



**Don't just assume that you are protected.
Practice Safe ESD Control In Your Company.**

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This story unfolds by going back in time, to an age of innocence at the dawn of the electronics industry. When component failures caused by static began cropping up, experts scratched their heads to find a solution to the problem. It was learned that direct contact with sensitive semiconductors would generate micro-sparks that eventually lead to component failure. The solution seemed simple enough; just avoid touching semiconductors during circuit assembly. But, danger lurked in every corner. It became evident that lethal amounts of static build-up posed a danger to "sensitive" components in storage racks, on benches, by people and just when sitting in packaging.

In the past quarter century volumes of "how to manuals" have been written on controlling static in the workplace, citing different parameters, such as electrical resistance, voltage generation, static decay, just to name a few. The level of component sensitivity to static discharge was discovered to be inversely proportional to the size and directly proportional to complexity of the component. That's tech talk, which means that tiny, complex components are more susceptible to failure caused by static. To complicate the situation, both induction and tribocharging-generated discharge were found to be leading reasons for component failure. To make matters worse, climatic conditions such as temperature and relative humidity contribute to the amount of static being generated. As it turns out, cold and dry climates encourage charges to build up on all surfaces, while humid and warm climates help charges to drain.

To mitigate component damage, standards and rules for controlling ESD were established. Among the most important are:

- Clearly define the boundaries of the E.P.A. - Electrostatic Protected Area.
- In the E.P.A., eliminate all static generating materials.
- Ground all surfaces, including shelves, benches, floor, moveable carts, etc.
- Replace all static generating racks with ESD conductive ones.
- Replace all static generating packaging with antistatic ones.
- Ground all personnel by wearing ESD shoes and/or by using wristbands.
- Cover street clothes with conductive lab coats or shirts.
- Ground all equipment, especially on the workbench.

In the early days only large companies understood the benefits of implementing ESD prevention programs, initially focusing on the most obvious items, such as bags. Companies realized that most of the damage was being caused in the production area. They tried covering bench tops with conductive or static dissipative mats and laminates,

but soon learned that a major cause of electrostatic discharge was (and still is), the human being. The human body is a conductor and when in motion, if not properly grounded, can naturally charge up to several thousands volts. Measurements show evidence that 10,000 volts can easily be reached when an operator is walking on a normal carpet and is wearing rubber shoes.

IEC or ANSI-ESDA standards recommend periodic controls and verification that a proper earth ground is connected to all workstations, and daily monitoring of operators and their equipment. This sounds logical. But compliance and practicing such ESD rules is harder than it seems. Let's learn how difficult it can be to comply with the ESD standards by studying two typical occurrences in the electronics assembly industry.

Scenario 1:

According to the rules, every morning each operator must check his wristband and grounding cord (and shoes, if applicable) before starting work. Conjure in your mind a long queue of grumbling people, wearing a skintight wristband with dangling cord, waiting to step on an ESD tester before being permitted to go to their workstation. For the uninitiated, the ESD test consists of standing on a metal conductive plate, plugging in the grounding cord's banana plug into a receptacle, pressing the correct button (there are normally more than one button on the tester to choose from), and waiting for a positive response by a green light. If the grounding cord has malfunctioned (loss of connectivity) then a red light and buzzer alert will sound. The next chore by the operator is to sign the report book stating that the test has been properly performed. In reality, the story gets more complicated; since employees normally must first retrieve their wristband from their workstation, then exist the product area to go stand in line to be tested. This daily ritual is time consuming; wasting 5 to 10 minutes of time per person, and tends to encourage some employees to find ways to circumvent the test altogether.

Scenario 2:

Let's say a potential customer intends to pay a visit to review your company. Everyone is rushing with excitement, getting everything in order to make a good impression. The president reminds everyone how important it is to gain the customer's confidence and win an important contract. The manufacturing engineer suddenly realizes that the customer will be bringing their quality control manager to inspect for ESD protection on the production floor. The manufacturing engineer asks his line manager, "when was the last time that we checked our workstations?" But, alas, not even the line manager can recall when the last reliable calibration was made. The manufacturing engineer shouts the order to check each workstation, mats, and grounding. Everything must be checked for proper ESD protection. With manual in hand, he starts to follow the rules to verify if all workstations are properly grounded. That's easy to say, but difficult to do. He will need to use a resistance tester, suitable to perform 100V testing. He will need to put one electrode on the mat, and a second one at the earth ground mains, located where else but in the most difficult-to-reach place, under the table, in dim light, amongst a tangle of power cords. Image how much dust and dirt has accumulated since it was last cleaned. Each workstation must be checked before the customer arrives. The excitement of the customer's visit suddenly turns to disappointment.

Let's review the consequences of scenario 1 and 2.

In scenario 1, we see the loss of tens of thousands of man-hours a year spent checking wristbands across the entire electronics and semiconductor industry. Time pressures and a lack of controls can result in non-observance of the rules. Without strict control, wristbands are often not checked. How can you be assured that every morning every operator will take his wristband and cord to check on the ESD tester located at the entrance of the company's production facility? Moreover how can you prove that the tests were really performed? A good way to manage controls and maintain traceability of conformance is to link the ESD tester to automatically log the results into a PC with tracking software. Keep in mind that wristband must be worn tightly to the skin in order to provide good static dissipation at all times. ESD standards specify that the wristband shall be checked "as worn", therefore not only does the wristband need to be checked, but it needs to be checked while connected to the cord.

In Scene 2, we learned that a proper ESD check requires the use of a regularly calibrated, professional ESD resistance meter, with electrodes able to test at either 10V or 100V. Moreover this test has to be performed by skilled personnel, who understand ESD standard requirements. Last but not least, we observed the disruption generated by this procedure, which will interrupt normal workflow and negatively impact productivity of your company. Undisciplined companies tend to postpone the controls, or simply not put in practice the necessary checks to assure correct grounding of operators. ESD standards have to be adhered to during all phases of production, handling, packaging and delivery. The consequences of not verifying that ESD procedures are followed are real. Any short cut in following proper ESD procedures jeopardize the reliability of sensitive semiconductors and assemblies.

There needs to be a better way.

A good solution in Scenario 1 is to install an Elme *xWatch*, workstation monitor at each workbench to monitor individual operator's correct ground connection. The *xWatch* continuously monitors the wristband and cord, bench mat and floor mat. The *xWatch* checks electrical continuity from the wrist of the operator all the way to the earth ground facility. Any disconnection from ground causes a highly visible red L.E.D. to blink and an audible tone to sound, advising the operator that something is wrong and needs to be fixed. Moreover, the *xWatch* Workstation Monitor checks that the operator is properly wearing his/her wristband. Sometimes operators inadvertently forget to wear the wristband, even if the wristband is properly working, resulting in an uncontrolled ESD liability. As an added benefit, the *xWatch* checks if the operator is properly wearing the band tightly on the skin. Remember that good physical contact between the operator's skin and the conductive inside of the wristband is necessary to correctly drain static to ground. A loosely worn wristband results in a poor electrical connection that insulates the operator from ground and stops the drainage. After installing the *xWatch* Workstation Monitor at each workstation, then there will be no need to queue at the ESD testing

machine in the morning. And since the *xWatch* is a continuous monitor, you are assured of 24/7, real-time control of the static drainage to ground of all operators.

Also a good solution in scenario 2 is to install an Elme *xWatch* at each workstation; therefore, assuring all working surfaces are properly and continuously grounded. Since the *xWatch* is connected to the bench mat and to the floor mat, any disconnection of the mats to ground will instantly sound an audible alarm and cause a highly visible red L.E.D. light to warn operators that the connection to ground has been interrupted and needs to be fixed.

How the *xWatch* works:

The *xWatch* compares it's own direct ground connection with the connection through the mats and the ground cords. When all aspects of the workstation are properly grounded, a green light will illuminate. Any disruption in ground will instantly sound an alarm.

Conclusion:

Installation of the *xWatch* Workstation Monitor lets you know for certain (instead of just assuming) that ESD protection is correct. Moreover, you'll save time and money, providing real-time, dependable information vital to maintain control over ESD discharge and provide the quality assurance your company needs. So, install *xWatch* Workstation Monitors and invite your customers to visit at any time, with confidence that you are ESD protected.

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