti-Dust RS
Dissipative	ANSI/ESD STM11.11	Surface resistance of flat materials	$\geq 10^4$ a $<10^{11}$	Plastilona antistat 18 Cortilona dissipative 13
	ANSI/ESD STM11.12	Volumetric resistance of flat materials	$\geq 10^4$ a $<10^{11}$	
	ANSI/ESD STM11.13	2-point electrode surface resistance	$\geq 10^4$ a $<10^{11}$	
Conductive	ANSI/ESD STM11.11	Surface resistance of flat materials	$<10^4$ ohms	
	ANSI/ESD STM11.12	Volumetric resistance of flat materials	$<10^4$ ohms	

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Denomination		Resistance (ohms)	Exponent
Conductive $< 1 \times 10^4$	↑	10 100 1,000	10^1 10^2 10^3
Dissipative $\geq 1 \times 10^4$ a $< 1 \times 10^{10}$	↑	10,000 100,000 1,000,000 10,000,000 100,000,000 1,000,000,000 10,000,000,000	10^4 10^5 10^6 10^7 10^8 10^9 10^{10}
Insulating $\geq 1 \times 10^{11}$	↓	100,000,000,000	10^{11}

Marina Coating - Dunnage Recommendations

· Avoid the use of **solvents** to clean packaging materials with ESD property, this reduces conductive, dissipative and antistatic properties.

· To achieve complete ESD protection in the packaging, it is necessary to use **conductive threads** for sewing panels and cells.