DESCO GAZETTE
Total ESD Awareness and Management
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THE SECRET OF IONIZATION

The Problem

Setting up an ESD-safe workstation is often more challenging than it first appears. There are many methods of controlling ESD and typically it requires a combination of these to curb all static problems. Unfortunately, there is no single method that will fulfill all requirements.

Wrist straps and work surface mats are probably the most familiar to us. They drain charges from operators as well as from the product being worked on, but what if the static charge is on an insulator? Electronic products by nature will normally consist of conductors and insulators. Insulators at the workstation can be found on the product itself, on tools being used, on tapes for masking, even on circuit boards.
A static charge on an insulator cannot be drained by grounding, as it can be with a conductive material.

What can we do?

To effectively remove charges from insulators we need to make the surrounding air more conductive. We have all seen a balloon cling to a wall because of a static charge, and we know that after a period of time, it will drop. That is because the air is somewhat conductive and the charge eventually drains off. The problem with this concept is that it takes too long. The more conductive the air is, the faster the charge will be neutralized.

The two methods most frequently used to increase the conductivity of the air are – increasing the relative humidity level and air ionization. In many applications, increasing the relative humidity creates a host of new problems, such as: operator discomfort, causing metals to oxidize or rust, solderability problems, and the high cost and difficulty in maintaining the desired level. For these reasons, air ionization has become the method of choice.

Air ionization

The four major types of ionizers are AC, pulsed DC, steady-state DC, and nuclear. The focus of this article will be on the first three types, which use electricity to create ions. The nuclear types, which are non-electric, are more frequently used in flammable or explosive environments for applications other than electronics.

Electrical ionizers generate air ions by a process known as *corona discharge.* A high voltage is applied to one or more sharp points and quantities of air ions are created. Fans or blowers may be incorporated in the ionizer to assist the movement of the ions and enhance performance.

AC ionizers use a transformer to multiply the AC power line voltage. AC stands for *Alternating Current*, which means that the power cycles from positive to negative sixty times per second. The AC ionizer therefore produces both positive and negative ions from the same points or *emitters*. The drawback with this approach is that many ions recombine because the cycle frequency is too fast. For this reason, most AC ionizers rely on fans or blowers to be effective.

Pulsed DC ionizers utilize separate power supplies to generate positive and negative voltages and usually each power supply has it's own dedicated emitters. The power supply alternates between positive and negative, but usually at a lower frequency than AC units. In this way, ion recombination is reduced and performance is increased. Airflow may then be reduced for operator comfort without sacrificing much performance. With pulsed DC, it is important to cycle at least two or three times per second to prevent harmful voltage swings on the object being protected.

Steady-state DC ionizers also employ separate power supplies and emitters, but instead of alternating positive and negative, both supplies are on all the time as the name implies. As would be expected, there is some degree of recombination, however, the ion density is still greater because of continuous operation of both supplies. The offset or balance voltage at the output will normally be more consistent than pulse units.

The Selection Process

Ionizer configurations range from elaborate systems that blanket an entire room to small palm-sized units. Selection of ionization equipment depends on the application, the space available, the performance desired, and what features are important. A single model may be well suited to one application and useless in another. Fortunately, there are many models on the market to choose from.

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DESCO IONIZERS

CRITICAL ENVIRONMENT IONIZER

60478	24" Ionizer, 120 volt, NIST	60482	48" Ionizer, 220 volt, NIST
60479	48" Ionizer, 120 volt, NIST	60480	Replacement Emitter Cassette
60481	24" Ionizer, 220 volt, NIST	60455	Replacement Screen

FEATURES	***BENEFITS***
Minimal contamination ionizer	*Rapid static charge neutralization of insulators; designed for use in clean rooms*
Multiple high output fans	*Provide more consistent and wider coverage*
Overhead mounting	*No waste of valuable worksurface space*
RJ45 port	*Auto-calibration and monitoring capability*
Flashing front panel display	*Signals when cleaning is needed*

Technical Bulletin TB-2087

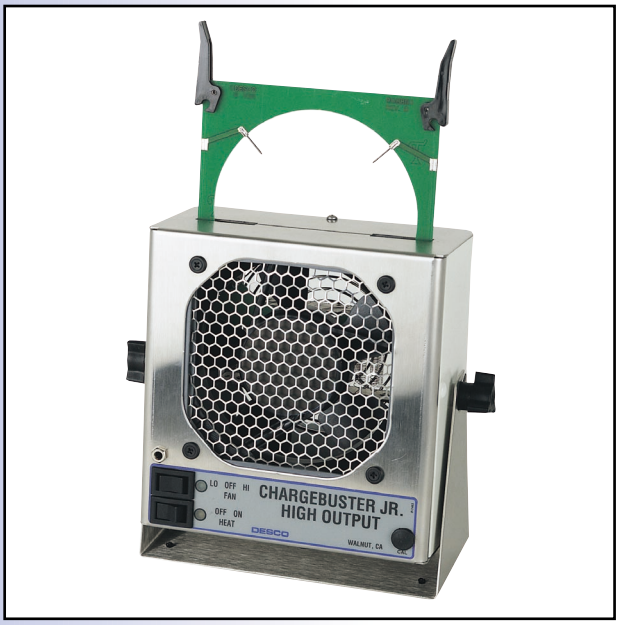
***US patent 6,137,670**

HIGH OUTPUT OVERHEAD IONIZER

60600	40" Ionizer with light and heater, 120 volt, NIST
19417	40" Ionizer, 220 volt, NIST
60455	Replacement Screen
60437	Replacement Emitter Array (6 required)

FEATURES	***BENEFITS***
Auto balance	*Monitors continually for optimum performance*
3 separate 4-3/4" fans	*Air delivery 150-260 CFM for faster charge decay; air flow will not cool joints, adversely affecting soldering*
"Clean-Me" indicator	*Power light flashes when emitters need cleaning*
Fixed temperature heater	*Removes chill from air for worker comfort and productivity*
Automatic visual/audible alarm	*Signals when maintenence is needed*

Technical Bulletin TB-3006



CHARGEBUSTER JR. H/O

60500	120 Volt, NIST
60501	120 Volt with Heater, NIST
60502	220 Volt, NIST
60455	Replacement Filter

FEATURES	***BENEFITS***
Grounded metal case	*Added safety eliminates fields*
Auto-balancing	*Ion output remains balanced*
Ozone output less than 0.05 PPM	*Environmentally friendly*
"Clean-Me" indicator	*Flashes when cleaning is needed*
Non-nuclear operation	*Added safety*
Removable back grill	*Easy access to fan blades and for general cleaning*
Available with Heater	*Removes chill from air, enhancing user comfort and productivity*

Technical Bulletin TB-2095

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DESCO IONIZERS

BENCH TOP IONIZER

19540	Bench Top Ionizer XL, 120 volt, NIST
19500	Bench Top Ionizer, 120 volt, NIST
19520	Bench Top Ionizer, 220 volt, NIDST
60416	Foam Filter

FEATURES	***BENEFITS***
Patented Faraday balance system	*Automatically maintains a balanced ion ouput*
Emits ions in a true laminar flow	*Reduces ion recombination and emitter contamination*
AC ionizing system	*Superior performance in neutralizing static charges at greater distances*
XL model is wider	*For wider performance zone*
Non-nuclear operation	*Added safety*
Gold plated emitters	*Longer life*
Multiple installation options	*Flexibility*

Technical Bulletins TB-2016 and TB-3009

ION PYTHON AIR NOZZLES

19585	Controller/Ion Python/Foot Switch 120 volt
19586	Controller/Ion Python/Foot Switch 220 volt
19587	Controller/Hand Gun w/Hose 120 volt
19588	Controller/Hand Gun w/Hose 220 volt
19589	Controller Only 120 volt
60350	Nozzle/ Hand Gun Attachment
60351	Nozzle/Hand Gun Attachment, Dissipative
60340	Foot Switch
60345	Photoelectric Switch
60355	Replacement Filter

FEATURES	***BENEFITS***
Ion Python	
Foot pedal controls	*Hands-free usage*
Electric sensor	*Can be quickly installed to control ionization*
Quick disconnect bench mount	*Easy to use and operate*
Flexible hose	*Allows accurate positioning of ionized air*
Hand Gun	
Detachable 7' air hose and nozzle	*Facilitates servicing*
Adjustable air stream	*Provides flexibility in usage*

Technical Bulletin TB-2079

AUTO CALIBRATION UNIT

60491	Auto Calibration Unit, NIST

FEATURES	***BENEFITS***
NIST calibrated	*Performs calibration of CE ionizers*
Simplifies calibration process	*Minimizes workstation down time*
Closed-loop calibration	*Calibrates Desco CE Ionizers to conditions at the worksurface*
Visual balance indicator	*Displays ionizer balance level*
Derives power from ionizer under test	*Just plug into ionizer; eliminates batteries or power supplies*

Technical Bulletin TB-3005

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Ionizers *Continued from Page 1*

Room ionization will typically have multiple emitters just below ceiling height and will rely on some amount of air movement for moving the ions down to bench level. Room ionization was considered by some to be the most effective way to protect large areas against ESD hazards. Current thinking is leaning more toward localized workstation ionization. There are several reasons for this. Product sensitivity has become much greater and long decay times of room ionization cannot be tolerated. Often, with room ionization, only a fraction of the ionized area may be ESD sensitive. Localized ionizers bring protection to the areas where it's needed and performance is often 10 times faster than the ceiling height system. Additionally, localized ionization moves with the workstation, or to a new workstation, making it much more flexible with changing production line layouts.

Workstation ionizers can be found in many shapes and sizes. The most common of these is the benchtop ionizer, which is about the size of two phone books stacked up. These models are the original workhorses for the bench and are still in high demand. As the market matured, smaller, lighter units began to appear. Because bench top real estate is valuable, many users prefer the smaller ionizers. Some small ionizers are suspended above the bench using a flexible, articulated arm mounting method. Whatever style is chosen, care should be taken to assure that items normally on the bench would not obstruct the flow of ionized air.

Overhead ionization was conceived to solve the obstacle blocking the ionizer problem. The overhead ionizer typically will be suspended 18 to 24 inches above the bench either by hanging from chains, or by mounting brackets to the bench or shelf. With this method of ionization, it is very unlikely that an object will block the flow of ionized air to the item being protected. In addition, the downward airflow is more consistent over the entire bench. To assure that adequate air is delivered, normally 2 to 4 fans are used in a package ranging from 24 to 48 inches long.

Focused air ionizers are often used where the process demands small area or spot protection. They are either hand-held similar to an air nozzle or they may be mounted in a fixed location. The main advantage of this type is that the user has the benefit of a strong air blast (20 to 100 P.S.I.) to help dislodge contamination, while the ionization in the air stream eliminates the static attraction of the particles at the same time. Hand-held air nozzle types will usually have a trigger or pushbutton to activate the air and ion flow, while the stationary-mounted type is frequently remote controlled with a foot pedal, photo sensor, or some other switch closure.

Industrial ionization, while not normally used for electronic work, also deserves mention, as it uses basically the same technology (usually AC ionization). This segment of the market is more related to processing materials and eliminating the undesirable static cling. Many processes such as injection molding, printing, film converting, and similar operations have serious problems with electrostatic attraction. Due to the fact that these processes are frequently fast moving, the normal bench-type ionizer will not keep pace. Instead, for these applications, large blowers or manifolds of compressed air are used to propel the ions. More often than not, the blowers or ionizing bars are placed in close proximity to the object with the charge for maximum benefits. By using industrial ionizers, many processes have improved yields, speed, and safety.

Features are important to consider when selecting an ionizer. If the unit is to be located at a bench, operator comfort is important. Some models have heaters built in to eliminate the "chill effect" of blowing air. Others have speed controls for the fans to tailor the airflow. Lights are sometimes incorporated with the ionizer to add additional illumination to the bench. Top of the line models will generally have some form of electronically controlled balance indicator to display the status of the ionizer, as well as automatic shutdown protection in the event of a problem. Some ionizers even have indicators signaling when cleaning or maintenance is required.

Maintenance is a requirement on virtually all ionizers to assure continued performance. Contamination will collect on the sharp emitter points, which must be cleaned away on a regular schedule. The contaminant build-up on the emitter can normally be removed with a soft brush, however, sometimes a more thorough cleaning is necessary using a swab and alcohol to remove tough deposits. The cleaning frequency is different for every application, however, the interval can be determined by using a *charged plate analyzer*. This piece of equipment is made specifically for evaluating ionizers. In addition to measuring balance of the ionized field, the analyzer will measure the decay performance. The charged plate analyzer applies a known voltage to the isolated plate and measures the time it takes for the ionizer to reduce the charge to a certain value. It's important to note that a manufacturer's claim that the unit *always stays in balance* is meaningless. An ionizer with *no ion output* can appear to be in balance. The decay performance must be checked to see the whole picture. By using the charged plate analyzer at regular intervals, the user can determine the proper maintenance interval when a drop in performance is noted.

In conclusion, ionization is one of the best methods of removing charges from insulators, and as a result plays an important role in controlling ESD. Remember, though, that the ionizer is a secondary form of defense and does not eliminate the need for standard ESD control devices, such as wrist straps, heel grounders, and work surface mats. It is only one element in an effective ESD program.

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