ANTISTAT™
ESD & PRODUCTION CONSUMABLES

Learning about ESD

Part 3
Choosing the right bag

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Choosing the Right Static Bag

BACKGROUND
Most people are aware of the effects of static electricity in general terms; that scuffing shoes on carpet and touching a person or metal door handle can produce a small shock. The use of a tumble dryer will often cause a “static cling”, but few people are aware of the damage that the static electricity behind these common events can cause on modern electronic circuits and devices.

As electronic circuits and their connecting pathways have reduced in size over the years, their susceptibility to damage from static electricity has increased. Protective handling and packaging techniques have been adopted by the electronics industry from the chip foundry to the production floor to the field service arena.

ESD / ANTI-STATIC BAGS
One of the most preventative measures used against ESD is the anti-static bag. The use of such bags began in the 1960’s with the introduction of “pink poly” bags. Static shielding bags followed in the late 1970’s, and whilst originally used in the military, moisture barrier bag usage has increased dramatically in Surface Mount Technology over recent years.

STATIC THREATS
Electronic devices should be protected from 3 primary threats:

1. Direct Discharge (ESD):
A discharge directly to a bag can subject the device inside to very high current, melting or fusing the circuit.

2. Static Fields:
Fields can induce destructive currents in circuit conductors. Field differentials can break down the circuit dielectric.

3. Tribocharging:
Friction between the bag and device can produce damaging static voltage and fields.

TESTING OF PROTECTION
An oscilloscope connected to a sensor inside the bag measures the amount of voltage that penetrates the bag. This test also addresses the field threat. Fields are generated by the discharge to the outside of the bag, fields that penetrate the bag are represented with a voltage measurement.

Tribocharging tests are difficult to perform and data from bag specs are only to be used as a benchmark, as they may not show how a material will perform in use.

Surface resistivity is an indication of a material’s ability to allow static to move around / dissipate. Note, this does not necessarily suggest low tribocharging.

Bag types

PINK ANTI-STATIC BAGS OR DISSIPATIVE POLY BAGS

The pink anti-static or poly bag dissipates static charge to ground keeping static charge from building up on the package or device. The material is anti-static and therefore should not charge up when rubbed against other materials. Pink poly's resistivity is in the dissipative range and is usually around 10^9 to 10^{11}.

Please note that these bags have no shielding ability. A static field or discharge occurring outside the bag will penetrate the bag and damage electronics inside.

Pink poly bags are constructed from polyethylene that has been loaded or surface coated with a chemical antistat. See Fig. 1.

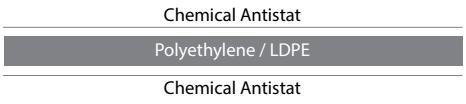


Fig. 1. Structure of Pink Poly
Our pink anti static bags are blow-molded with anti static additives from LDPE and LLDPE.

The pink color is a colorant added to differentiate static control materials from standard packaging. In the past, a reactive form of amine was used in the chemical antistat causing oxidation of some metals and stress cracks in some plastics. The pink color is some times incorrectly associated with this amine type antistat. Some manufacturers switched to amide based antistats and removed the pink color in response to customer requests.

USES: FOR ITEMS THAT HAVE NO STATIC SUSCEPTIBILITY.
Their primary use is to package support or processing materials that will be in close proximity to static sensitive devices. This keeps static generating packaging materials away from sensitive areas.

Fig. 2. Structure of Black Poly
Our black conductive bags are constructed from a conductive material made out of a 4 mil single layer of carbon loaded polyethylene, creating a Faraday Cage

BLACK CONDUCTIVE POLY BAGS

Black poly is very conductive, usually about 103 - 104 and dissipates quickly. Unfortunately the speed of this dissipation also means that a charged person or object can 'spark' to its surface. The primary objective in static control is to transfer charges at a slow enough rate to avoid sparks, but not too slow so as to allow a build up of static. As black poly is conductive it does provide a small measure of shielding (<30%), however there is no dielectric layer to isolate a device inside. The charge may be transferred through the volume of the material to the device instead of around the material to ground.

Black poly bags are a polyethylene plastic that is volume loaded with a conductive form of carbon. The material is black and opaque in appearance. See Fig. 2.

USES: Black poly bags are normally used as a bridge between pink poly and shielding bags as they are slightly lower in cost and offer some shielding as opposed to none with pink poly. Black poly bags are opaque in appearance and therefore the bag's contents must be removed for identification purposes creating a opportunities for static damage.

SHIELDING BAGS

Shielding bags provide similar dissipative and antistatic properties of the poly bag but add a metal shield and polyester dielectric to stop static from entering the bag. The test for shielding demonstrates the difference between the various bags. Shield bags will generally stop 97% of a 1,000 volt pulse applied to the outside of the bag from reaching the inside and its contents whereas pink poly stops only about 10% and black poly about 30%.

Static shielding or metal shield bags consist of several layers. From the interior to the exterior the layers are: dissipative poly laminated (glued) to aluminized polyester. The outside dissipative layer has an antistat coating. The metal is vapour deposited in a vacuum chamber. Aluminum is most commonly used in this process, with nickel and copper also being used. This structure, with the metal between two layers of plastic, is called "buried metal" or "metal-in".

In a "surface metal" or "metal-out" structure, the poly is laminated to the polyester with the metal on top. There is an abrasion coating on the metal. The metal generally used is nickel and it is sputtered instead of vapour deposited. See Fig. 3 and 4.

Fig. 3. Structure of a Metal In Shield Bag.

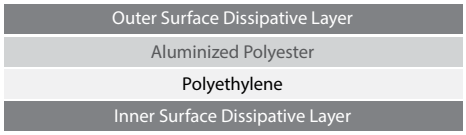
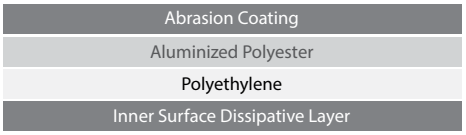


Fig.4. Structure of a Metal Out Shield Bag.



Our bags are manufactured from industry approved polyester and polyethylene laminates. The polyester dielectric works with the metal layer to provide a Faraday effect, the metal layer preventing penetration from damaging electrostatic fields. The specially processed polyethylene keeps tribocharging to a minimum.

The metal-in bag offers better protection of the transparent metal shield by placing it between two plastic layers. The metal-out bag has a conductive outer surface providing fast charge dissipation, however like the black poly bag it can be sparked to.

USES: STATIC SHIELD BAGS SHOULD BE USED FOR ALL ELECTRONIC COMPONENTS, BOARDS AND ASSEMBLIES.

MOISTURE BARRIER BAGS

Moisture barrier bags provide dissipation, antistatic properties, static shielding, and add a moisture vapor barrier protecting moisture sensitive items and improving long term storage.

Moisture barrier bags are similar in structure to the shield bags, but are typically much stronger. There are 2 types of construction “foil and tyvek” (Fig. 5.) and “heavy metallisation” (Fig. 6.).

Fig. 5. Structure of a Foil Barrier Bag.

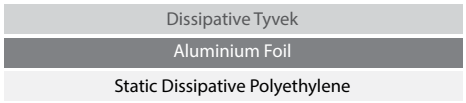
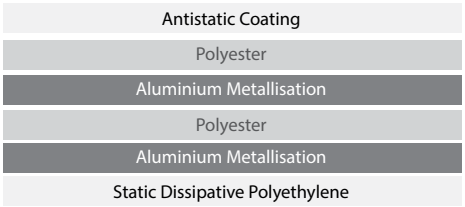


Fig. 6. Structure of a Metallised Barrier.



The heavy metallisation structure is essentially that of a shielding bag but with opaque, thick layers of metallisation. Nylon is regularly used in place of Tyvek or polyester, providing the needed strength at a lower cost than Tyvek.

USES: WHEN BARRIER PROTECTION IS NEEDED OR MAXIMUM SHIELDING PROTECTION IS DESIRED WITHOUT TRANSPARENCY BEING AN ISSUE.

Summary

Static protective bags should be used as part of a static control program. Selecting the appropriate bag can help reduce static damage and save money on costly repairs and rework. The cost of static protective packaging is insignificant when compared to the protection it affords the costly items placed in the package.

PICKING THE RIGHT BAG

- Use static shielding or moisture barrier bags for all electronic circuits.
- Use pink poly for non-electronic parts and production goods that must be near electronics.
- Use bags as part of a full static control program.

BAG SOURCING

Key things to remember when sourcing bags:

- The least expensive bag may not be the best investment. Look for a product that works for its application. Materials and bags should be tested by the manufacturer before shipping. Look at a supplier's quality program, material trace ability, and test standards.
- Consider the supply chain; stability and delivery.
- A large selection of standard sizes, (more than 100) will keep you from paying for custom sizes.
- Look for technical depth to support the product.
- Finally, after the aforementioned issues are addressed, consider the price.

GLOSSARY OF TERMS

Electrostatic Charge is an electrical charge at rest.

Electrostatic Discharge (ESD) is the transfer of static charge between two objects at different potentials.

Electrostatic Discharge Sensitive (ESDS) refers to a device that is sensitive to ESD.

Antistat is a chemical that makes a surface able to resist charging. Most antistats, when applied to plastic, attract water (humidity) from the air creating a moisture layer on the surface of the plastic that can conduct electricity. Some more modern antistats contain different chemical arrangements that carry their own water with them.

Tribocharging is when 2 objects are rubbed together and separated causing a charge, eg when a person walks across a carpet and then sparks to a door handle., the person's contact and separation with the carpet charged them.

Antistatic refers to a material's ability to resist generating a charge by friction (tribocharging). Antistats can create an antistatic surface by increasing the surface's lubricity.

Static Dissipative materials can conduct static across their surface or through their volume to a ground point.

Insulative materials have a resistivity of more than 10^{12} ohms and should not be used in an EPA environment.

Dissipative materials have a resistivity of more than 10^{5} and less than 10^{12} and should be used for intimate contact with electronics.

Conductive materials are defined as having a resistivity of less than 10^{5}. Note to be considered static shielding they should have a resistivity of 10^{2} or less.

Shielding materials will shield electronics from electrostatic voltages and fields. Please note that these ranges apply to static control and not to general electronics.

For more information on how we can help you with all of your ESD requirements, please either visit www.antistat.com or contact one of our experienced sales advisors on +1 512-243-5762.

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BAG MARKINGS
Antistat uses flexo printing to mark stock bags with the appropriate industry standard ESD or Moisture warning and on certain products lot numbers for traceability. Custom hot stamping and bag printing are also available.

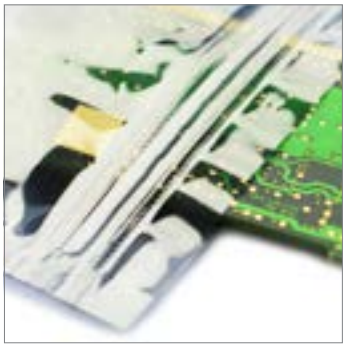
HOT STAMPING
A packaging industry method for marking bags by thermo-mechanical transfer of pigment to the bag.

FLEXO PRINTING
A method of printing ink to bags using a press plate. Produces higher quality marking that hot stamping.

LABELING
Pre-apply a label to the bag. Saves you labour time and provides consistent label location.

BAG FEATURES
Antistat can provide bags with these different features to simplify and suit your packing process.

GRIP SEAL
A recloseable bag simplifies access to parts.



TEAR NOTCH
If you heat seal the bag closed, a tear notch makes it easy for your customer to open it.

EXTENDED LIP
An over sized lip at the opening improves part insertion, and is easy to close with a label.

ALSO AVAILABLE UPON REQUEST:

COMPARTMENT BAGS
A bag with 2 or more separate compartments allows paperwork to travel safely with parts. Or allows multiple parts and part kits to be shipped together.

BOTTOM SEALED BAGS
A heat seal across the bag fold is helpful with locating the bag in some automated packaging equipment.