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Managing Static— The Invisible Threat To Data Centers and Mission Critical Operations

by David H. Long

Random static discharge will wreak havoc inside your data or call center causing lost or corrupted data, dropped calls, pc lockup and blown headsets.

Designers of 24/7/365 mission critical spaces such as data centers, 911 call centers, command centers, server rooms and flight control towers routinely design their spaces to withstand external threats such as weather, power outages, earthquakes and, in some cases, even biological threats. An invisible internal threat that is sometimes overlooked, electrostatic discharge (ESD) can wreak havoc inside any mission-critical space. Dropped calls, blown headsets, PC lockup and lost or corrupted data represent just a few of the problems.

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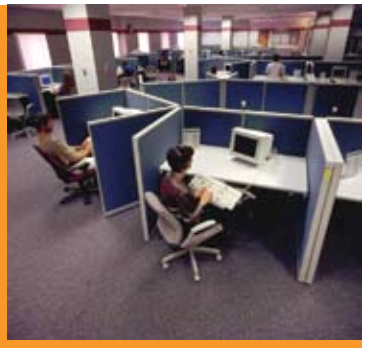

ESD carpet tile helps protect the network at this Verizon call center.

Why is static a greater threat today? Microcircuits inside electronic equipment perceive a static discharge as an overwhelming burst of energy. Older, more rugged components, though still prone to ESD failure, contained special microcircuit gate protectors, capable of diverting the random charge away from the heart of the device. These interior shields slowed the performance of the devices. Today, many designers of the new breed of electronics have done away with these cumbersome internal protection devices in exchange for faster, more capable computers and telephony equipment. Without the internal shields, however, these new devices are far more susceptible to the invisible threat of static electricity.

Most people, having experienced the nuisance of static cling or felt the zap of a shock, assume that static is something that can be seen and felt. Yet it takes at least 3500 Volts of static electricity for human beings to perceive the effects of a static discharge. To put that number in perspective, according to a leading edge consulting group, www.dangelmayer.com, sensitive electronic components can be damaged or destroyed by discharges under 25 Volts. **Random static discharge and field effects caused by such common events as sliding a chair, rising from a seated position or walking across a floor can wreak havoc on state of the art computers and sophisticated telephone systems.** Last year, Palm Source, Inc., the manufacturer of the Palm Pilot, was engaged in a class action suit after low levels of static (< 1000 volts) inside its PDA caused lost and corrupted data during transmission to PCs.

Why antistatic HPL, static diisipative vinyl and computer-grade flooring should be avoided.

In almost all cases, your floor is the primary source of static generation and electrostatic discharge (ESD). Fortunately, it is also the easiest place to mitigate the problem. Almost every conceivable floor covering can be manufactured with some sort of static protective properties with companies often advertising their products as computer-grade or 3kV.

For the mission-critical facility manager, these terms are often misleading. The word antistatic is too broad to be useful. By antistatic, people usually mean that the floor will reduce the generation of static between footwear and the floor. But which footwear? What type of floor? How much antistatic mitigation is adequate and how long will the antistatic properties last? **Since most anti-static ratings are the result of one time lab tests, most flooring manufacturers do not provide any form of static control warranty.**

Some shoe soles produce low levels of static when they rub against certain flooring materials (antistatic) and high levels of static when they interact with others (static-generating). The important distinction is that antistatic is merely a snap shot condition that will easily change if any parameter is altered — from the humidity in the room to

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surface hardness to footwear composition.

As for computer-grade flooring, the term means only that the floor will suppress static charges below a level of 3.5 kilovolts (3,500 volts)-so you won't feel a discharge. What good is a computer grade flooring product that will reduce static charges to under 3.5 kV when sensitive electronics and telephony equipment can be destroyed by a static charge of less than 1/100 of that? And how will an antistatic or computer grade floor tested in the summer at 50 percent humidity perform a in dry winter conditions when the RH drops to 10 percent? The keys are finding a permanent product that requires no special sprays or coatings, provides a low static rating at all humidity levels and one that also provides a verifiable path to ground.

Three objectives when choosing a protective static control floor.

To ensure electrical performance, the static control floor must meet three basic objectives:

1) The floor must not contribute to static generation.

2) It must be groundable after it is installed.

3) The static resistant properties should be permanent regardless of temperature, humidity, maintenance or traffic.

Checklist when choosing static control flooring:

- Only conductive floors can be grounded. Standard flooring installed with ground strips or conductive adhesive will not offer any static protection.
- Any effective conductive floor can be verified with an ohm meter to determine the electrical resistance of the material. If the material does not pass the ohm meter test than it cannot be grounded.
- Conductive floors should never require any antistatic sprays or waxes to enhance or maintain performance. The conductivity should be achieved by the actual permanent physical composition of the material.
- The floor should reduce static electricity regardless of relative humidity. Ask the supplier specifically about performance in very dry conditions.
- The floor must prevent static buildup in real world conditions without special conductive shoes or shoe straps. When in doubt, ask for independent test data verifying this property. It should be available. The data should come from an installed floor and not from a lab test of new flooring.
- Never assume that a shock-free environment means a static-free environment. A shock-free environment only means that static charges are below 3500 Volts.
- Do the homework up front. It is much more costly to remove an ineffective floor and replace it than it is to do it right the first time. Any mission-critical space is only as secure as its Achilles' heel.
- Even if your present electronics are immune to static, if at some point in the future they will be upgraded or replaced with state-of- the-art equipment, then static will be a problem. As with any potential security breach, it is always best to plan ahead.

Computer-grade and static dissipative flooring provide a false sense of security. Many static control floors are capable of meeting one of these objectives, but not all three. A computer-grade carpet, for example, might marginally address the first objective, but it cannot be grounded and it will lose all anti-static properties after the antistatic additives break down. An ungrounded floor can allow a person to remain charged and as soon as they make contact with equipment or some other item in the room, unwanted rapid static discharge takes place. What is to be gained from a floor that prevents shocks if it cannot be grounded, so will not reduce charges below the threshold of damage to the mission critical equipment it was intended to protect?

Similarly, certain dissipative materials like SDT vinyl are comprised primarily of ordinary static generating materials (standard VCT) in combination with a chemical known as an amine to provide conductivity. Although the amines do make the floor groundable, the regular VCT in the floor is highly static generating. When shoe soles contact and separate from the VCT, static builds. To prevent static buildup, the floor must be waxed regularly with 3 to 5 coats of an expensive polish and everyone who walks on the floor must wear special conductive shoes or conductive heel straps, a requirement that would be difficult if not impossible to enforce in a data center or other mission critical space.

Static Control Carpet protects data centers from the threat of ESD.

You might think that conductive carpet would be less effective than carbon loaded hard surface floors in preventing static buildup, but in fact the opposite is often true. **Conductive carpet tiles contain thousands of grounded conductive fibers that sweep off static from shoes, safely discharging the static to ground.** This does not mean that conductive epoxy is an inferior product. It simply means that conductive epoxy works best in applications

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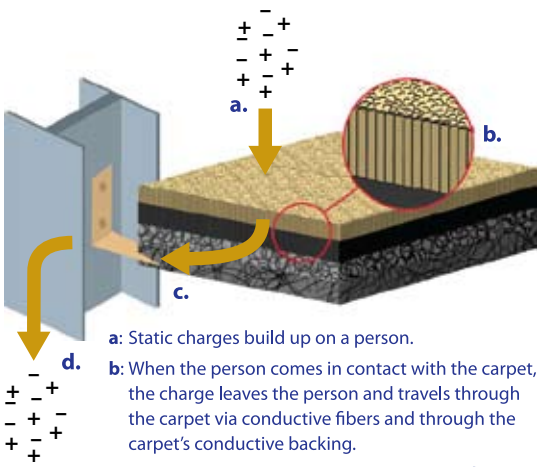
such as electronic manufacturing and assembly — where footwear and traffic are monitored and controlled.

Conductive carpet resembles standard carpet except for the addition of special carbon fibers that are woven throughout the surface and backing (see figure at right). When a person walks on the carpet, the conductive fibers extract excess static build-up from the shoe sole-before it damages components- and safely discharge the static through the conductive backing. The charge is then routed through a conductive release adhesive that secures all of the tiles in place. The release adhesive contains millions of conductive fibers that create a conductive network below all of the tiles. The adhesive's conductive network is connected to ground along the edges of the room through eighteen-inch copper strips (one ground strip per one thousand square feet) that bridge the gap between the perimeter floor tiles and electrical conduit. When properly installed, every single floor tile is at the exact same electrical potential as all of the others. This condition is called electrical continuity. This procedure requires no more skill than a standard carpet tile installation. The key to success is specifying carpet tile products manufactured with conductive fibers in conjunction with conductive adhesive and grounding strips.

How ESD Carpet Tile safely transfers static discharge to ground



a: Static charges build up on a person.

b: When the person comes in contact with the carpet, the charge leaves the person and travels through the carpet via conductive fibers and through the carpet's conductive backing.

c: The charge continues through conductive fibers that run throughout the conductive release adhesive under the carpet tiles and to copper strips that are spaced throughout the floor area.

d: The copper strips are connected to grounded AC outlets or some other grounded source such as a steel I beam that safely neutralize the static discharge to ground.

Other ESD flooring solutions: EC Rubber and EC Vinyl Flooring

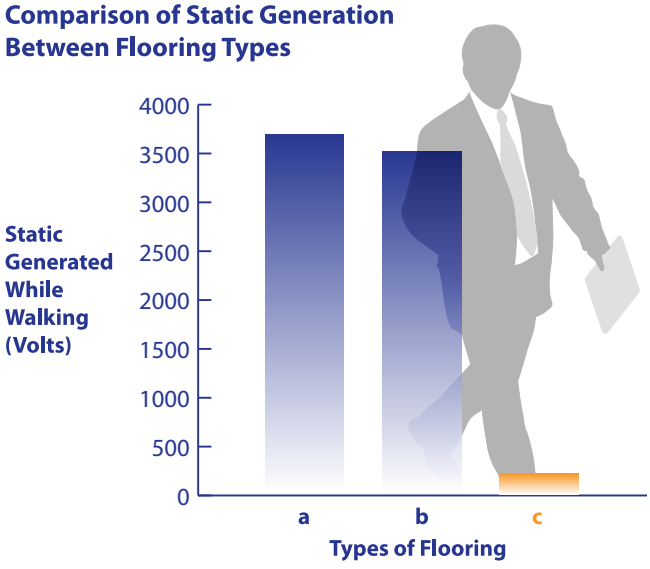
Carpet may be not be the best choice for certain situations such as entry areas and areas with messy applications. Some data center managers choose resilient flooring simply because a resilient floor was installed when their facility was built and no other flooring material has ever been tested or used. Some people see carpet as inferior to vinyl or other hard surfaces because of the recent concerns with SICK building syndrome.

Fortunately, it is possible to meet the same static protection level of conductive carpet with certain rubber and vinyl flooring alternatives. Conductive or EC resilient flooring, in particular, provides static inhibiting properties similar to conductive carpet tiles, but for very different reasons. Similar materials generate less static when they interact. The base compound used in rubber flooring sufficiently resembles most shoe soles to the degree that it inhibits the buildup of static by preventing static generation in the first place. **Unlike SDT vinyl, EC rubber is a permanent conductive material with conductive properties distributed across the surface and throughout the thickness of the tile.** The full distribution of conductive properties means that shoe soles will never contact anything on the surface of the floor that can generate static. And, like all effective conductive flooring options, rubber meets the second critical criterion: it can be grounded.

Conductive vinyl contains thousands of conductive carbon capillaries that extend across and through the entire thickness of the tile. These veins make contact with the bottoms of shoes as people walk across the floor. As static is generated, the carbon capillaries pull the static from the surface and dissipate it safely to ground. Conductive vinyl must have an electrical resistance below 1.0 X 10E6 to be effective. Research has shown that flooring materials whether they are rubber or vinyl, do not perform as well if they are static dissipative and not conductive.

A typical rubber or vinyl installation relies on the same conductive adhesive as carpet tiles. Without conductive adhesive, the floor tiles cannot reach electrical continuity or be grounded and an ungrounded floor has no means of dissipating static away from the floor.

Comparison of Static Generation Between Flooring Types



a: Static Dissipative Vinyl

b: Antistatic HPL (High Pressure Laminate)

c: Staticworx Rubber ESD – EC Series (Electrically Conductive)

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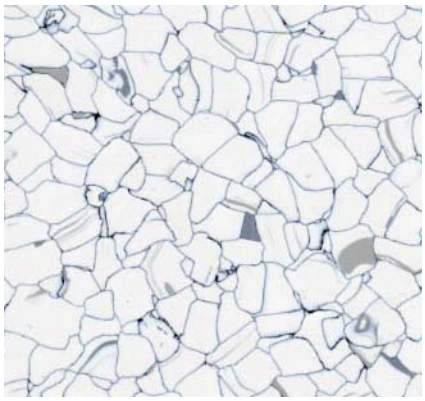
Summary

To protect their sensitive electronic equipment, data centers and mission-critical command centers need static protection on which they can rely. With so many options, choosing the right static control floor can be a challenge for architects, designers and facilities managers. The most important criteria to remember are these:

1) The floor must be compatible with the environment.
2) The material should require a minimal amount of maintenance.
3) The floor must meet the electrostatic requirements of the facility.

By following these few simple guidelines, choosing the right floor can be relatively painless and easy. And static, the invisible threat inside the call center, will no longer compromise job performance or threaten to damage or destroy sensitive electronic or telephony equipment.



Carbon capillaries dispersed within an Ameriworx Conductive Vinyl Tile.

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