PROTECTIVE INDUSTRIAL POLYMERS

ESD-CONTROL FLOORS · TECHNICAL WHITEPAPER

The Proper Grounding of an ESD Polymer Floor Coating System

Separating ESD fact from sales fluff: why every static-control floor must connect to a verified earth ground to perform as an auditable part of an electrostatic protected area.

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THE PROBLEM

Grounding a flooring system

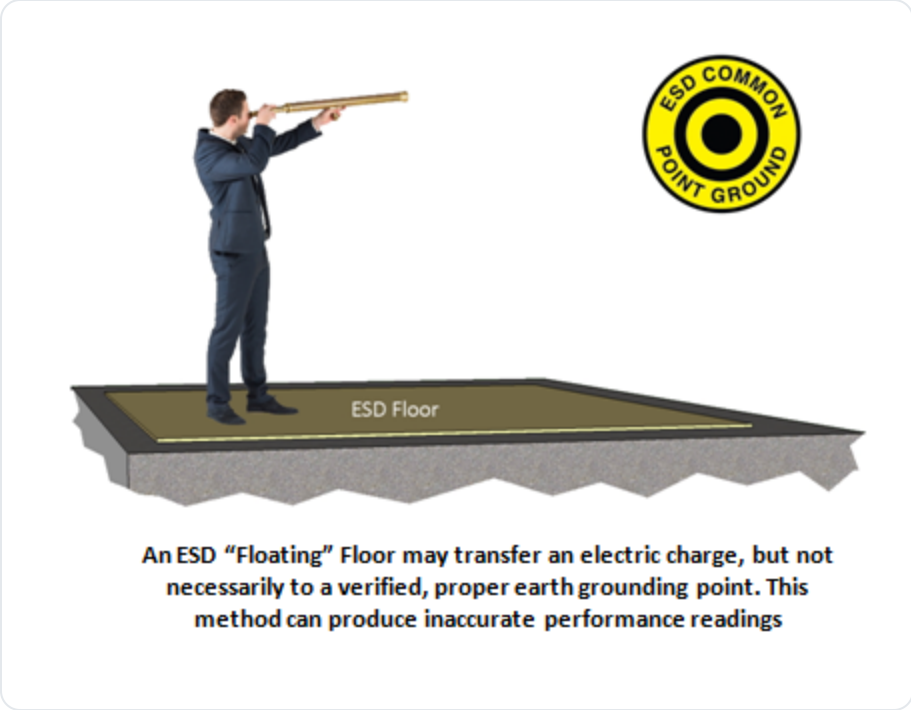
A trend has developed among ESD flooring manufacturers of advertising ESD floors that do not need to connect with a verified ground. This paper will explain and hopefully lead the reader to understand that this marketing claim, although based on an "ESD truth", is an "ESD myth". Any type of ESD floor whether Carpet, Tile, Rubber or Polymer-based coating should be connected to a confirmed earth ground to perform as a functional, auditable part of an electrostatic protected area. This paper will provide an explanation of why and how ESD floors dissipate a charge and explain the industry standards for confirming and measuring the performance of the floor surface. Fact will be separated from "sales fluff" and "sales pitch". The proper methodology for grounding an ESD floor surface will be outlined.

The facts behind the misinformation

It is indeed true that a large conductive body, such as an ESD floor coating, will accept an electrical charge from static energy — even if it is not connected to a known ground point. The floor is acting as what is referred to as a sink. Based on the mass and relative neutrality of the floor surface, it will typically allow a charge to transfer. The conductive film or floor coating essentially becomes an isolated, conductive island. As such, because of its neutral nature, it is able to add a charge to its surface. This island of conductive material is referred to as a "floating floor". Some overzealous manufacturers promote this principle and even refer to it as a "Self-Grounding" floor. It is occasionally touted as a property unique to their design.

Recommending this "floating floor" has two possible motives. It is an attempt to simplify the floor installation for contractors or the creation of a special ESD performance claim. Some manufacturers go as far as to put performance statements on literature indicating that some degree of ESD functionality may be achieved without a direct ground connection.

> **This is like advertising a parachute with the claim that it may offer some degree of function.**



An ESD "floating" floor may transfer an electric charge, but not necessarily to a verified, proper earth grounding point. This method can produce inaccurate performance readings.

WHY AUDITS MISLEAD

"Floating floors" often pass an ESD audit

There is incidental ground contact with the placement of any ESD flooring system. This contact can occur at columns, door frames and plumbing fixtures. Often, this makes contact with an earth ground. This testing result can lead to the assumption that the floating floor is effective. Suggesting reliance on this approach to support proper ESD function would be the equivalent of saying that it is ok to walk across a busy interstate blindfolded because cars have brakes. It is true that it is difficult to put a floor in without at least some inadvertent connection to an earth ground, but it's wrong to expect a reliable or consistent result based on haphazard contact.

The facts that debunk misinformation

This portrayal of this island as an effective ground is what creates the ESD myth. It is implied that an ESD floor will predictably and certifiably meet recognized international ESD performance standards. There is no standard that points to resistance to a ground sink as a functional measurement. All international ESD standards for performance point to resistance to an Earth Ground as the proper confirmation of viability. Connecting an ESD floor surface to a tested primary ground is instructed, supported and documented within these standards. Using these correct methods for grounding a floor will create the

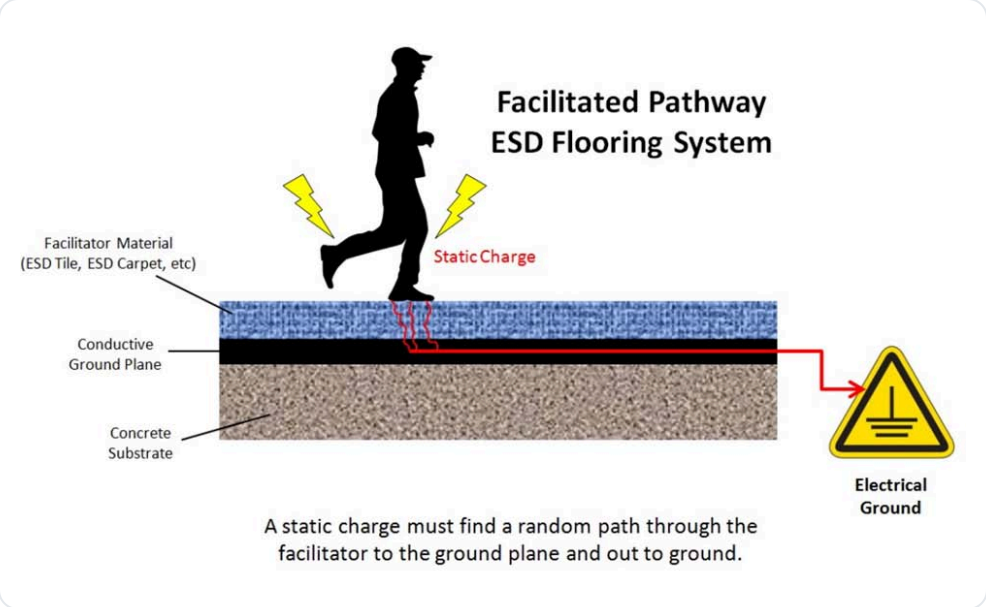
best ESD flooring performance because it is measurable, definable and perhaps most important allows for the statistical creation of the probability that an ESD event will occur.

RECOGNIZED INTERNATIONAL STANDARDS

ANSI/ESD S20.20 | IEC 61340 | NFPA 77 | ANSI/ESD S6.1

You need to effectively ground your ESD floor

The basic function of an ESD floor is universally consistent. Whether helping to prevent fire, explosion or product damage, an effective ESD floor provides a Facilitated Pathway to ground for people, vehicles, materials and items that cannot easily be hard wired or physically tethered to that ground. Although the quality of the connection to mobile personnel and equipment will dictate the level of function, all ESD floors are designed to remove an electrical static discharge, from moving items, by carrying the charge they are holding to a ground.



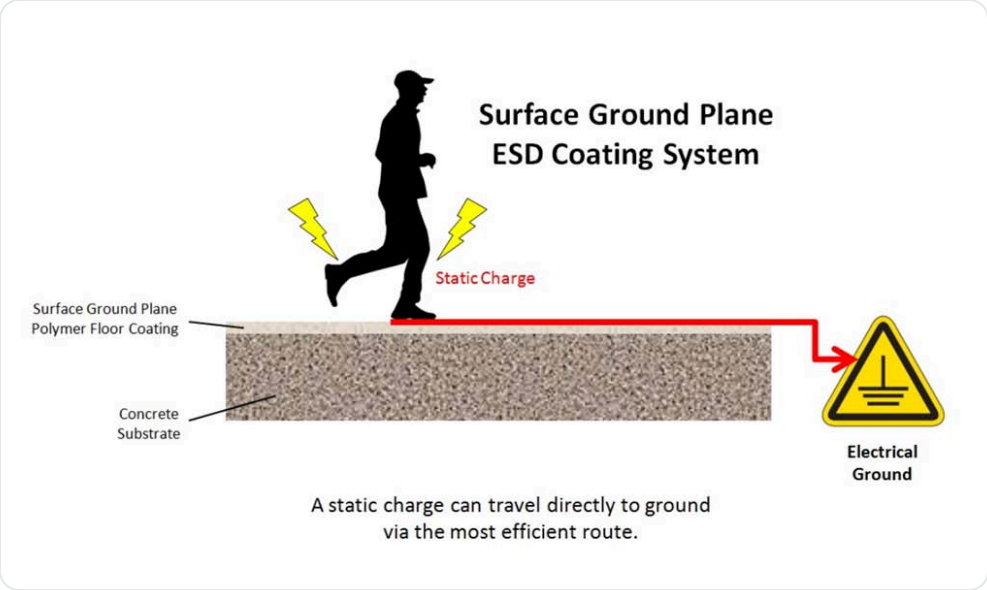
A static charge must find a random path through the facilitator to the ground plane and out to ground.

THE PHYSICS

Static charge must safely go to ground

Essentially all ESD floors use a monolithic or contiguous ground plane. This plane may be a conductive adhesive below tile, a conductive primer below a facilitating coating or a Surface Ground Plane. If this plane is large enough, it can provide a source or sink to

absorb a charge. The problem comes when the assumption is made that the self-capacitance of this mass of conductive material is sufficient enough to act as a safe ground sink and no further bonding or connection of the plane to a known earth ground is needed. Capacitance is the ability of a body to store an electric charge. There is a growing trend among ESD flooring manufacturers to make this assumption and actually indicate that it is an acceptable practice to rely on this sink.



A static charge can travel directly to ground via the most efficient route.

Although the capacitance of a contiguous floor material could theoretically be calculated, the manmade nature of the floor makes determining the actual capacitance and the amount of voltage required to transfer a positive or negative charge to the capacitor, nearly impossible. One factor that can be determined when attempting to use a floor as a sink is the fact that the presence of a negative or positive charge stored in the floor, creates an electrical field, repelling any other matching negative or positive charge attempting to move onto the floor/conductor; i.e., increasing the necessary voltage to transfer the charge. In other words, the floor will not have a consistent acceptance of a charge and for this reason it would be unreasonable to expect a consistent charge sink.

THE METHOD

Connecting the grounding plane to earth

The grounding plane should be directly connected to a verified or known ground. There are several methods to measure ground. The most convenient reliable source for determining a known ground is testing a grounded outlet. This ground can be verified using a circuit analyzer such as a Protstat PGT-61-164 to determine ground impedance

per ANSI/ESD S6.1. After verification, a grounding point such as shielding copper foil can be placed in contact with the grounding plane and bonded directly to the ground of the outlet. Most quality flooring contractors will recommend that their role be limited to the creation of a bonding point and allow the professional electricians to take the responsibility or task of connection or bonding.

Although there is no standard for the number of grounding points needed, the fact that ESD floors develop a level of electrical resistance require several points to be placed. The flooring industry has widely and consistently felt that there should be at least one grounding point per 1,000 square feet of surface. Given the wide range of ground planes in use, finding a good default number may be best determined by the flooring manufacturer and supported by a manufacturer provided field certificate of compliance.

Connect directly to earth ground for effective ESD control

In summary, regardless of the number and frequency of grounding points, recommended or required, an ESD floor placed for any reason must be connected to a recognized, ideally primary ground for full functionality. This applies to all ESD system uses ranging from safety and comfort to sensitive component protection. Without exception, the grounding plane (Surface Ground Plane or other) should be directly connected to an earth ground.

In the rare case that there is an absence of an accessible ground or if it is required for unique performances or exposure stability, best practice would be to create a zero potential by bonding all of the functional components within a protected area via a common point to avoid a damaging ESD event (ANSI/ESD S6.1-5.2.3).

ABOUT THE AUTHOR

Patrick Scudder

Patrick Scudder is the President of Protective Industrial Polymers, a company that manufactures high-performance resinous floor coatings for industrial manufacturing environments. It has a keen focus on developing unique solutions for managing electrostatic, microbial, chemical, explosion and safety risk concerns. He has been in the protective coatings industry for over 25 years and is a leading advisor for manufacturers with unique environmental challenges. Patrick is a SH&A Level I Certified ESD Plant Auditor.

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