

Conducting ESD Audits

1. The Importance of Audits

ESD audits are an essential part of a proper ESD control program. Audits check all ESD control practices and products, identify problem areas and faulty equipment, provide a reminder to personnel of their responsibilities and indicate areas that require correct action.

The compliance of all aspects of the ESD equipment, procedures and training must be checked at regular intervals, otherwise gradual deterioration can be expected. Equipment will fail over time and materials and equipment will become non-compliant. Static awareness and correct use of procedures will tend to gradually fade unless reinforced by refresher training.

An audit is based on an ESD control document that has been defined, approved by management, and implemented at all operating levels. This document is usually based on a government, military or industry standard for ESD.

In the audit, all facets of the ESD program must be checked to see that they are in accordance with the ESD control document. Discrepancies must be recorded and reported to supervisors and to company management as soon as possible.

Each company's audit procedures are unique to the local control program or plan, but certain aspects will be part of every program. The major areas to be examined are work area integrity, operator conformance to proper procedures, condition of the workbench and floor, and general aspects of the program.

2. Work Area Compliance

The audit must verify that the boundary that separates an ESD Protection Area (EPA) from non-EPA areas is clearly defined. Signs, directional arrows, aisle marking tape, and other methods may be used. This is a reminder to the workers in that area, of course, but also reminds visitors that they are entering or exiting a sensitive control environment.

When entering an EPA, it should be easily identified by the use of signs, posters or other designations to enforce the proper use of ESD controls.

Any supply carts in the sensitive area used to store or transport ESD sensitive devices should have the uprights and shelves electrically connected and grounded to the ESD ground via a drag chain to minimize tribocharging. A permanently attached ground snap to the cart is highly recommended for hard grounding the cart when docked in an EPA.

Cleaning crews, contractor personnel, and maintenance workers must come into sensitive areas from time to time. These visiting personnel should be quizzed or trained for ESD safe practices before entering EPAs areas and instructed to not touch ESD-sensitive components.

Any visitor who will be in the area for an extended period should be required to wear a smock of a different color from regular workers, or should be given a different-colored badge for control purposes. This makes it easy to identify and monitor them for ESD practices.

3. Employee Audit

Every operator, supervisor, material handler, or other employee that comes near sensitive equipment or parts should go through an orientation to be certified or trained in ESD practices. A yearly refresher ESD control training program is recommended for all personnel. Certification records should be readily available to the auditor and to area supervisors.

There should be a self-check procedure in the area, and the auditor must verify that each operator is aware of the procedure and follows it every day. Self-check shall ensure that the employee performs the following:

- ✓ Check the work area for charge generators
- ✓ Wear and test personal grounding devices
- ✓ Check for ESD insulators and remove them from the work area
- ✓ Check that ESD sensitive equipment is in proper packaging with labels
- ✓ Ensure that approved cleaners are on hand
- ✓ Check that wiring of discharge devices is grounded
- ✓ Ensure that ionizer is positioned and working properly
- ✓ Ensure that non-grounded personnel stay at least a foot away from your static-safe area

Some companies require that every person entering the sensitive area pass a grounding test, and that certification be verified. The audit must verify that such a system, if implemented, is operating properly.

Each operator must wear the prescribed grounding devices at all times. A continuous monitor tests the wrist strap and static mat connections continuously and sounds an alarm when there is a problem. If an operator uses a monitor, the auditor must verify proper operation. If the monitor is not used, the auditor must determine that wrist straps and heel straps are checked daily.

If smocks or other ESD outer clothing are required, the auditor must verify that they are worn properly and checked regularly. Smocks help to minimize problems with street clothing. Proper use of a smock includes securing the smock at the opening and covering of the sleeves.

As an additional precaution, the smock may be grounded by connecting it to a grounded wrist strap or ground cord at the hip connection. ESD garments should be bar-coded, laundered and tested (sleeve-to-sleeve).

4. Work Benches and Floor Covering

The floors in an ESDP area must be checked for surface resistance, especially in the high-traffic areas. A common high-end limit for this is 1 GΩ per ANSI/ESD-S7.1.

The auditor can check for high-end limit using a megohmmeter that meets both ESD and ANSI/ESD-standards. ANSI/ESD S20.20 states that footwear and flooring are individual elements. Each element should be less than 1×10^9 ohms, but the total system resistance should be less than 35 Megohms. The best electrical check for a floor is surface resistance to ground (RTG) as this insures a connection to ground as well.

Each workbench must be evaluated for ESD prevention, which involves removal of non-essential insulators (such as coffee cups, radios, food wrappers, etc.) or the control of essential insulators via ionization (such as some tools and jigs).

The workbench should have a dissipative-grounded work surface, a common point ground or continuous monitor with banana jacks for grounding wrist straps and a ground cord to power ground (connected to the common point ground or continuous monitor).

A good practice is to use a conformity sticker (always located in the same spot for each workstation) indicating that the bench meets all ESD control requirements. If a sticker is missing, it denotes that an infraction had occurred and not to use the bench. If the bench is ever moved then the sticker should be removed until re-inspected.

The positioning of equipment that generates static must be monitored carefully in relation to ESD-sensitive equipment. The PC monitor, a well-known static generator, is necessary on many production benches. The static generation from this device can be made acceptable by use of a well-grounded protective screen or a topical antistatic-dissipative treatment.

If ionizers are used on or above workbenches, then the audit must include a verification that each ionizer is working properly. The checking procedure should be defined in the ESD document and the audit should verify that each operator can and does follow that procedure.

Documents stored at the bench should be in dissipative holders and or binders. Packaging or general purpose tapes found at the work bench should be verified that they are ESD safe (antistatic and or dissipative) with a field meter.

5. Cleaning Materials and Packaging

The auditor must evaluate the types of cleaning materials and the cleaning practices for the work area. Cleaners should not contain insulators such as silicon, soap, lanolin, free-salts, mineral oil, etc.

All sensitive components must be protected both as they arrive and as they leave the EPA. The auditor must verify that proper care is taken. Equipment to be shipped is especially vulnerable, because the manufacturer cannot control the environment in transit. Those goods must be packed for the worst possible ESD environment.

6. Reporting Discrepancies

If there are any discrepancies, then the archived test records should be consulted to verify that the control devices in question have been historically tested and comply to specifications. The discrepancy must be recorded on the audit form as an infraction.

As each audit is completed, the auditor must go over it with the supervisor in charge of the area, and must present it to plant management. Corrective recommendations will be a part of the report, and the net result will be an improved or well-run ESD Control program.

7. ESD Test Schedule

An ESD coordinator, supervisor or other person responsible for the static control program should regularly test all ESD control products to ensure that they are functioning properly.

The table below describes the test intervals recommended by the Electronics Industry Association, in accordance with Standard ANSI/EIA-625.

ESD Test Schedule	
Test Schedule	ESD Control Item
Daily	Wrist straps, foot straps, footwear, smocks
Weekly	Workstations, floor mats, ESD ground connections
Monthly	Static surveys of EPA and work stations
Quarterly	RTG of flooring, ESD ground continuity
Semi-annually	Ionizer balance and charge decay
Annually	ESD system compliance to the ESD document

8. ESD Audit Checklists

MIL-HDBK-263 K has a suggested checklist to use in performing an ESD audit which encompasses over 500 specific questions in several subjects:

- Management
- Training
- Engineering
- Procurement and shipping/receiving
- Storage
- Work areas
- Intra- and inter-plant movement
- ESDS protected work stations
- Quality functions

The checklist should be tailored to reflect the requirements of the ESD control program as well as complement the program plan.

9. ESD Standards

ANSI/ESD S20.20 provides a collective resource for ESD recommended constraints on product performance. Designing your ESD audit around your specific ESD components and in compliance with ANSI/ESD S20.20 makes it easy to audit your ESD control program.

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