

## Taking Charge of ESD on the Manufacturing Floor

Control of ESD is an important part of the manufacturing process for any electronics company, but prevention of static is considered by many to be an even more effective method to protect products from ESD damage. Tellabs Operations, a manufacturer of telecommunications products, advocates static prevention—not just because of the return on investment (ROI), but also because it keeps them competitive in a very tough business.

And competitive they are. A recent issue of *Business Week Magazine* reviewed the top 1,000 global and U.S. companies. Tellabs was ranked 183 among U.S. companies and 388 among international firms.

The company has manufacturing sites in Illinois, Texas, Finland, and Ireland. When the plant in Bollingbrook, IL was built about four years ago, it provided an additional 70,000 sq ft of space, 55,000 for general manufacturing and 15,000 for shipping and stockroom areas.

In the older facility in Lisle, IL, the company concentrated on very basic ESD-control measures which consisted of wrist straps and tabletop mats. For the Bollingbrook facility, Ken Hansen, a senior member of the technology staff at Tellabs, decided to set up an area that would do more than just bleed off charges. He wanted one that would minimize or eliminate charge buildup.

Mr. Hansen was not focused on any particular solution because no single control solution was considered a cure-all by the company. So the search began by looking at tiles and waxes, mats, carpeting, and epoxy floors.

In the new facility, the company was starting to use VLSI-type devices on their PCBs. Like many electronics manufacturers, Tellabs had not determined the ESD thresholds of all their components.

In the selection process, many ESD flooring manufacturers need to know what sensitive devices you are using and what the ESD thresholds are for those devices. Tellabs could not answer those questions, but the company did know that the maximum level of ESD charge generation must be no more than 100 V.

Tellabs considered setting the charge level at 50 V but determined it was impractical and not cost-effective.

The company purchases bare PCBs, puts components on the boards, integrates them into a system, and tests the system. For light manufacturing operations like Tellabs, the 50-V level of protection was not needed.

Once the maximum acceptable charge-generation level was chosen, Tellabs looked at different types of flooring. That entailed some cost analysis and asking the flooring manufacturers some important questions:

How long will the floor last?

How easy is it to maintain?

Does Tellabs have to periodically clear the manufacturing floor to perform the maintenance?

Can the company maintain the entire floor?

Tellabs found that some tile floors need waxing. Applying waxes not only incurs maintenance costs for material and labor, but also for continually moving furniture and equipment out of the way to reapply the wax. So they decided flooring that required reapplication of wax was not acceptable.

Tellabs chose epoxy flooring and carpet tile because they provide permanent ESD characteristics. Additionally, the company did not want the range of ESD protection to vary with the weather, the environment, or wear.

When Tellabs looked at flooring for its durability, they had to consider how the flooring would hold up when people walked on it and when pallet trucks or small carts drove on it. The company also had to look at the wear caused by heavy machinery used in the stockroom and loading-dock area.

Approximately 15,000 sq ft of epoxy flooring was installed in all the shipping and stockroom areas where very high durability was needed. Those areas also needed to withstand skids and nails gouging the floor and high traffic from the lift trucks and stock pickers.

When Tellabs was ready to investigate carpet tile, they

asked StaticWorx, a specialty manufacturer of anti static-ESD carpet to install a test patch in the production area. A 400 sq ft manufacturing area was designated to test how the carpet would hold up and what problems might arise.

The ESD performance of the carpet tile met their needs with 95% of the surface-to-ground resistance falling in the range from  $5 \times 10^5 \Omega$  to  $3.5 \times 10^7 \Omega$ . Additionally, the static control of the carpet tile was unaffected by swings in relative humidity from 10% to 90.

After the test, Tellabs chose The Conductors Series ESD carpet tiles for the general manufacturing area which covers 55,000 sq ft. In addition to exhibiting consistent ESD-control characteristics, the carpet tile is easy to replace and reconfigure.

The carpet tile allows us to install aisles with different color carpet which later can be moved, said Mr. Hansen. We also can replace damaged portions of the carpet in a matter of minutes. And the new pieces tend to blend very well into the existing flooring without making a checkerboard effect that you can get with some tiles.

Tellabs expected cleaning problems with the carpet, especially from solder splashes and pieces of component leads. They found the carpet tile held up well and cleaned up more easily than hard surface flooring.

Tellabs also wanted to know how the workers would react to carpet in the manufacturing environment. Not surprisingly, they discovered that the workers' perception of the area was improved.

For example, 15 minutes was set aside every day to clean up the flooring area in the Lisle facility with brooms and dustpans. In the carpeted area, no time is needed for daily clean-up because workers voluntarily keep the area clean using vacuums.

The carpet tile also adds significantly to the ambiance of the manufacturing environment. You don't think you're in a manufacturing environment, said Mr. Hansen, even though you have surface-mount assembly machines all around you. It even feels a little like an office environment. As a result, boxes and packing material are not scattered around. People tend to get rid of the clutter because they imagine that it is an office.

## Prevent The Charge

From the beginning, Tellabs wanted to minimize the



generation of ESD charges, and the floor accommodates a large part of that. Unlike conductive vinyl materials which only conduct static electricity, Tellabs found that StaticWorx" carpet tiles safely discharge static to ground and also prevent triboelectric generation in the first place. However, the cleanliness of the environment also has a significant effect on charge generation.

For example, keeping packing materials out of the area reduces the potential for static charges. Keeping non-ESD-control chairs out also is important because they can generate static charge. The company uses ESD control chairs to minimize the generation of charges rather than to drain static charges.

ESD-control footwear is another important part of the charge-prevention equation. Tellabs evaluated how a particular floor product reacted to wearing ESD shoes, - ESD heel straps, and non-ESD footwear.

To find the best footwear, it is important to understand how any flooring product reacts to each type of footwear. Tellabs wanted an ESD floor to minimize the charges, even when non-ESD footwear was used.

However, this does not mean workers can meet the 100-V charge level without ESD-footwear—because they can't. But the carpet tiles proved to generate the least body-voltage charge of all the products considered.

In very tightly controlled electronic manufacturing environments, personnel with non-ESD-control footwear are restricted from access to these areas. But there is a price to pay for such restrictive measures.

Tellabs does not want to limit the access to the manufacturing floor to just those people who work there. They want the production planners to go out and talk to the people that make, schedule, or get the product out the door. They also want the engineers to go out on the floor to interact with the workers whenever there is a problem.

Tellabs ESD-control rules state that, if you are handling products, you must wear either a wrist strap or ESD footwear. If you are transporting products, you must wear ESD footwear or the product must be in an ESD-safe container. Personnel sitting down also must wear an ESD wrist strap 100% of the time.

## Conclusion

Tellabs never asked how much money the flooring would save. Although it was important, it was more of a quality issue. As a producer of sophisticated electronic equipment, the prevention of ESD was mandated if they wanted to remain competitive in their industry.

Many companies in the electronics industry restrict ESD control programs because they cannot calculate an acceptable ROI. They cannot justify the use of products other than the typical ESD wrist strap and table matting, observed Mr. Hansen. It's very difficult, if not impossible, to change the attitude of a company that can't cost justify every expenditure.

But any company can look at ESD prevention as a cost of doing business to remain competitive. There is enough evidence out there that indicates that ESD is a problem. Tellabs believes it because this past year they added another 70,000 sq ft of space with exactly the same layout of carpet tile and epoxy. Their thinking is that you should not tinker with a successful formula.

Successful companies do not approach ESD-control programs from an ROI standpoint. They recognize that ESD is real, that it can and does damage products so they take a proactive stance.

You don't have to spend 2 million dollars but you do need to continually upgrade your ESD control program so it eliminates as many causes of charge generation as possible, added Mr. Hansen. To do anything less is a disservice to your customer.

**This is an old case history from Tellabs. The original flooring supplier was United Technical Products. United Technical Product's Conductors line of manufacturing grade ESD carpet tile is now sold by StaticWorx, Inc in Newton, MA. David Long, StaticWorx CEO, was formerly the executive vice president of UTP.**

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