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Q: Is it safe to have workers wearing ESD wrist straps to be grounded to the building electrical system ground during stormy weather?

A: Grounding of personnel that handle or otherwise are in close proximity to electrostatic discharge (ESD) susceptible items (not just electronics, this applies to munitions and explosives and other materials as well) is a necessary requirement to reduce the chance of damage to the susceptible items from human body generated static electricity. The systems used for the purpose of electrically bonding personnel to ground contain current limiting resistance. This added resistance is in place to make sure that this intended path to ground is never the path of least resistance from the person to ground. Hand-to-hand, hand-to-knee or contact between any other two body parts to electrical circuits may become a ground path regardless of whether or not a person is wearing a static control wrist strap or shoe grounding system. Therefore, a wrist strap or ESD rated shoe system or shoe grounding straps are not considered safety devices - they contain added resistance to limit current flow through that path to ground.

In the event of lightning strikes to a building, the electrical system ground allows the lightning current to flow into the grounding system and into the earth. It is extremely rare for a lightning strike to impact the interior wiring of a properly grounded building. It happens in homes once in awhile since the ground path may not be as well defined as in an industrial building. Also, the frame of a typical home is not as substantial as an industrial building (usually containing steel frame members).

In the 40-50 plus years of the industry handling electronic parts by personnel grounded with wrist straps and shoe systems, there has been only 1 documented report of an incident involving a lightning strike where personnel received a noticeable shock. In the reported case, lightning actually entered a facility and eye-witnesses (dozens of people) saw the lightning travel along the ceiling of a wood frame industrial building and enter into light fixtures. All the light fixtures exploded and emergency lighting came on. Dozens of people were wearing wrist straps at the time and a few received minor burns but no other injuries were reported. This was an extremely rare event - even considering it happened in Florida which has the most frequent occurrence of lightning strikes on the planet. In the reported case, a problem was found with the building lightning protection which was compounded because of the lack of a steel frame.

The National Fire Protection Association (NFPA) maintains the National Electric Code - NFPA 70. This document defines the grounding system required for all buildings in the United States. Buildings that meet the code have an electrical grounding system that is suitable for use as the static control grounding system. In the event of a lightning strike to the building, the fault current will naturally seek the path of least resistance and enter the earth. Feedback into the interior wiring and then into the static control grounding

system is extremely unlikely. Fully 50 years of practice provides excellent support for the use of a building electrical system ground as the static control ground. The use of a secondary, auxiliary or supplemental ground system for static control grounding may actually have higher electrical risk and is not recommended. Facilities that use a supplemental grounding system, such as a driven ground rod or chemical ground for a separate ESD system ground must electrically interconnect or bond the supplemental ground to the equipment grounding conductor (bonded to the neutral buss). This important electrical bond must have an electrical resistance less than 25 ohms to meet national code. Normally, this bond will only have a few ohms resistance at most. The reason that this interconnection between grounding systems is important is to keep the electrical potential between powered equipment and the static control technical elements, including personnel, as low as possible. An electrical potential will almost always exist between different grounding systems so it is vital to make sure they are bonded together to equalize that potential difference.

For further information and details, please see ANSI/ESD S6.1 - *Grounding* (ESD Association) and NFPA 70 – *National Electric Code* for more details

About the Author

This article was prepared on behalf of the ESD Association by David E. Swenson, President of Affinity Static Control Consulting, LLC, located in Round Rock, TX. David is currently president of the ESD Association and member of the Board of Directors. He is also a member of the Association's Standards Committee, Technical and Administration Support (TAS) committee and is chair of the Grounding working group. He is a US National Committee Technical Expert to IEC TC101 – Electrostatics, and is a member of the Electrostatic Society of America.