ASA Best Practice
Handling of ESD Sensitive Parts for Distributors

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Purpose and Audience

This document is intended to be useful for Distributors which handle aircraft parts susceptible to damage from Electro Static Discharge (ESD). The guidance in this document is meant to help prevent such persons from accidentally damaging ESD sensitive parts during handling, inspecting, storing, receiving or shipping operations. This guidance is bound by the assumption that Distributors will not be performing manufacturing operations (such as assembly, installation or building up) or maintenance operations (such as removing and replacing components, testing, or adjusting) ESD sensitive parts. Those regulated manufacturing and maintenance operations may typically require additional equipment and procedures not contained herein.

Legal Effect of this Guidance

This guidance represents recommended practices, based upon common industry practices that have been found to be successful. It does not represent a regulation or a requirement. The Aviation Suppliers Association does not require any company to adhere to this recommended guidance, and does not recommend that any company require a business partner to adhere to this recommended guidance.

Related Documents

a) ATA Spec 300, Specification for Packaging of Airline Supplies

Background

For many people, static electricity is little more than the shock experienced when touching a metal doorknob after walking across a carpeted room. However, static electricity has been a serious industrial problem for centuries. As early as the 1400's, European and Caribbean forts were using static control procedures and devices to prevent electrostatic discharge ignition of black powder stores. By the 1860's, paper mills throughout the US employed basic grounding, flame ionization techniques, and steam drums to dissipate static electricity from the paper web as it progressed through the drying process.

The age of electronics brought with it new problems associated with static electricity and electrostatic discharge. Due to electronic devices becoming faster and smaller, their sensitivity to ESD increased. Today, ESD impacts productivity and product reliability in virtually every aspect

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of today's electronics environment, and in fact for all market segments, studies have estimated that up to 60% of device failures are ESD caused.[1]

A major factor contributing to ESD damage is lack of awareness of the ease in which damage occurs. For example, the average person can feel a discharge on a doorknob if it is greater than 3500 volts; hear the discharge if it is greater than 5000 volts, and see it if it is greater than 8000 volts. By comparison, damage to integrated circuits occurs at fractions of those voltages. This means that the person imparting the damage will not have felt, seen or heard the discharge, and because of this we must always assume we can potentially cause ESD damage unless those charges are properly grounded, as for example, in accordance with this Best Practice.

ESD sensitive parts that have been damaged could manifest such damage in one of several ways upon being installed on the aircraft:

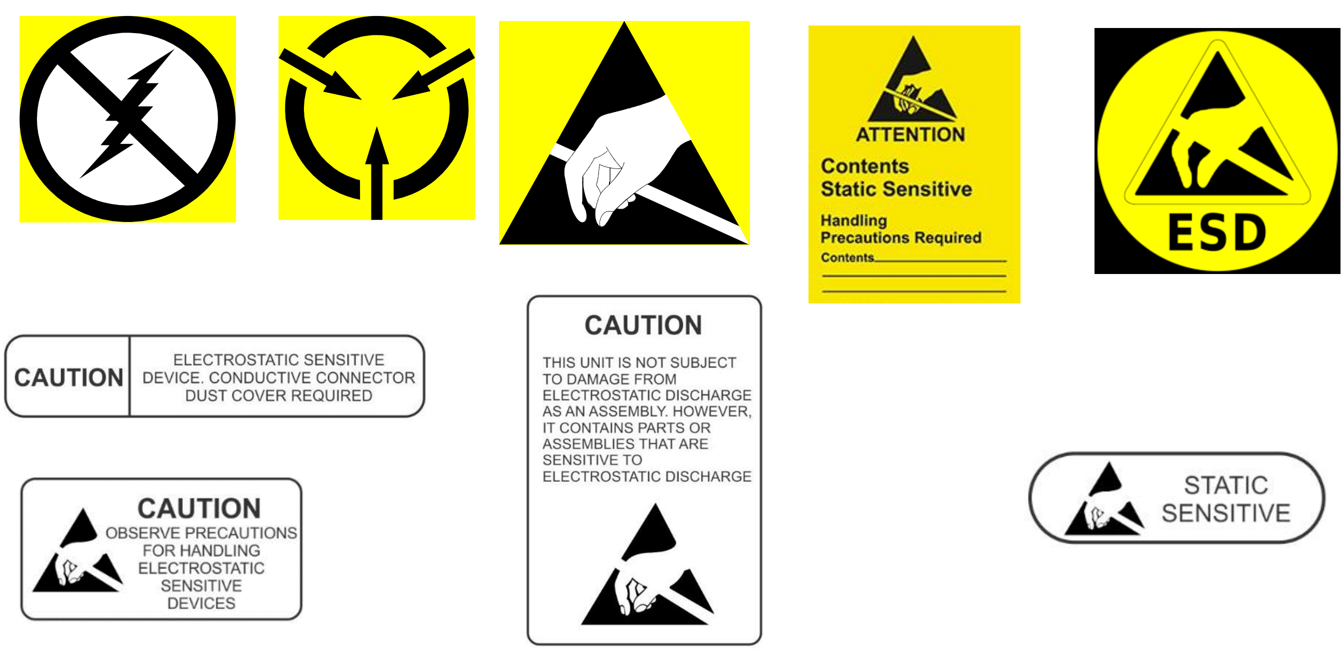
a) Immediate failure of the part when the component/system is tested.

b) Premature failure of the part. E.g. the part fails much sooner than its designed Mean Time Between Failure (MTBF) figure.

c) The part or its next higher assembly exhibits intermittent or random failures.

Depending on the part's criticality, ESD damage can affect safety, flight delays or cancellations, system reliability, create chronic or rogue parts, and increased maintenance costs.

Parts which are subject to ESD damage can be positively identified by these typical markings which include:"



Selection of Equipment for an ESD Protected Area (EPA)

Selection of the equipment that will make up the EPA should consist of any of the following configurations:

A. Continuous Monitoring Workstation (Figure 3). The advantage of this setup is that it continuously monitors the resistance of the operator and work surface ground connections and displays a visual and/or audible alarm if a problem occurs with the aforementioned. It typically consists of the Monitor, Dual Conductor Wrist Bands, Wrist Band Chords, grounding connection, and Table-top Conductive/Dissipative Work Surface Mat. All EPA components should be installed in accordance with the manufacturer’s instructions.

B. Simple EPA (Figure 1). Consists of an ESD Wrist Strap and chord, Wrist Band Chords, grounding connection, and Table-top Conductive/Dissipative Work Surface Mat. All EPA components should be installed in accordance with the manufacturer’s instructions.

C. Additional EPA Components: Users may optionally choose to have additional Mats or Wrist Straps to support additional employees working simultaneously. All EPA components should be installed in accordance with the manufacturer’s instructions.

D. Selection of a ground for the EPA must be in accordance with the manufacturer’s instructions. Examples of such grounds are included in Figure 2.

Common EPA Characteristics

A. Segregated area: A dedicated area should be set aside to set up the EPA to be used exclusively for this purpose. This will help ensure the equipment is maintained, kept clean, and the connections are not broken.

B. The EPA should include signage denoting its intended use. Examples include “ESD Protected Area”, “ESD Work Station”, or “ESD Inspection Area”.

C. Cleanliness: In order to eliminate sources of static, the EPA should remain free of any non-EPA related items such as, but not limited to coffee cups, food wrappers, beverages, reading material, radio’s, and personal gear such as purses and backpacks. In addition, the EPA should be periodically cleaned as recommended by the ESD equipment manufacturer.

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Determining the Continued integrity of the EPA

The user should have a method to demonstrate the continued integrity of the EPA; that it is able to perform its intended purpose of electrically grounding the static charges on the employee before handling the ESD sensitive parts. Note that this in not calibration.

As a point of reference, per Grounding/Equipotential Bonding Requirements of the ANSI/ESD S20.20- (Latest revision year) standard "*Protection of Electrical and Electronic Pars, Assemblies and Equipment (Excluding Electrically Initiated Explosive Devices";* the equipment grounding conductor of the grounding/bonding system should have a limit less than 1.0 ohm impedance. The measurement of ohm impedance of the grounding conductor can be verified using a standard electrical multimeter. The inclusion of the multimeter into distributors calibrated tool system may be considered as it is measuring a variable within the overall EPA.

While the connection to electrical ground (in accordance with the manufacturer's instructions) is among the most critical steps in setting up the EPA, once accomplished it is typically fixed and permanent (see Figure 2: Typical ground sources). However, the level of effectiveness of the electrical ground should be periodically verified by measuring the level of ohm impedance (see above). While this verification is not a "calibration", consideration may be given to record the results of the measurement/verification, providing evidence of the effectiveness of the EPA electrical ground. Experience has shown however, that the most problem-prone component of the EPA tends to be the electrical continuity between the human-wristband-wristband chord combinations. Factors that affect this integrity include excessive hair between the human and wristband, dirt, minor corrosion of the metal connections, or loss of elasticity/tightness of the wrist band.

A. Continuous Monitoring Workstation: As the name implies, the integrity of this type of EPA system is continuously monitored and the workstation will display an alarm if problems arise with the connections of the EPA. There is no additional need for separate Testers.

B. Simple EPA: The user should have a method to determine the integrity of the Human-Wristband-Wristband Chord combination. Commonly available Testers exist for this purpose. For facilities where the EPA is not used on a daily basis, it would be typical to test integrity before the first use on each day on which it is used (but testing would not be performed on the days when it is not used).

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C. Documenting Results: The user may implement a method to record continued integrity test results. Some, but not all, facilities keep a log of this information. Typically, a log for recording test results would contain the date, employee identification (e.g. name, number, etc.), and results of the test. Typically, the first user of the day should make this record once daily before use. On days where the equipment is not used, the record is not required.

- Continuous Monitoring Workstation: The user should test the alarm by purposely either lifting off the wristband, or breaking any of the quick connections of the workstation.
- Simple EPA: Record the results of the Tester.

Packaging

When packaging ESD sensitive parts, consideration is given to one of three types of parts; Piece parts (such as IC Chips, Transistors), Circuit Boards, or LRU's (Line Replaceable Units, commonly referred to as Rotables or appliances). ATA Specification 300 offers simple additional guidance.

CAUTION: Staples should not be used to seal any ESD-protective packaging or used to attach documents as this may compromise the ESD protection.

A. Piece Parts: The Leads for these parts should be embedded in ESD protective foam, typically black. The parts are then placed in static shielding/dissipative bags (typically gray or silver, not pink which is not recommended due to its limited protective properties; they do not shield from Electrostatic Fields[1]). The parts may then be placed in standard protective shipping packaging.

Typical ESD Protective bag

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B. Circuit Cards: Cards are placed in static shielding/dissipative bags (typically gray or silver, not pink which is not recommended due to its limited protective properties; they do not shield from Electrostatic Fields[1]). The cards may then be placed in standard protective shipping packaging.

C. LRU's: Assure ESD Protective Caps are placed over the connector pins. Once the LRU has these caps in place, the part can be handled outside of an EPA without fear of inducing ESD damage. With the ESD caps in place, placing the LRU in static shielding/dissipative bags is not required[2]. It may then be placed in standard protective shipping packaging.

Typical ESD Protective Caps

D. LABELING: ESD labels should be affixed to the outside of packages or containers to apprise handlers of the ESD sensitive nature of its contents.

Handling, Warehousing

With the exception of being placed in the final standard shipping container/package, once ESD sensitive parts have been protected as described in the 'Packaging' paragraph, the parts may be safely handled outside of an EPA.

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Training

Persons who handle ESD sensitive parts should have the following topics documented in their training files:

A. What is ESD?
B. Sources of static charges
C. Use and care of the EPA
D. Packaging

Calibration

Equipment such as, but not limited to, Wristband-Chord Testers typically require periodic calibration in accordance with the manufacturer's instructions, and should be placed on the distributor's calibration program and documented in its Quality System.

Documentation

The Distributor should maintain files of the manufacturer's instructions regarding the equipment contained in the EPA. This serves to verify for employees as well as auditors conformity with installation instructions. In addition, equipment documentation such as may exist with certain models of Continuous Monitoring Workstations which state that calibration is not required (except for factory settings), shall also be filed and presented for employees or auditors as needed.

[1] *ESD Control Handbook*, *Static Control Measures*; 3M Corporation.

[2] ATA Specification 300 figure 6-2.1

Additional Resource Documents

The following documents are provided for further reference and additional information. Some documents listed below may be canceled/obsolete.

ANSI/ESD S20.20-(Latest revision year), “Protection of Electrical and Electronic Parts, Assemblies and Equipment (Excluding Electrically Initiated Explosive Devices”

MIL-DTL-117, “Bags, Sleeves and Tubing – Interior Packaging”

MIL-PRF-81705, “Electronic and Electrical Equipment, Accessories, and Provisional Items (Repair parts): Packaging of”

MIL-STD-1686, “Electrostatic Discharge Control Program for Protection of Electrical and Electronic Parts, Assemblies and Equipment (Excluding Electrically Initiated Explosive Devices)”

MIL-HDBK-263, “Electrostatic Discharge Control Handbook for Protection of Electrical and Electronic parts, Assemblies, and Equipment (Excluding Electrically-Initiated Explosive Devices)”

MIL-PRF-87893, “Workstations, Electrostatic Discharge (ESD) Control”

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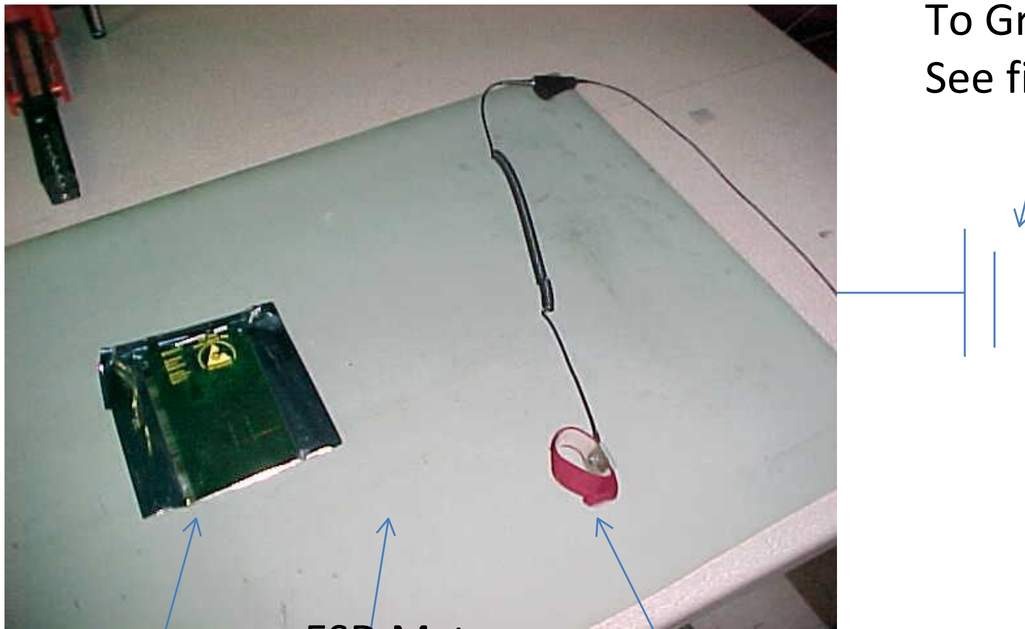
Figure 1: Typical Simple EPA



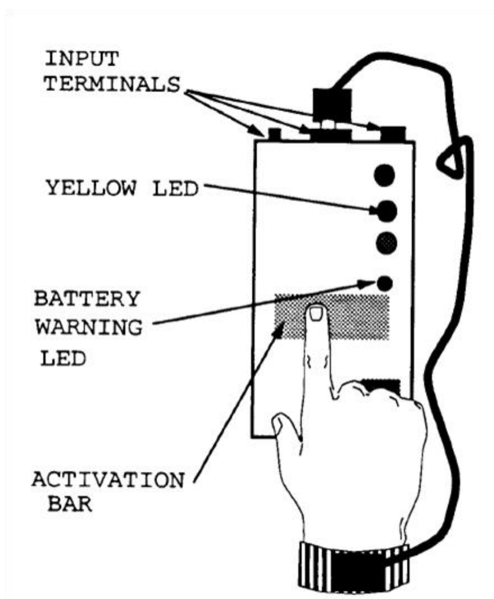


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Figure 2: Typical ground sources

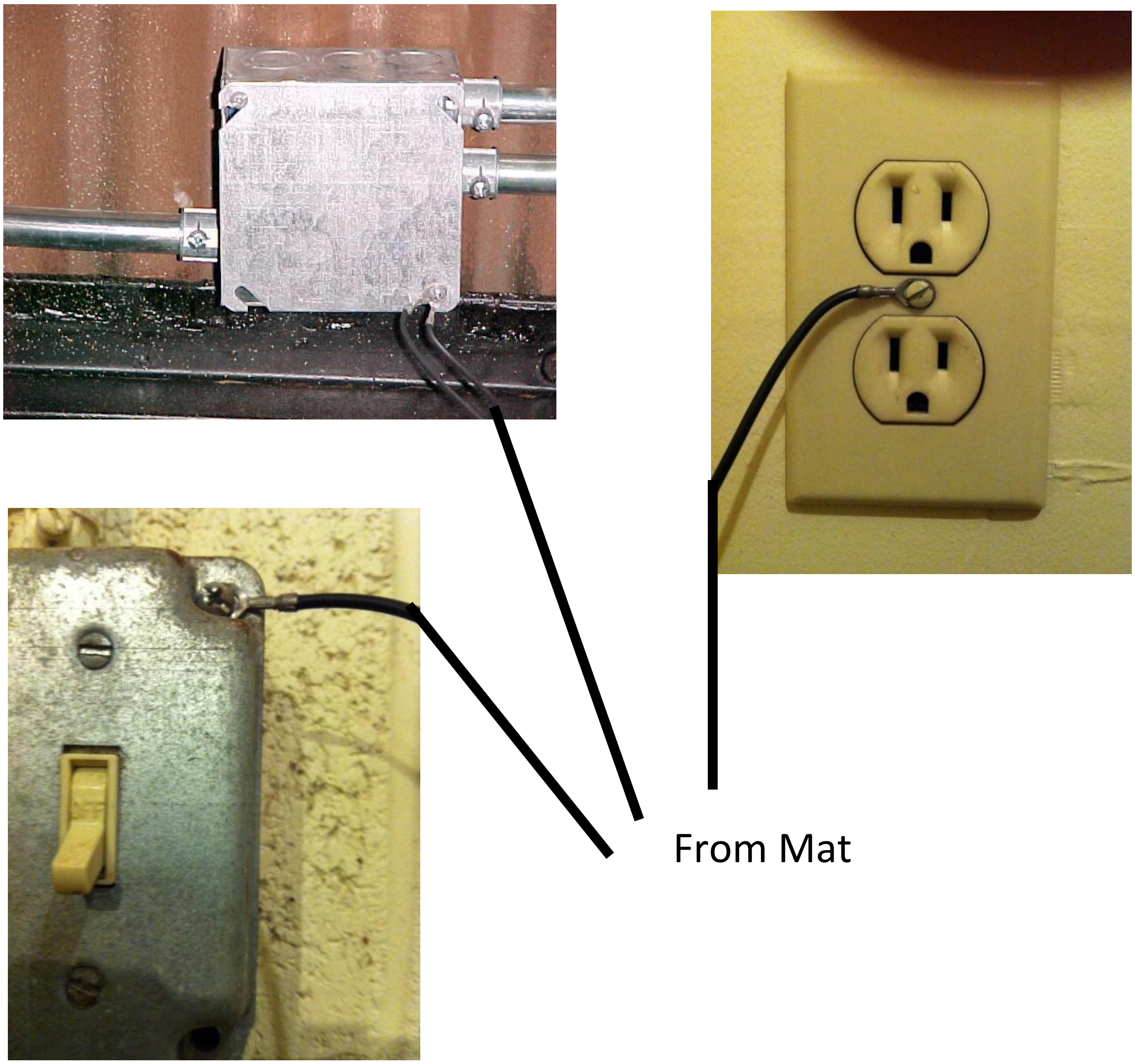

Figure 3: Typical Continuous Monitoring EPA