APPLICATION NOTE

EMI/ESD

Pulse Ionizer Interference Issues

Under certain circumstances, pulse ceiling ionization systems can cause significant interference problems for processes and tools. This interference most often takes the form of large ESD transient pulses radiating broadband noise throughout the production area, causing tool lockup, process interruption and a host of other problems.

Pulse ionization systems, most commonly deployed on production area ceilings over sensitive tools and processes, can sometimes ironically lead to significant electrostatic problems in their own right. These ceiling ionization systems work by propagating large volumes of alternate polarity ions into the laminar airflow from ceiling to work surface. Pulse ionization systems are typically deployed where a considerable distance exists between the ionizer and the discharge target. Under optimal conditions, emitter points are far enough from the ceiling and the airflow is linear enough to carry these single polarity ions directly to the target work surface or product. Under those circumstances, no problem exists.

The Ceiling Connection

Unfortunately, too often several other factors combine to create a serious problem. The first complication arises when ceiling diffuser panels are not grounded to the ceiling frame. Due to most ceiling manufacturers use of powder coating and insulative clips to hold diffuser panels in place, large electrically isolated panels with considerable capacitance are often located adjacent to pulse ionizers. The gap between the ungrounded panel and ceiling frame can be as much 0.3 inches (0.76 cm), leading to periodic discharges between the panel and ceiling frame. Panels can load to 1-2 kV potentials during ionizer pulse intervals before reaching the gap discharge threshold between panel and frame, creating very large electromagnetic pulse transients (e.g., 118 V/m, 37 W/cm2).

The second factor which contributes to this phenomenon is non-linear airflow around ionizers and ceiling crossbars. These unavoidable obstructions in the laminar airflow create rotating backflow to the ceiling due to pressure differentials. If this backflow carries significant numbers of single polarity ions (positive or negative) into contact with an ungrounded ceiling diffuser panel, large discharge events can occur.

To compound the problem, many of these large discharge events are taking place in close proximity to sensitive tools and processes (often directly overhead). Many production tools and other process equipment are not immune from this magnitude of pulse-EMI event.

Some interference occurs due to the extraordinary event amplitude involved; other interference can result from the broad frequency spectrum noise often generated as well. Without the equipment and expertise to detect and identify this phenomenon, production staff can end up fighting hopelessly against an unseen enemy which masquerades as tool software or hardware problems.

The Proactive Solution

The best solution to this problem is to identify and correct it before it has a chance to impact production. This typically involves the following elements:

Verify and test ceiling ground paths between diffuser panels, the ceiling frame and facility ground.

Verify wall bonding to facility ground (noting that reconfiguring walls sometimes breaks effective grounding).

Identify and test a ceiling ionizer configuration protocol (emitter wand length, pulse timing settings, surface discharge parameters, etc.) for non-interference. Note that this involves full-range testing to determine safe boundaries for pulse settings and must coincide with evaluation with interference test equipment.

Conduct an ESD/EMI interference audit to qualify ionizer performance in the production areas with equipment capable of identifying individual event locations (usually multi-antenna signal vectoring).

Remediation Solutions

Unfortunately, many ceiling ionization systems have been installed without due consideration for this problem. This leads in some cases to an interference problem occurring in a critical production environment. As can be expected, remediation efforts in this type of circumstance are more problematic due to continuous production requirements. This type of remediation effort should typically consist of the following elements:

An ESD/EMI interference audit should be conducted using appropriate test equipment capable of determining precise interference event origins. This audit both establishes interference levels and provides a comparison benchmark for later remediation verification.

A ceiling/wall ground path evaluation should be conducted to determine if discontinuities are contributory.

Ceiling ionizer settings should be evaluated and tested to determine if a protocol alteration alone is capable of reducing interference (i.e., panel gap discharge threshold alteration).

In some cases, remedial grounding of individual diffuser panels is required. If this is to occur over critical production equipment and processes, the deployment of an experienced ceiling grounding team is strongly advised for both safety and production reasons.

Consider installing an active ESD/EMI monitoring system to prevent recurring problems.

Solution Implementation

In the case of a proactive evaluation, the time and cost involved is usually quite low, typically taking from several hours to a day to complete. An experienced interference evaluation team can characterize large production areas in a short period of time using appropriate equipment, providing sufficient data for determination of further courses of action. This activity can be performed rapidly and without interruption to production.

If ceiling grounding remediation becomes necessary, a decision needs to be made whether to implement in only problem areas or to undertake a facility-wide remediation. This operation can be managed through interactive scheduling and a controlled protocol to minimize any impact on production processes. In addition, following any remediation, a re-verification of interference levels should be included to assure that the remediation was successful.

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