ESD Shoes – Why You Should Wear Them

It seems counter intuitive that someone would pay $50 to $100 for a pair of ESD shoes, when lower cost solutions – such as heel grounders - are available. But, I am getting ahead of my story.

When discussions about the necessity of ESD protection first emerged, more than a decade ago, most electronic companies did not fully address the subject matter as seriously as they should have. Damage from ESD (Electro Static Discharge) cannot be easily seen, or felt. Back in our industry's day of innocence, we did not pay too much attention to effects that static electricity would cause sensitive SMD electronic components. Many cases of ESD damage went undetected or remained latent, until equipment failed in the field. As the complexity and sensitivity of components increased, the result of ESD damage grew more rampant.

The human body behaves as a walking "Isolated Conductor". As such, we continuously accumulate electrostatic charges while performing normal activities. For this reason, human beings unwittingly carry lethal doses of static (as viewed by static sensitive SMD components) just by walking around, scratching our heads (or other places) and rubbing against materials. Long ago, it was common practice to provide ESD protection only by using dissipative grounding bench mats and wearing wristbands in the EPA ("Electrostatic Protected Area") where electronic assemblies are made. Workers don't remain stationary at their workbench and it became impossible for workers to be tethered to ground cords as they moved around inside the EPA.

The most practical and efficient solution was to ground workers by their feet, by means of ESD shoes or by using heel grounders. Anyone who has worn a heel grounder knows they are awkward to wrap around your feet, as well as being uncomfortable, often causing back pain, due to walking on an uneven surface. Originally, ESD shoes were crude. Some workers back in the "good old days" wrapped sheets of aluminum foil around their street shoes, as a way to ground themselves. Later, ESD shoes with conductive soles (made of carbon filaments) were invented. The conductivity of carbon fibers allowed discharge of accumulated static that was generated by movements of the human body.

It is a law of nature that when surfaces of two different materials (for example: polyurethane and rubber, or leather and fabric) rub together, they will create an accumulated positive charge (loose electrons) on the surface of one of the materials and a build up of negative charges (acquired electrons) on the surface of the other material. This phenomenon is due to the combination of different chemical structures within the materials. With each walking step, the operator accumulates charges (positive or negative) due to the separation of different materials in the soles from the floor. The charging of the sole is carried to the body of the operator because humans are conductive, due to the high percentage of water in our body.

By using an instrument called an electrostatic discharge monitor, you can measure the incredibly high amount of static (several thousands of volts) created by rubbing your soles on the ground after taking just a few steps. This accumulation of charges on the human body is often lethal to static sensitive electronic components. The sudden energy release of static discharge will literally burn the insides of semiconductor components, causing ESD damage.

Another important fact to remember is that damage to sensitive components can be caused without directly touching the circuit board or loose components. Damage can be caused by induction with accumulated build up of charges on the hands, being transferred through the air (much like a capacitor, where the dielectric is "*air*") to the components. When the "*air*" dielectric

breaks down, the sudden discharge (ESD event) will release a huge amount of energy, destroying the component on the spot, or worse - causing latent damage that only becomes evident at a later date (field failures). Most likely, you will be completely oblivious to the damaging ESD event, since you might not see or feel it. Such voltage is lethal to the component, but not visible by the operator.

Hence, primitive ESD shoes were born to provide a continuous discharge from the human body to earth ground. The first ESD shoes were simply normal shoes with a conductive sole (constructed with polyurethane or PVC loaded with carbon black fibers). Such early model ESD shoes had low resistance ratings of 10^3 Ohms (10,000 Ohms) and were electrically efficient. However, these shoes experienced major problems in the EPA. Firstly, the black carbon fibers left objectionable footmarks on the flooring. Secondly, but more importantly, conductive ESD shoes did not provide sufficient safety for personnel. Low resistance, conductive shoes with 10K Ohms resistivity are too dangerous for personnel, because of the presence of live conductors, powered tools, high voltages in the work environment.

Therefore, we had to find a way to: 1) provide continuous drain of static to ground in order to protect sensitive components; 2) provide a safe level of electrical insulation, should workers come in contact with dangerous amounts of electricity; 3) provide non-marring soles on shoes.

The solution was to design ESD shoes with static "dissipative" white soles having resistance ratings of 10^6 Ohms (1 million Ohms) that don't mar flooring. One Meg Ohm is the optimum resistance that provides sufficient electrical insulation to ground to protect the operator from unwanted passage of electrical current (according to the national safety standards) while providing continuous discharge of static to ground to protect sensitive components. Specifications and electrical features of the ESD shoes are determined by international standards (ANSI ESD 2020, IEC 61340-5-1 etc). ESD safety shoe (toe and foot protection) are addressed in Standard EN 345-347.

Today, a wide variety of different ESD shoe colors and styles are available such as: lace ups for colder climates, sandals for warmer whether, and clogs and moccasins for comfort. ESD safety shoes and boots (with steel toe protection) are suitable for workers that must constantly walk from the EPA to loading docks and warehouse. Some ESD shoes can even be washed in a standard washing machine to maintain optimum hygiene.

For optimum ESD protection in the EPA environment, dissipative and grounded flooring should be used to control voltage build up on the surface of the floor. It is recommended that wristbands be worn in conjunction with ESD shoes while sitting at the workbench. Without saying, ESD shoes should be worn at all times when the operator is moving. That way, continuous drainage of static from the human body to ground will cancel out any charge build up due to walking in the EPA.

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ESD Shoes
For All Occasions

ESD Shoes – Italian Styling

Examples of ESD Shoes:

MOKA
Black
Slip On

MOKA
White
Slip On

STRINGA
Black
Lace Up

STRINGA
White
Lace Up

RADO
Black
Clog

RADO
White
Clog

NATURA
White
Open Sandal

CLASSIC MAN
Black
Lace Up

CLASSIC Lady
Black
Pump

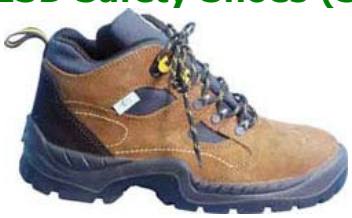
ZAD 9000
White
Clog

FTP
Washable
Insole

FLEXA
Brown
Lace Up

Examples of ESD Safety Shoes (Steel Toe Cap):

Trucker SS
Gray
Boot



ECO BOOT SS
Brown
Boot

ECO 570 SS
Dark Gray
Closed Sandal

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