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Selecting a Moisture Barrier Bag

Surface Mount Devices (SMD's) are mounted to printed circuit boards by reheating solder on the pads. This technique, called reflow soldering, heats the circuit board, device leads, and the device case.

Moisture trapped inside the device case expands at a rate faster than the case causing the case to rupture. If the device case becomes broken it may cause immediate failure of the device, or damage to the device which only becomes apparent when the device is used.

SMD's must either be kept dry or slowly baked under controlled conditions removing any moisture on the device. Devices shipped without low moisture packaging must be baked, this can take up to 24 hours, delaying production, and the added expense of equipment to control temperature and humidity.

Keeping SMD's dry between manufacture and the point of reflow soldering has lead to the development of moisture barrier bags. These types of bags may also be referred to as vapour barrier bags.

Barrier bags are not moisture vapour proof nor do they remove moisture and over a period of time moisture vapour may leak into the bag. To assist with this issue desiccant may be into the bag reducing humidity. A humidity indicator card (HIC) may also be put into the bag to show the relative humidity with moisture-sensitive, color-changing chemical dots. As a final moisture impediment, vacuum packing may be used to remove air-containing moisture before the bag is heat-sealed.

MVTR TESTING
Moisture Vapour Transmission Rate (MVTR) is the rate that water vapour passes through an area of barrier material. As MVTR is reduced, dry storage time is increased and desiccant loading is reduced. MVTR is measured in grams of water vapour, per 100 square inches of barrier, per 24 hours (g/100in2/24hrs).

There are two primary test methods for MVTR:

1. ASTM F 1249: A sample of barrier material is placed between wet and dry compartments, infrared light is then used to detect water vapor leaking through the barrier material. The sealed bag is then placed in a large container and inserted with probes to assess MVTR. This test is also known as a MOCON test.

2. Federal Test Method Standard 101 Method 3030 (FTMS 101 MTH 3030): A sealed barrier bag with a desiccant pouch inside is weighted and placed in a chamber at 100°F and 90% relative humidity for 64 hours. Weight gain of the bag indicates moisture gain. Using these figures to calculate the MTVR.

BAG INTEGRITY TESTS
1. Submersion: FTMS 101 MTH 5009 is a test method specified for finding leaks in bags. The bag is inflated, sealed, submerged in water and applied with pressure. Air bubbles coming from the material or seals indicate the location of any leaks.

2. Hanging Weight: FTMS 101 MTH 2024 stresses a 1-inch section of the side seam with a 3.5lb. hanging weight. This test method allows no separation of the sealed material.

3. Puncture Resistance: This test looks at a material's resistance to puncture with a steel probe. The test requires a minimum of 10lb. resistance. With test method FTMS 101 MTH 2065, a specimen of the material is placed into a flat cage with a hole through the center, a 5in long rod with a 1/8in radius is then pushed through the material using an Instron tensile tester. An electronic load cell measures the force (in lbs.) required to puncture the material.

BARRIER TECHNOLOGIES
There are 3 types of barrier bag technology currently in use:

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- Foil/Polymer: The oldest and highest barrier technology. A thin sheet of aluminum foil (usually about .00035" thick) is laminated to nylon or Tyvek for support and protection.

- Aluminized Polymer: This newer technology reduces material costs. Aluminum is vapour deposited onto polyester. As the metal is so thin multiple layers of aluminized polyester are laminated together this way any voids in a layer are covered by the next.

- Engineered Polymer: Clear plastics that do not use metallic layers provide limited moisture protection and are primarily used for food packaging. In the electronics industry their use tend to be very short-term for dry storage and clean room situations.

MOISTURE BARRIER BAG STRUCTURES

Nylon/Foil/Poly
Typically, this structure consists of a 60 gauge nylon laminated to 0.00035 aluminum foil, which is laminated to heat sealable polyethylene. This is the most common foil/polymer laminate. MVTR for this structure, when properly converted into bags is very low at about 0.0005 g/100in2/24hrs(1).

Tyvek™/Foil/Poly
A structure consisting of Tyvek, laminated to 0.00035 aluminum foil, which is laminated to heat sealable polyethylene. Tyvek Foil is the oldest barrier structure, however has gradually been replaced by nylon/foil or metallized polyester structures. MVTR for this structure, when properly converted into bags is very low at about 0.0005 g/100in2/24hrs(1).

Aluminized Polyester/Poly
This is the newest technology for barrier materials with a structure consisting of two layers of 48 gauge-aluminized polyester laminated to sealable polyethylene. These bags are generally lower in cost and have become are a big success with medium to short term dry packaging users. For 3.6 mil materials, MVTR is about 0.02 g/100in2/24hrs*. Structures that are 7.0 mils thick can achieve 0.005 g/100in2/24hrs(1).

Standard Structure of a Foil Barrier Bag.

Dissipative Tyvek
Aluminium Foil
Static Dissipative Polyethylene

Structure of our Moisture Barrier Bags.

Aluminized Polyester
Dissipative Nylon
Cast Polyethylene

Standard Structure of a Metallised Barrier.

Antistatic Coating
Polyester
Aluminium Metallisation
Polyester
Aluminium Metallisation
Static Dissipative Polyethylene

Our Standard Construction:
Our moisture barrier bags are constructed in 3 layers. The bag features an anti static metallized polyester outer layer and an anti static inner layer. In between are layers of polyethylene, nylon and an aluminium foil shield.

OTHER CONSIDERATIONS

Moisture barrier bags should provide dissipation, antistatic properties, static shielding and some measure of EMI/RFI attenuation. The generic specifications in the following table should be met.

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Details	Test Standard	Result
Surface Resistance (interior/exterior)	ANSI-EOS/ESD S11.11	<1.0 10^{11} Ohms
Static Shielding	EIA 541 Appendix E EOS/ESD S11.31	<30 Volts <10nJ
Tribocharging	EOS/ESD ADV11.21	Lower than virgin poly film

MEETING THE STANDARDS

EIA 583 "Packaging Material Standards for Moisture Sensitive Items" defines a 'Class 1' barrier as having a MVTR of <0.02g/100in2/24hrs. 'Class 2' barriers are set at <0.08 g/100in2/24hrs. The test standard also sets a puncture limit at 10lbs and provides desiccant loading calculations.

EIA/JEP 124 "Guidelines for the Packaging, Handling and Repacking of Moisture-Sensitive Components."
This document provides some general suggestions regarding vacuum sealing, receiving, and repacking of barrier bags.

THICKNESS
Every manufacturer will offer a material with a slightly different structure, this difference is normally in the thickness or gauge of the material. Barrier bags are available in a wide variety of thicknesses (one mil equals 0.001 inches). In general terms, only large thickness differences change the bags performance and cost. There are generally 3 standard gauges which are more widely available; 3.6, 6.0, and 10 mils, generally the thicker the materials the greater the puncture resistance.

MVTR
Industry standards require an MVTR of <0.02g/100in2/24hrs. A lower MVTR will provide low interior humidity for a longer period. For example, a 16"x18" barrier bag with an MVTR of <0.02 g/100in2/24hrs, and a maximum interior humidity (MIH) of 20%, sealed for 12 months, requires 6.6 units of desiccant per EIA 583. A bag of the same size and conditions with an MVTR of <0.0003 g/100in2/24hrs, requires only 0.01 unit of desiccant. This also shows that desiccant costs can be reduced by using a bag with lower MVTR.

BAG SUPPLIERS
Any supplier you choose should be able to provide you with full test certificate and be able to perform some type of bag integrity testing.

BARRIER BAG COMPARISON

Material	Gauge (mils)	MVTR (g/100m²/24hrs)	Puncture Resistance (lbs)
Clear Barrier	5.0	0.1 to 0.05	20
Aluminised Polyester	3.6	0.04 to 0.02	17-20
Aluminised Polyester	7.0	0.009 to 0.005	<30
Nylon / Foil	6.0	<0.003	18-22
Tyvek / Foil	10.0	<0.003	17-19