

<b>Vermason</b>		Product Information No: PIS 091		
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## PINK ANTISTATIC BAGS

Code BQ3..

### Description

These products are made of an antistatic polyethylene film that under normal working conditions doesn't generate triboelectric charges. The film is tough, amine free, does not affect polycarbonate housings and does not cause corrosion. The product is transparent and tinted pink. It is available in a range of bag sizes as well as roll widths. Typical film thickness is 70 micron.

Bags are hot foil printed in yellow with a descriptive text and logo to comply with IEC 61340-1.

The film is designed for use as packaging for **non-ESD sensitive** devices that are required in ESD protected areas e.g. passive components, screws. The antistatic properties are long lasting provided the film is stored in a cool dry place. Do not store outside and do not expose the film to heat or store in an overheated warehouse.

### Typical physical properties

MD = Machine direction CD = Cross direction

Tensile strength	MD	30	kPa	ASTM D882-A
	CD	29	kPa	
Elongation at break	MD	1000	%	ASTM D882-A
	CD	1100	%	
Elmendorf tear strength	MD	8	N	ASTM D882-A
	CD	10	N	
Dart drop impact strength		300	gr	ASTM D1709-A
Water vapour transmission rate		<0.8	gr/m <sup>2</sup> 24 hr at 50% rH & 20°C	
Weight		0,07	kg/m <sup>2</sup>	
Roll and bag width tolerance (inside)		+15	mm	
		-2	mm	
Bag length tolerance (inside)		+30	mm	
		-2	mm	

### Typical electrical properties

Surface resistivity	<10 <sup>11</sup> ohm per square	DIN54382
Charge decay time	<2 sec	EIA541 appendix F

### Availability and dimensions

Bags are available in standard sizes. The first dimension is the width of the opening of the bag, the second is the length of the inside of the bag. The bottom skirt of the bag i.e., from weld to bottom of the bag is approximately 4mm.

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# 'Faraday Cage' - An Elusive Term by Ben Baumgartner

Threshold, April 1996

Should the term 'Faraday Cage' be used to describe the electric field (E-field) shielding ability of an ESD protective package?

For many people this term implies an electric field free area, that translates to absolute shielding. Protective bags and tote boxes can only behave as a 'Faraday Cage' for a static field (stationary in time). Faraday showed by his ice pail experiment that electric charges placed on the inside surface of an ice pail move to, and eventually reside on, the outside of a conductive container. The charges on the outside of the container have E-field lines that terminate on opposite polarity charges that are outside the pail or a conductive container. Therefore, the area inside the pail is free of the electrostatic fields associated with these charges. The 'Faraday Cage' (area inside) is free of an electrostatic field only when the charges have moved to arrange themselves to suit the surrounding surfaces and are static (stationary).

In the opposite case when the ice pail or container (ESD bag) is placed in an electrostatic field, the free electrons in the metal arrange themselves to prevent field lines from passing through the conductive surface. This movement of charge takes a certain amount of time, depending mainly on the resistance of the material. This movement or charge does not occur instantaneously. Therefore, the rate of change (or movement) of the electrostatic field becomes a factor in maintaining an electric field free area. As the frequency increases for AC electric fields, the inside of the ice pail or ESD container becomes a less electric field free area. For the high frequencies of ESD, the maintaining of a electric field free area depends mainly on the resistivity of the container until very high frequencies are reached (Electromagnetic waves in the form of light pass through metallized bags and X-rays also go through fairly easily). Therefore, does a metallized bag maintain an electric field free area (shield) effectively?

A search of old school textbook indexes for Faraday's name did not shown any reference to a 'Faraday Cage'. The only shielding reference is in old transformer and radio books. The grounded copper shield (layered foil, not a closed cage) that is placed between the primary and secondary on a high voltage transformer is called a 'Faraday shield'. It is used to shield the primary transformer and secondary winding from each other. 'Faraday Cage' is not in the IEEE Standard Dictionary of Electrical & Electronic Terms (1978 ed.) or other electronic handbooks or references. The references that mention the 'Faraday Cage Effect' discuss it in terms of static charges. The Faraday's ice pail principle does not apply to shielding for high frequency electric fields (E-fields) such as those from electromagnetic waves or ESD. The space inside the cage is an E-field free area only when an external static charge is present on a surface and is stationary. A 'Faraday Cage' for static charge is not necessarily effective in providing a complete electric field free shielding from radio frequency (RF) electromagnetic waves or an electrostatic discharge to the 'Faraday Cage' surface. A surfactant loaded polyethylene bag will provide a static free area inside the bag if you wait a few seconds for the charge to distribute itself around the surface of the bag.

Enclosures are effectively free of electromagnetic interference (EMI), only when enclosures are carefully designed and

constructed. These enclosed spaces are still not totally free of the E-field component of an electromagnetic wave. These enclosures, such as screen rooms and electronic packages (black boxes), have their electromagnetic field attenuation (shielding) measured in decibels (dB or dBm).

The Faraday Cage shielding term is being used in the wrong sense by many in the ESD community. If the 'Faraday Cage' term is incorrectly used, we will have an ambiguous and incorrect concept of what a metallized or even a foil bag is capable of shielding. 'Faraday Cage' will replace E-field shielding in our jargon forever. The latest version of the Military ESD Handbook (MIL-STD-263) does not use the term 'Faraday Cage'; neither does the ESD Association's packaging Standard EOS/ESD S-11.31-1994.

'Faraday Cage' implies total E-field protection to many people, while shielding to an electrical person indicates a degree of E-field attenuation. Most electrical engineers recognise that the degree of shielding varies and must be measured to determine the amount of attenuation (protection). Measuring how much shielding is provided by an ESD protective bag enclosure is not an easy task. That is why ESD bag shielding has not been satisfactorily addressed to determine if a given device is protected and to what level. It can be shown that a voltage sensitive (unprotected gate oxide) device can be damaged (shorted) in a metallized bag by ESD. When a 100 volt gate oxide transistor is put in place of the 500 ohm resistor in the ESD Association's EOS/ESD S-11.31 Standard's fixture, the transistor can be damaged by a 2000 volt human body pulse. In fact, the 100 volt transistor can even be damaged in a 2 mil metal foil bag. No 'Faraday Cage' here.

Another question to be answered is: how much more protection does a metallized shielding bag provide in a real situation? A discharge to the metallized bag is very evident and will have a much higher current than a discharge to a surfactant type of bag. In an actual test using a handheld HBM simulator, a discharge to a surfactant loaded polyethylene bag is difficult to see. There is nothing more than a weak corona discharge as 12 kV. How does this type of ESD relate to the protection of energy sensitive devices? Energy sensitive devices are certainly the most prevalent devices around and may be better protected by a thicker bag or a bubble pack pouch (air space does not provide shielding, it provides de-coupling, contrary to articles claiming air attenuates).

The high voltage 'punch thru' of metallized bags versus 4 and 6 mil polyethylene material has not been addressed either. The Electronic Industries Association EIA 541, Packaging Task Force 1, discussed this problem many years ago, but never tackled it. It was and still is a difficult question to answer because a standard configuration that represents devices would have to be agreed upon.

There is still a lot more work to be done. We can fool ourselves by saying metallized bags protect devices because they are 'Faraday Cages', or we can analyse the situation to find out what is really happening. Let us hope that a good analysis is not as elusive as the 'Faraday Cage'.

\*Reference: Demonstration Experiments in Physics, Sutton, McGraw-Hill, 1938, p.263.