



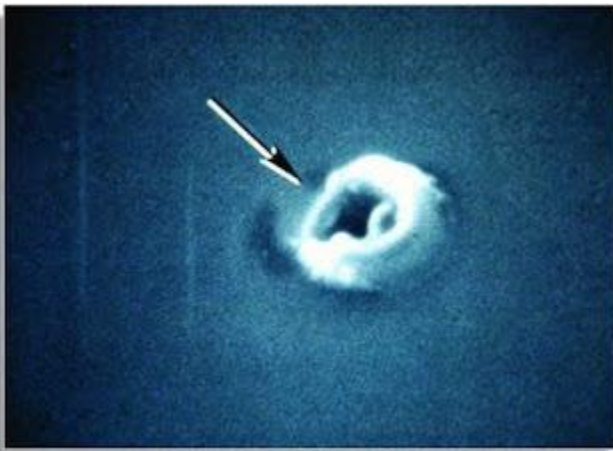
Transforming Technologies

Outstanding Alternatives in Static Control

Elements of an Effective ESD Control Program

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Electrostatic Discharge (ESD) has been a threat for centuries, dating as far back as the 1400s when European and Caribbean forts were using static-control procedures and devices to prevent electrostatic discharge ignition of black powder stores. ESD, simply put, is the sudden transfer of an electric charge from one conductive surface to another. A common example of ESD is the annoying shock one receives when touching a door knob after walking across a carpeted room.



In today's manufacturing environments, the threat from ESD is constant. As electronics become smaller and more sensitive, ESD can affect production yields, product reliability, and profits. The human body can feel ESD at 2,000 volts, but sensitive components can be damaged at as little as 15 to 30 volts (the image to the left shows a magnified example of ESD damage)! This is why ESD has sometimes been called the "invisible threat." To combat this potential threat, companies involved in electronics manufacturing today follow the industry accepted elements of an ESD Control Program.

An effective ESD Control Program requires three main parts:

1. **An ESD Prevention Program**—This is developed by first assessing your ESD problem and then documenting the necessary equipment and procedures to follow to ensure electrostatic safe handling
2. **A Training Program**—Required to ensure everyone is aware of, and understands, the ESD Control Program, use of equipment, and correct procedures
3. **An Audit Program**—Required to ensure that equipment remains functional and that the ESD prevention procedures are correctly followed. There should be daily, monthly, and yearly checks

These three policies should be included in any effective ESD Control Program. In the next section, we'll take a closer look at specific procedures and materials that become part of your program.

In the first section, we broadly touched on the three main parts of an ESD Control Program: ESD Prevention, Training, and Auditing. In this section, we'll look closer at each part—beginning with the ESD Prevention Program.



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Elements of an Effective ESD Control Program Part 1 Prevention Program

Designing the ESD program should be made with company-wide input because ESD damage can occur at all stages in a product's life from fabricating to shipping. Appoint an ESD manager responsible for making sure that all aspects of the ESD program are carried out. ESD problems should be accessed through a facility audit and a close examination of production losses. This information will be critical when deciding what equipment and procedures to implement.

An Electrostatic Protected Area (EPA) area should be established where sensitive materials can be handled. An EPA is a prohibited region where items or activities able to cause ESD damage to sensitive devices are not allowed. This area should be designated with ESD signs or [floor marking tape](#).



All conductors in the EPA should be grounded to a [common point ground](#) and all insulators should be removed if possible. Insulators, such as plastic or glass, are materials that prevent the flow or transfer of electricity and cannot be grounded. Charges can accumulate on insulators, which cause many problems. Air ionization can neutralize any charge that builds on insulators and other materials that cannot be grounded. [Ionizers](#) produce positively and negatively charged ions and flood a surface area with ions. Ions are charged particles that are present in the air and, as opposites attract, charges will be neutralized over time.

Work surfaces and floors within the EPA should be covered with [grounded ESD matting](#), such as two-layer rubber or vinyl. Operators in the EPA should be grounded at minimum with a [wrist strap and coil cord](#) set or [heel grounders](#). [ESD garments](#) such as jackets or [gloves](#) may also be advisable. Shelving, storage containers, and even [pens](#) can generate static, and these items should either be grounded or made from an ESD-safe material.

Test equipment is also necessary in the EPA to ensure that all devices are in proper working order. This equipment may include a [wrist strap/footwear tester](#), a [constant monitor](#), or a charge plate monitor.



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Part 2: ESD Training

The second part of an effective ESD Control Program is ESD Training. ESD training leads to the success of an organization's ESD Control Program through educating the best practices for ESD prevention. A dedicated ESD training program shows a sustained company-wide commitment that ESD prevention is a valuable and on-going effort. There are three aspects to ESD training: initial training, recurring training, and evaluation.

The initial ESD training should cover the fundamentals of ESD and define the type and frequency of training for all employees. An initial training program should cover electrostatic discharge, how to identify insulators and conductors, how to identify how much static is necessary to damage equipment, and it should emphasize the costs of such ESD damage. Hands-on training includes how to properly use and wear ESD items, such as a [wrist strap](#) or [heel grounder](#), and what precautions to use in non-protected ESD areas. ESD training of personnel can take many forms: In-house training, instructor-led ESD classes, computer-based training, or off-site workshop training.



Recurring ESD training is a vital aspect of an ESD Control Program because it reinforces the information taught in the initial ESD training, but also offers a chance to incorporate program updates and changes. Recurring training also gives employees the opportunity to provide feedback on procedures, which is valuable when evaluating the current ESD Control Program. Guidelines for recurring testing may vary based on the organization, but periodic training is a must for the success of any ESD Control Program.



According to the ["Standards of ESD Training Plan"](#) required by [ANSI/ESD S20.20](#), an evaluation should be incorporated into all ESD training programs. This evaluation, which could take the form of a written test, computer-based test, or a Q&A with an ESD instructor, ensures that the employee understands and has retained the information taught in the ESD training sessions. The organization should establish

pass/fail guidelines for ESD certification/re-certification and procedures for recording this training in employee records.

An effective, systematic, and sustainable ESD training certification and re-certification system is key for all successful ESD Control Programs. It cannot be stressed enough how essential ESD control is for successful electronic manufacturing.



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Elements of an Effective ESD Control Program Part 3: The ESD Audit Program

An ESD audit program is the engine that keeps the ESD Control Program running smoothly by continually reviewing, verifying, analyzing, and providing feedback to improve all aspects of the program. An audit program reinforces management's commitment to ESD compliance, triggers corrective action when issues arise, and helps foster continuous improvement.

There are three types of ESD Audits that are performed: Program Management, Quality Process, and ESD Control Program Verification. Each audit is performed at different intervals but each is vital to an organization's successful ESD Control Program.

A Program Management Audit evaluates how well a program is managed and the strength of the management commitment. This program emphasizes factors such as the existence of an effective implementation plan, realistic program requirements, ESD training programs, regular verification audits, and other critical factors of program management. This audit should be done annually or bi-annually.

A Quality Process Audit is a daily maintenance of the program. Examples include daily testing of [wrist straps/footwear](#) and checking the quality of electrical grounds. These should be checked by operation personnel on a daily, weekly, or monthly basis.

The ESD Control Program Verification Audit verifies that program procedures are followed and that ESD equipment is within specification or is functioning properly. This procedure typically involves a checklist of ESD materials and equipment to test, such as [ionizers](#), work surfaces, and [wrist straps](#). All ESD areas must be evaluated and this is typically done by a random sampling. This type of audit requires the use of basic ESD test equipment: a charge plate monitor to test ionizer performance, a static field meter to test the static buildup on surfaces, and a [resistance meter](#) for evaluating the resistive properties of surfaces. This audit should be done monthly.

As with the actual ESD control procedures of companies, audit programs vary from company to company. To ensure a successful program, specific points must be addressed:

- The written and defined ESD Control Program must be reviewed
- Testing and measurements must be taken of all ESD areas and equipment
- Audits must be regularly scheduled and performed
- Documentation of audit results must be created and made available for review
- Corrective action must be used, if necessary





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Audits should be performed by the ESD manager or by unbiased outside auditors from other departments. Oftentimes, paid professional ESD auditors may be the best course of action, but input from the operations personnel is also important and should be considered at all times.

Auditing is a key element in maintaining an effective ESD control program. It helps ensure that procedures are properly implemented and it can provide a management tool to gauge program effectiveness and make continuous improvements.

That ends our look at ESD Audit Programs and concludes our discussion of an effective ESD Control Program. This three-part, introductory series is just the beginning of our focus on ESD control. Please check back soon for other articles covering this very important topic.

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