

# ESD Open Forum

*Conformity—2008*  
Provided by the ESD Association

**Question:**

When it comes to disposable ESD shoe covers in a clean (class 10K or 100K cleanroom), ESD protected manufacturing area, does this kind of ESD protective footwear perform as well as ESD shoes?

**Answer:**

In order to thoroughly answer this question, three key issues will be addressed which include ESD protective properties, particle generation and cost.

A comparison has been made in the level of static charge generated on a medium sized person while walking on a grounded, static dissipative floor and wearing one of three different varieties of ESD protective footwear. The footwear varieties tested were disposable ESD protective shoe covers (one on each foot positioned over the wearer's street shoes) and two varieties of ESD cleanroom shoes each from different ESD shoe manufacturers.

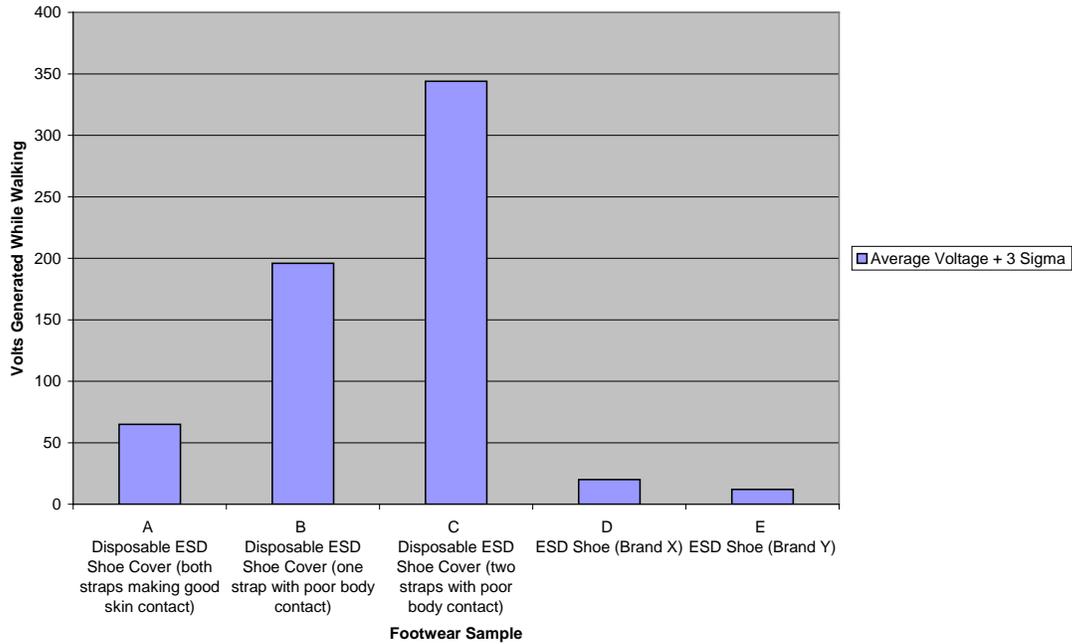
One of the potential issues with disposable or reusable ESD protective shoe covers is the possibility of one or both conductive straps not making adequate contact to the body of the person wearing the shoe covers. This problem also exists with heel/ toe grounding apparatus.

The conductive straps on the disposable ESD protective shoe covers are meant to connect the body of the person (either through direct contact to the skin or through the sweat layer between the person's socks and the inside of their "street shoes") to the bottom or conductive section of the shoe cover. The bottom of the shoe cover then makes contact to the grounded ESD floor for the purpose of draining charge from the person to the ESD floor. The electrical continuity between the wearer's body and the bottom of the disposable shoe cover can be verified via an ESD footwear testing system.

The chart below shows the body voltage generation comparisons. The sample subject is a medium sized person walking on a static dissipative floor with no other means of personal grounding.

- A) ESD shoe covers with both conductive straps making good body contact
- B) ESD shoe covers with only one conductive strap making good body contact
- C) ESD shoe covers with neither conductive strap making good body contact
- D) ESD shoe sample from shoe manufacturer X
- E) ESD shoe sample from shoe manufacturer Y

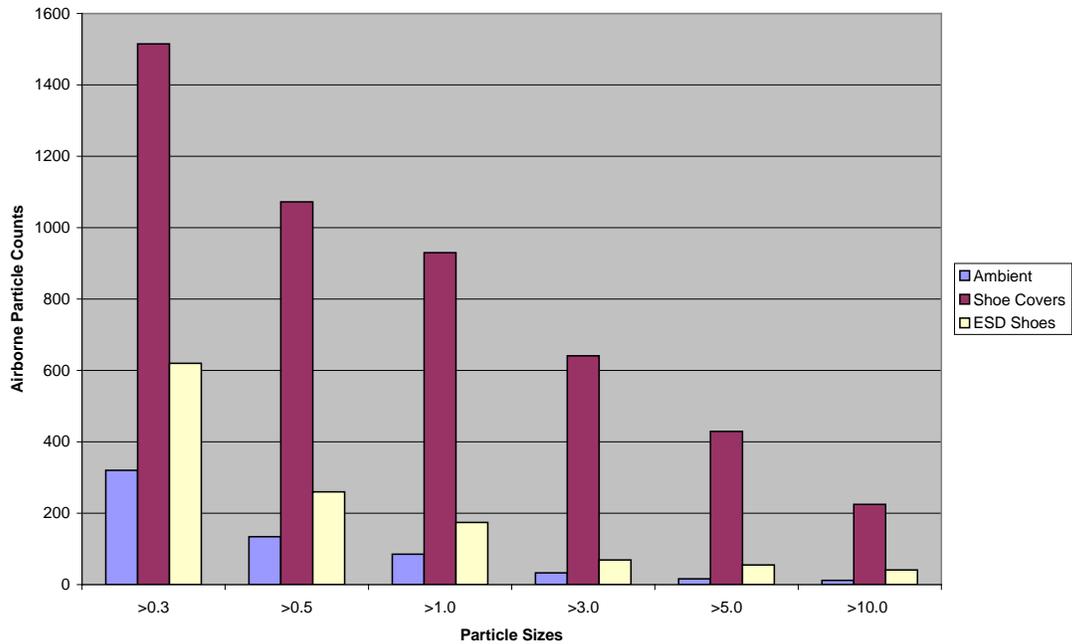
**Body Voltage Generation for ESD Footwear**



It can be seen very clearly in the chart above, that if the grounding strap on ESD protective shoe covers loses good body contact, the charge from the person is not drained as well. ESD shoes seldom lose body contact and serve well to drain charge from the person wearing the ESD shoes.

The chart below displays a comparison of airborne particles generated by new disposable shoe covers and used, but freshly cleaned, static dissipative rubber soled ESD shoes.

**Airborne Particle Counts from Footwear**



Airborne particle counts were taken as shoe cover samples and ESD shoe samples respectively, were scuffed against each other 30 times per minute, directly over the isokinetic sample probe of a calibrated, portable airborne particle counter. Each sample on the chart represents the average of three (3) one minute sampling sessions.

The data from the airborne particle counts clearly show that this particular brand of disposable ESD protective shoe covers generate a greater number of airborne particles in each of the particle size categories.

Lastly, a cost comparison between disposable shoe covers and individual pairs of ESD protective shoes has been made.

ESD shoes are available from many different suppliers with various styles and features with varying costs. Two examples follow which demonstrate alternatives.

Expensive ESD shoes cost approximately \$80.00 - \$120.00 per pair. There are also inexpensive ESD shoes that cost approximately \$20.00 - \$30.00 per pair. One pair of ESD shoes should last 1 - 5 years (this will vary with quality of shoe construction and materials, amount of actual wear, the wearer's body weight and foot/walking abnormalities).

If each member of the workforce used one pair of disposable shoe covers per day, it would cost over \$100.00 per year for disposable shoe covers for each person. This is much more expensive than supplying the same person with a pair of ESD shoes lasting several years. (Calculations based on a 5 day workweek, 48 workweeks per year).

Of course, if a facility decides to have their employees wear ESD protective shoes (restricted to the ESD protected area only) street shoe storage and change facilities are required.

In summary, lower human body voltages can be maintained, foreign material in the work area can be reduced, and considerable cost saving can be achieved by using ESD shoes versus disposable shoe covers in certain ESD protected work areas.

**Notes:**

The equipment used to evaluate body voltage generation and airborne particle generation:

711A Electrostatic Field Meter with body voltage probe attachments with current calibration

PGA-710 and Autoanalysis System 1.5 (Version 1.5.1.0) with current calibration

Model 3016 Airborne Particle Counter Calibration with current calibration

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**About the Author**

Jay Hamlin is Principal Product Engineer and ESD Control Program Manager, Medtronic Microelectronics Center, Tempe, AZ. Jay earned a BSEE from the University of Colorado, Colorado Springs, CO. He has held Engineering positions at: Intel, Motorola, Qualcomm, and

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#### **About the ESDA.**

Founded in 1982, the ESDA is a not-for-profit, professional organization directed by volunteers dedicated to furthering the technology and understanding of electrostatic discharge. The Association sponsors education programs, develops ESD standards, holds an annual technical symposium, and fosters the exchange of technical information among its members and others.

**Additional information may be obtained by contacting the ESD Association, 7900 Turin Rd., Bldg. 3, Rome, NY 13440-2069 USA. Phone: 315-339-6937. Fax: 315-339-6793. Email: [info@esda.org](mailto:info@esda.org). Website: [www.esda.org](http://www.esda.org).**