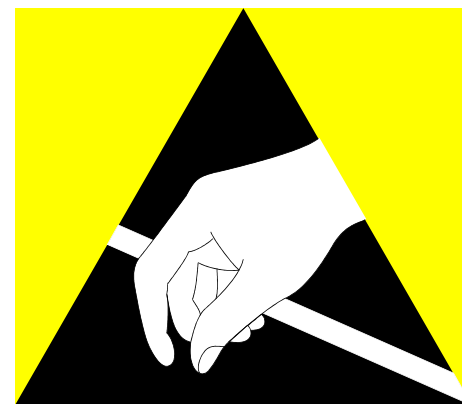
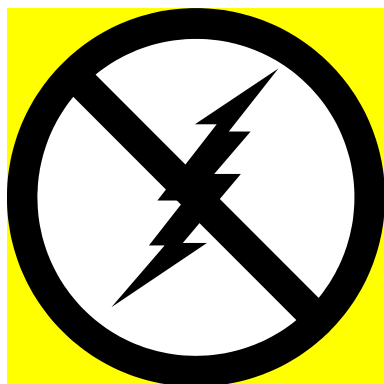




AIM Solutions Consulting Presents: ESD Protective Measures for Aircraft Disassembly and Distribution Operations





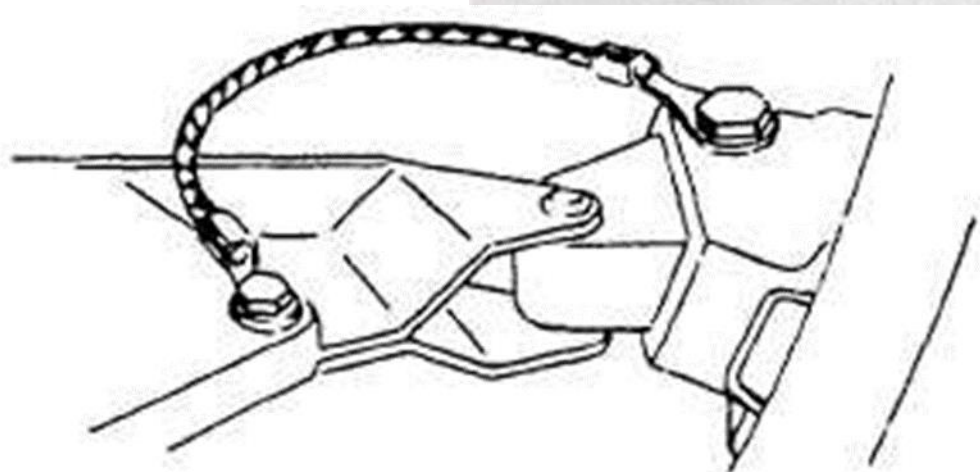
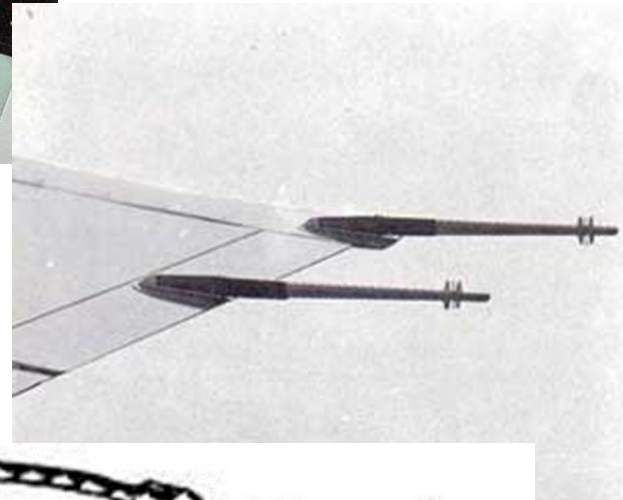
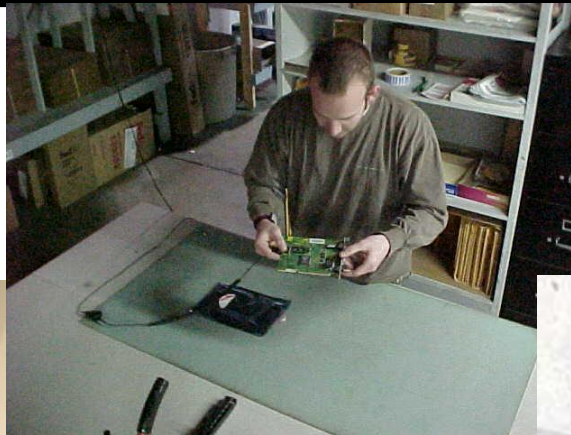
WARNING: The material in this presentation is general in nature, and under no circumstances is it meant to replace published OEM or Maintenance Manual instructions



BACKGROUND



What do these all have in common?



All are methods to control and manage static



HISTORY AND BACKGROUND

To 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 of today's electronics environment.



Ok I give up, what is this
ESD stuff?



Static electricity is defined as an electrical charge caused by an imbalance of electrons on the surface of a material. This imbalance of electrons produces an electric field that can be measured and that can influence the objects at a distance.

Electrostatic discharge is defined as the transfer of a charge between bodies at a different potential



Electrostatic Sensitive Devices (ESD)

- Although we may not feel it, we built up and discharge electrical charges constantly. A doorknob discharge may involve voltages as high as 10,000 volts! The reason we are not instantly killed by these discharges is because the current flow or amperage is very small.
- There are some electronic components that are especially sensitive to ESD. Remember, to an ESD sensitive part, a discharge is like getting struck by a lightning bolt!

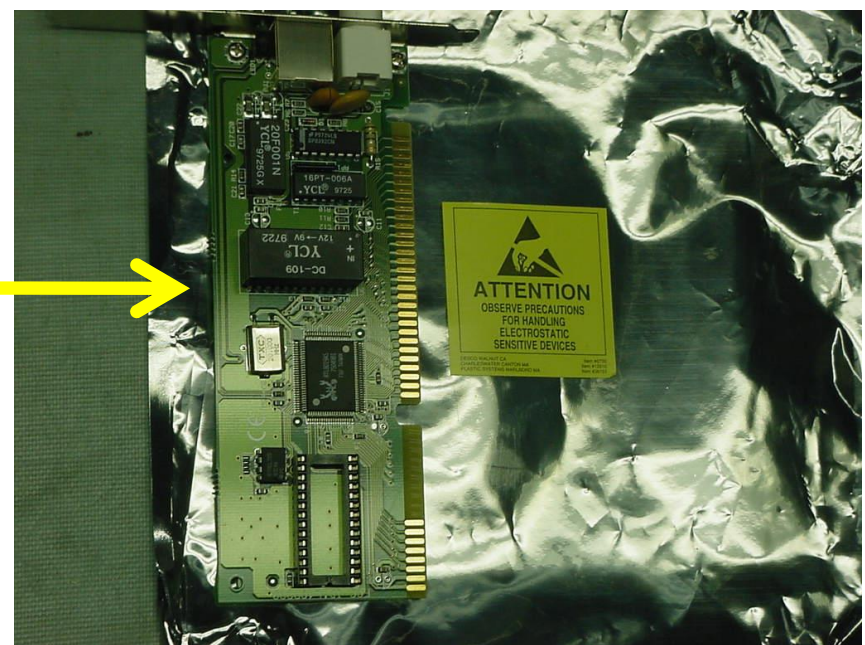


**You'll know positively
that you have an ESD
Part when you see one
of, or a variation of
these ESD symbols**



You will generally come in contact with 3 types of ESD sensitive parts:

Cards/Boards

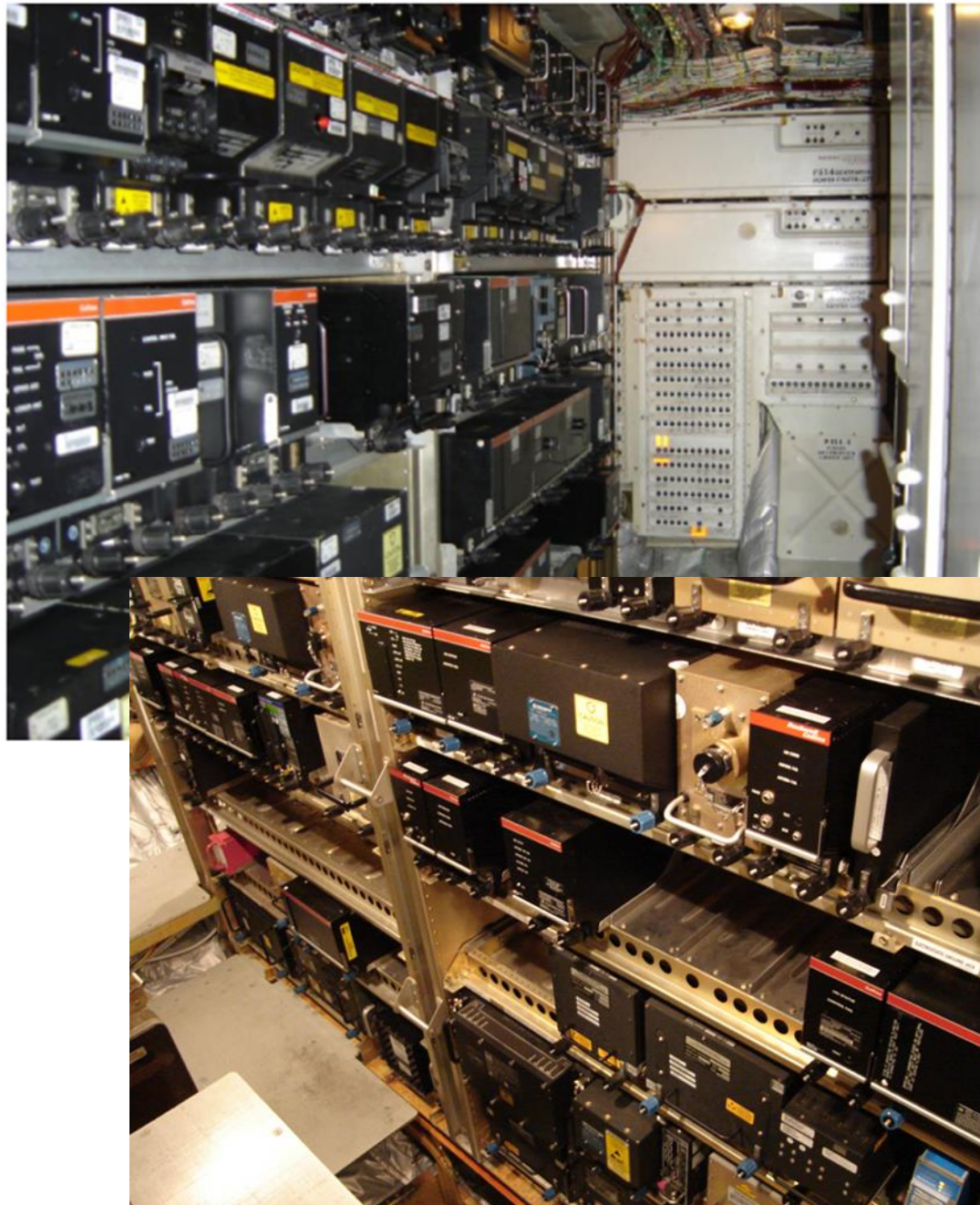


Discreet components such as IC Chips

Component Assemblies (LRU's, Rotables)



About LRUs or Rotables:



INSTALLED ESD Component's:

You will **NOT**
induce ESD
damage by
merely
touching them



About LRU's or rotables:

When ESD Caps are protecting the pins, you can safely handle the LRU without being personally grounded

Typical ESD Caps

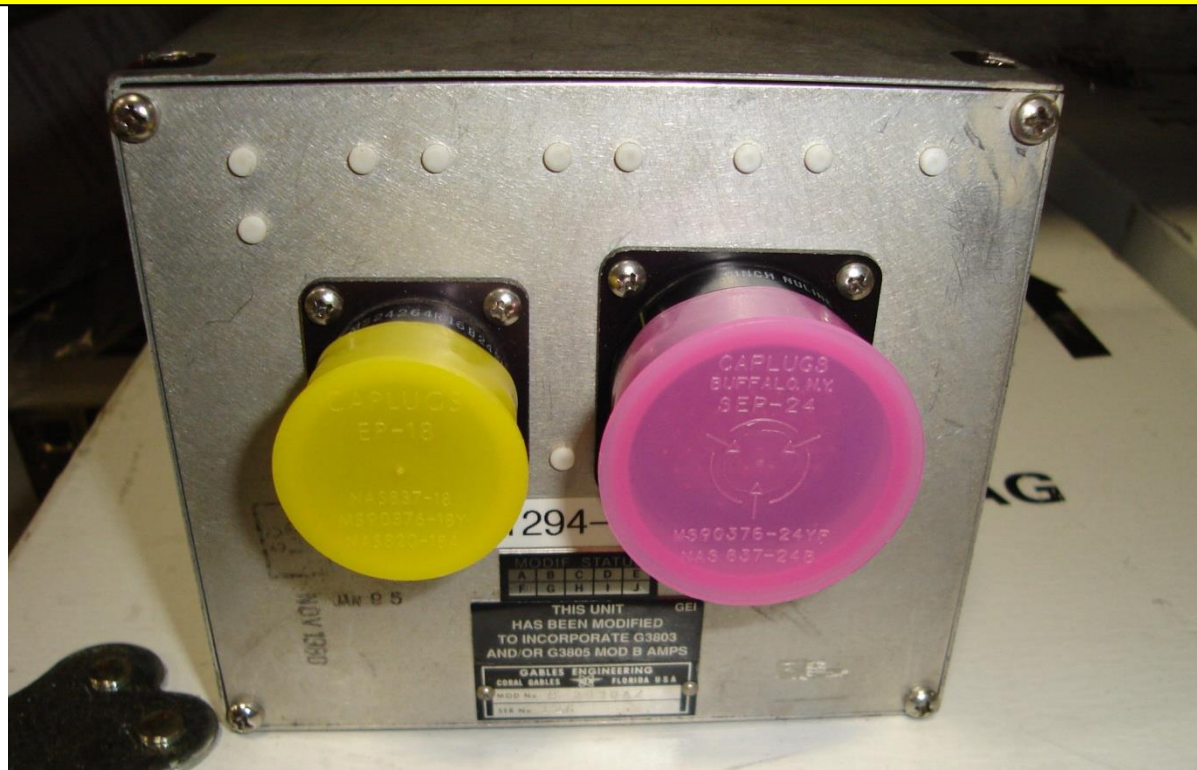




About LRU's or rotables:

LRU's are damaged by ESD charges in one of two ways:

1) By installing the WRONG cap. The yellow cap is actually a very efficient generator of static charges





About LRU's or rotables:

LRU's are damaged by ESD charges in one of two ways:

2) When the protective caps are off, and the pins come in contact with static charges:

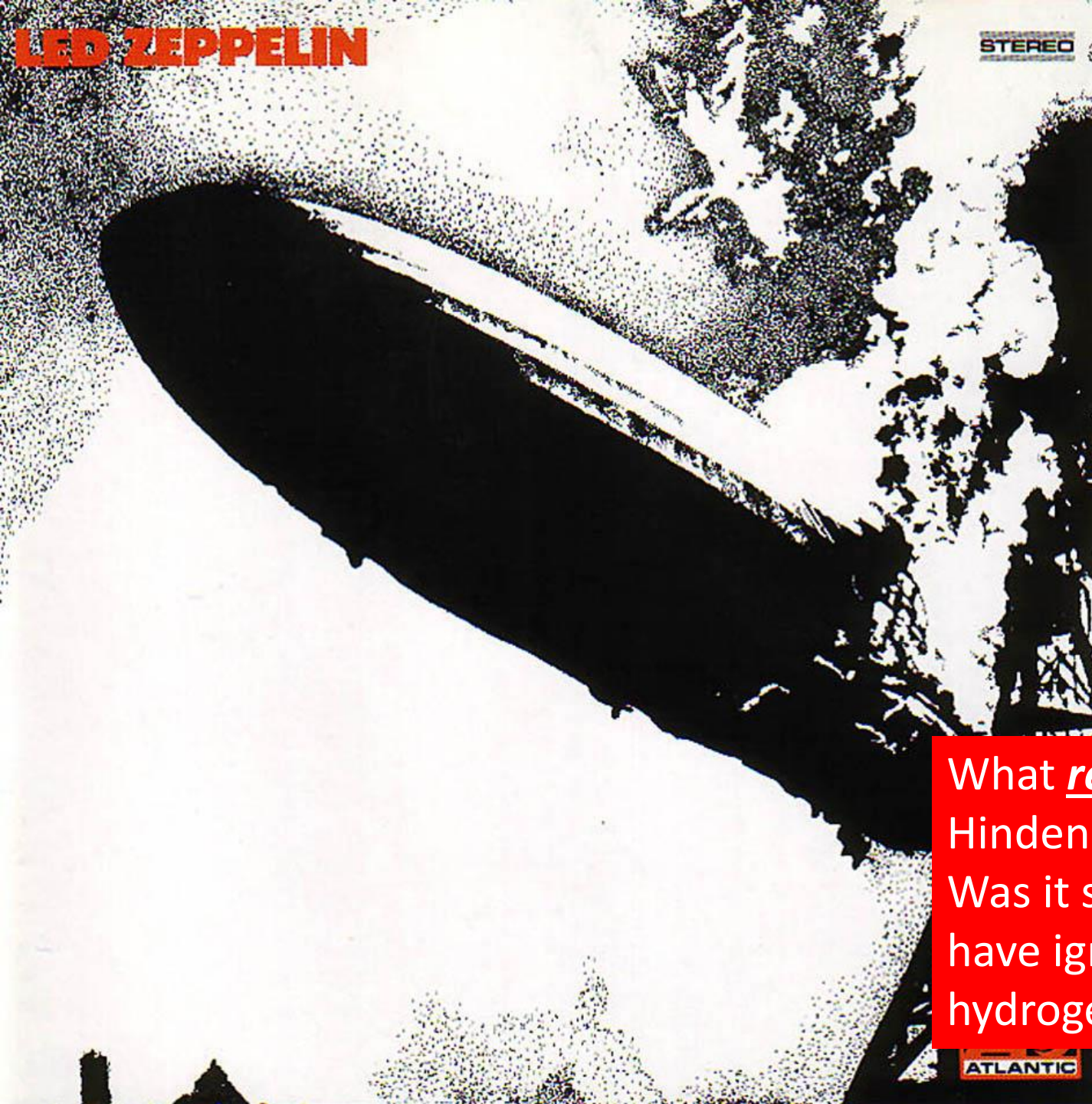
- During installation***
- During removal***
- In storage***
- In transport to and from the aircraft***





***End of:
Background***

***Next:
Effects of ESD
Damage***



LED ZEPPELIN

STEREO

What really caused the Hindenburg disaster?
Was it stray ESD that may have ignited the volatile hydrogen gas?

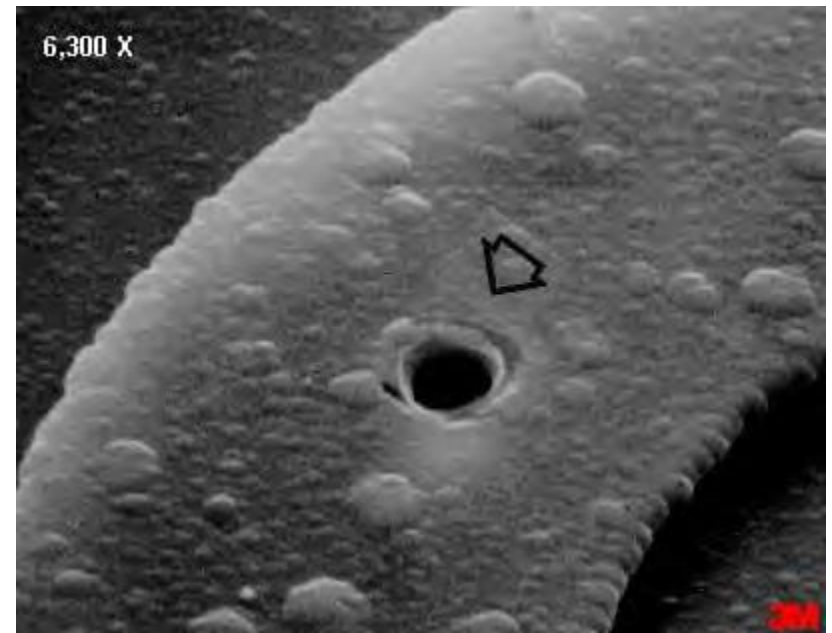
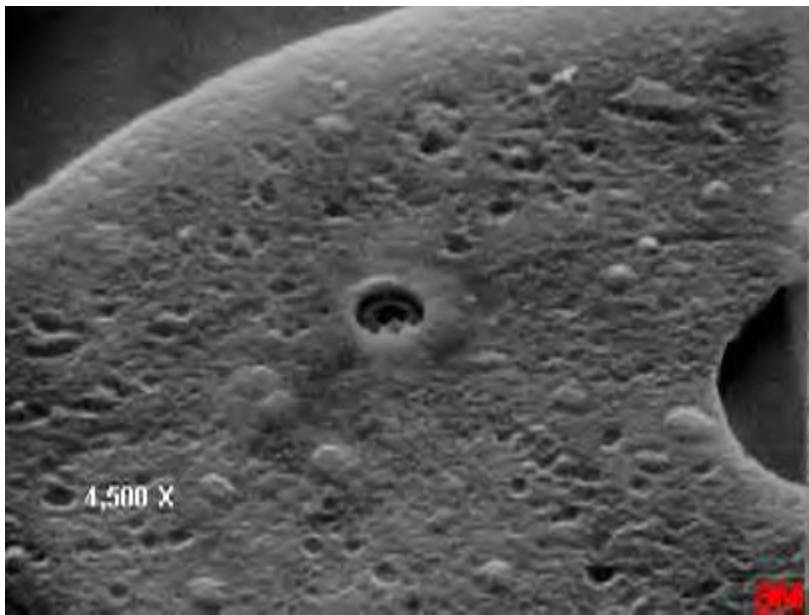
ATLANTIC



I've got the forensic
evidence of ESD Damage
right here!



Typical ESD damage. These pictures were taken by scanning electron microscopes. Note the magnification



But Holmes,
can the issue of
ESD damage be
quantified and
deduced?

Watson, due to the high
cost of scanning
electron microscopes,
and the complicated
process to isolate it,
nearly all instances of
ESD damage are not
diagnosed as such; *it is
unquantified and
undetected except for
the failures it causes*





**ESD DAMAGE
WILL MANIFEST
ITSELF IN ONE OF
THREE WAYS:**

***Outright failure of
the unit upon
installation***

***Premature Failure:
It should have
lasted 1000 hours
but failed after 50***

Intermittent failures



By the way, this is
a contributor to
those pesky No
Fault Found (NFF)
findings





NEXT:
ESD Protection
During Aircraft
Disassembly
Operations

ESD BEST PRACTICE

Published by the

Aircraft Fleet Recycling Association



Revision 0.0

REVISION HISTORY

Revision:	Date:	Revision Description:	Prepared By:
0.0	TBD	Initial Release	AFRA BMP Development Committee

Title Page

Rev 0.0

AFRA's new ESD
Best Practice
(BP)



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Take notice of the flexibility built in for two possibilities:

- You have the AMM
- You don't have the AMM

Subsequent visual inspection of the parts after removal from the aircraft



Typical Manufacturer warnings

From “The Direct Approach, Technical Information & Tips for Citation Customers”

Epic Handling and ESD Tips- 680

ATA 34-00

Honeywell is very concerned that everyone understands how important it is to follow proper ESD (Electro Static Discharge) and handling procedures of Epic hardware.

Use Caution with Honeywell KA 92 GPS Antennas

560XL, 550, 525, 525A, ATA: 34-40

“... Our vendor has requested that we make owners/operators aware that these types of antennas are extremely sensitive to Electrostatic Discharge (ESD). Uncontrolled ESD can cause degraded operation of certain electronic components within the antennas.”

For Training and Reference Only

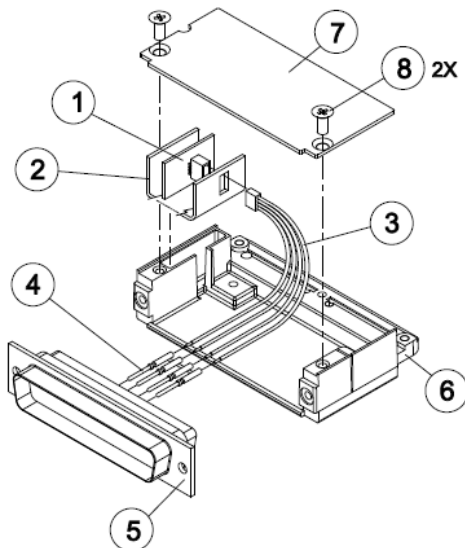


Figure 6-3. Configuration Module Installation

Table 6-2. Configuration Module Kit – 011-00979-00

Item	Description	Qty Needed	Garmin Part Number	
			011-00979-00 Kit	011-00979-03 Kit
1	Configuration Module PCB Board Assembly w/EEPROM & Temp Sensor	1	012-00605-00	011-02178-00
2	Spacer, Config Module	1	213-00043-00	N/A
3	Cable, 4-Conductor Harness	1	325-00122-00	
4	Pins, #22 AWG (HD)	5	336-00021-00	

Removal:

NOTE

Use ESD protection when handling the configuration module.

1. Disconnect connector from LRU.
2. Remove 2 screws (8) from cover (7) and remove cover.
3. Unplug connector from configuration module (1).
4. Remove configuration module.

Typical ESD Warning in a Maintenance Manual



But where might you find the ESD guidance in the AMM?

ELECTROSTATIC DISCHARGE SENSITIVE DEVICES - MAINTENANCE PRACTICES
1. General
(Figure 201)

- A. Many electronic line replaceable units (referred to as LRUs) contain micro-circuits and other sensitive devices which can be damaged internally by electrostatic discharges. These LRUs are identified as Electrostatic Discharge Sensitive (referred to as ESDS). The placards installed on the ESDS LRUs show that you must be careful. The persons who remove, install, and move the ESDS LRUs must know about static electricity and the protection from static discharges that is necessary.
- B. Electrostatic charges can be caused by these: human bodies, hair, clothing, floors, equipment racks, and equipment units. An electrostatic discharge is electrostatic energy transmitted between substances of different electrical potentials. Electrostatic discharges from nylon clothing or human hair onto polyethylene or steel can damage ESDS components. Damage to the internal components of an ESDS LRU can cause failure with one static discharge. System properties can change with time because of many static discharges.
- C. The function of these procedures is to show the maintenance persons how to know and touch the ESDS LRUs. These procedures contain the precautions that are necessary to safely touch the units that are identified by the ESDS placard. Three types of decals are in used to identify the units with ESDS sensitive circuits. The military and commercial symbols are used on some units, while the international (JEDEC) symbol is used on most ESDS placard (Figure 201). The ESDS printed circuit boards that are LRU's are identified with a "STATIC SENSITIVE" placard (Figure 201).
- D. This procedure contains these tasks:
 - (1) ESDS Printed Circuit Board Removal
 - (2) ESDS Printed Circuit Board Installation
 - (3) ESDS Metal Encased Unit Removal Handling
 - (4) ESDS Metal Encased Unit Installation Handling

TASK 20-41-01-002-001
2. ESDS Printed Circuit Board Removal
A. Equipment

- (1) Ohmmeter
- (2) 100% Cotton Twine - Commercially Available

B. Tools/Equipment

NOTE: When more than one tool part number is listed under the same "Reference" number, the tools shown are alternates to each other within the same airplane series. Tool part numbers that are replaced or non-procurable are preceded by "Opt:", which stands for Optional.

Reference	Description
COM-1565	Strap - Adjustable Wrist, Conductive, Static Control
	Part #: 09070 Supplier: 62576
	Part #: 14810 Supplier: 62576
	Part #: 2214 Supplier: 55203
	Opt Part #: 2211 Supplier: 55203
	Opt Part #: 2212 Supplier: 55203
	Opt Part #: 2213 Supplier: 55203

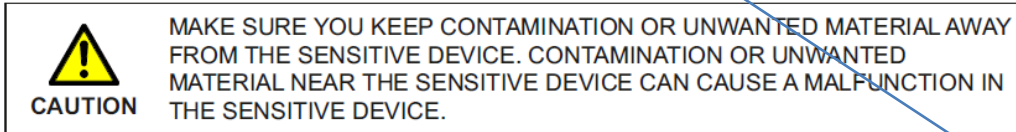
For Training and Reference Only

If you're having trouble finding the guidance for ESD procedures for aircraft work, try ATA Chapter 20 (Standard Practice).

20-41-01

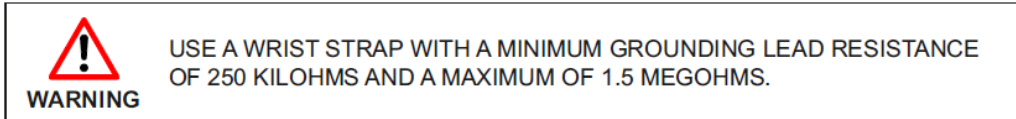
D. Remove the Metal Encased Units with the ESDS Placards

SUBTASK 20-41-01-862-041



- (1) Remove the system electrical power with the applicable Removal/Installation procedure.

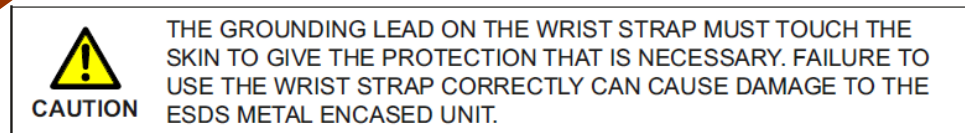
SUBTASK 20-41-01-762-046



- (2) Do these steps to do a test of the static control wrist strap, COM-1565 resistance:

- (a) Use a digital/analog multimeter, COM-1793 to make sure the static control wrist strap, COM-1565 assembly has a minimum resistance of 250 kilohms and a minimum of 1.5 megohms.

NOTE: A wrist strap is kept on the plenum of the racks E3 and E4 in the main equipment center. (Figure 202)



- (b) Connect the static control wrist strap, COM-1565 on the wrist of the person that will remove the device.
- (c) Use an digital/analog multimeter, COM-1793 to make sure the resistance is less than 10 megohms.

SUBTASK 20-41-01-422-047

- (3) Connect the static control wrist strap, COM-1565 to an applicable electrostatic ground jack.

SUBTASK 20-41-01-022-026

- (4) Remove the ESDS unit with the applicable removal task.

SUBTASK 20-41-01-032-027

- (5) Install conductive dust caps on the connectors that have static sensitive placards, and standard dust caps on the connectors that do not have the placard. An alternate to the dust caps is put the ESDS unit in a conductive bag.

NOTE: The conductive dust caps and the connector covers are black in color.

NOTE: The conductive dust caps and the connector covers from the installed unit can be used on the removed unit.

SUBTASK 20-41-01-862-028

- (6) Put the ESDS unit in the antistatic conductive container, COM-1567.

**SAMPLE AMM EXCERPT.
NOTE THE FOLLOWING:**

- This procedure is for an LRU/Rotable part
- It has you use an ESD wrist strap and cord and have its resistance checked
- Once the part is removed, install the ESD Cap and place it in an ESD bag

For Training and Reference Only

JEOPARDY!

www.jeopardy.com

ANSWER:

ESD wrist-strap/cords have a built-in resistance, typically 1 Meg-Ohm to prevent this



In case you're working on equipment with live voltages, you don't want to be a direct short to ground; an easy electrocution!



Whereas the preceding sample AMM excerpt is a typical Boeing procedure, the following is an AIRBUS excerpt presented for familiarization purposes only:

AIRBUS

CUSTOMIZATION	AIRCRAFT TYPES	DOCTYPES	REVISION DATE	REVISION NUMBER	TITLE
EIN	A318 A319 A321 A320	AMM	01-Feb-2024	107	20-15-00-910-001-A - Handling Precautions for Electrostatic Discharge Sensitive Devices

TASK 20-15-00-910-001-A
Handling Precautions for Electrostatic Discharge Sensitive Devices

1.

Reason for the Job

Self explanatory

2.

Job Set-up Information

A.

Fixtures, Tools, Test and Support Equipment

REFERENCE	QTY	DESIGNATION
No specific	1	STRAP-WRIST

3.

Job Set-up

SUBTASK 20-15-00-860-050-A

A. Not Applicable

4.

Procedure

SUBTASK 20-15-00-912-050-A

A. General Handling Precautions for LRUs

(1)

No special handling procedures or instructions are necessary.

(a)

The LRUs have sufficient built-in protection to prevent electrostatic discharge damage.

(b)

No protective electrostatic-discharge handling procedures are necessary unless the LRU housing is open.
For example, antistatic or conductive protective caps are not necessary for connectors on the LRU housing (standard caps are sufficient).

(c)

The standard precautions for each LRU are specified in the AMM in the applicable Removal/Installation task.
For example, "Put blanking caps on the receptacle and on the LRU connector(s).

NOTE:

Some LRUs such as the Passenger Interface and Supply Adapter (PISA), or Power Supply Unit are Printed Circuit Assemblies without housing. They are sensitive to electrostatic discharge. During maintenance operations, refer to the applicable Removal/Installation task for electrostatic discharge precautions.

SUBTASK 20-15-00-912-051-A

B. Handling Precautions for OBRMs

On Board Replaceable Modules (OBRMs) are not LRUs.
It is necessary to wear STRAP-WRIST wrist straps for the Installation/replacement of OBRMs.

For Training and Reference Only

NOTICE: If you have access to this AMM, and it applies to your aircraft, Airbus is clearly stating that unless stated otherwise, ESD handling procedures are not necessary, Read it carefully.



But what should I do if I
don't have the
applicable AMM (Aircraft
Maintenance Manual)
ESD Guidance during my
disassembly?



About Working the Aircraft:



GOOD PROTECTION



***Make sure power is off
and:***

***Put on your ESD Wrist-Strap
chord with an alligator clip at
the end.***

***Find a good ground (typically
structure) and clip it.***

Perform your removal

Cap and bag it immediately

BTW: How can you verify you have a
good ground?

***USE AN OHMMETER TO CHECK FOR
CONTINUITY BETWEEN ANOTHER
GROUND/STRUCTURE AND THE ONE
YOU'VE CHOSEN***

About Working the Aircraft:



And PLEASE, if you don't have any ESD caps, put it in an ESD bag!



About Working the Aircraft:

If you do not have any ESD caps, do not use ESD tape to cover the connector.

From the ASA-100 paragraph 11.B.2):

WARNING

TAPE SHALL NOT BE USED TO COVER ELECTRICAL CONNECTIONS OR FLUID FITTINGS/OPENINGS. ADHESIVE RESIDUE CAN INSULATE ELECTRICAL CONNECTIONS AND CONTAMINATE HYDRAULIC OR FUEL UNITS.





Next:

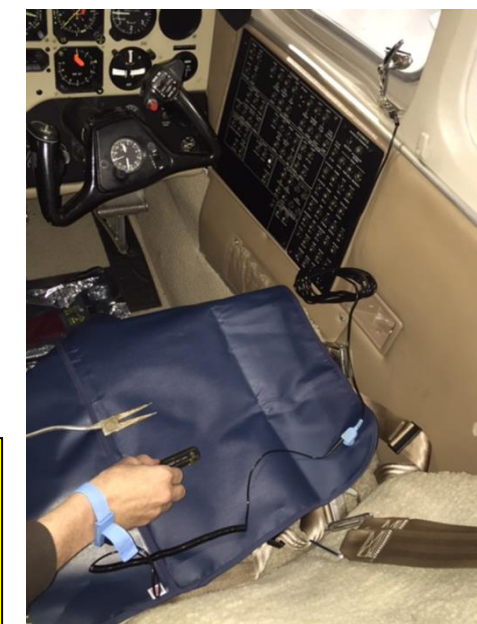
***Introduction to the
ASA's ESD Best
Practice Document***



For Persons involved in manufacturing or Aircraft Maintenance, there are a multitude of ESD Standards and Procedures, for example:



ANSI/ESD S20.20, "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"



For Distributors not involved in Manufacturing or Maintenance, these standards created dizzying, confused options for ESD Protection





PSB Singapore

CERTIFICATE

The Certification Body
of TÜV SÜD PSB Pte Ltd

certifies that



ASE GROUP
ASE ELECTRONICS (M) SDN BHD
Plot 20, Phase 4,
Bayan Lepas Free Industrial Zone,
11900, Bayan Lepas,
Pulau Pinang
Malaysia

has established and applies
an Electrostatic Discharge Control Program for

Wafer Sorting, Assembly and Testing of Semiconductor Devices
(See Appendix to Certificate for Details)

Proof has been furnished that the requirements
according to

ANSI/ESD S20.20 : 2014

(Lead Assessor : Low Teng Leng)

are fulfilled. The certificate is valid from **2020-01-15 to 2021-02-01**
Certificate Registration No. **ESD-2018-0015**
Date of Print : **2020-01-16**



CHUAH Choo Huat
Vice President
Business Assurance Division
Management Systems



Page 1 of 2

Please refer to www.tuv-sud-psb.sg for current certificate status in the "Directory of Management System Certified Companies".

TÜV SÜD PSB Pte Ltd • 1 Science Park Drive • Singapore 118221

TUV®

***In Fact there are
ESD Standards
whereby you'll
be audited and
become
accredited,
similar to ASA
and ISO
accreditation
programs***

Aviation Suppliers Association Best Practice
Handling of ESD Sensitive Parts for Distributors



ASA Best Practice
Handling of ESD Sensitive Parts for Distributors

Published: 9/11/2022

Revision: 3

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***SO, WHAT CAN
DISTRIBUTORS
DO?***

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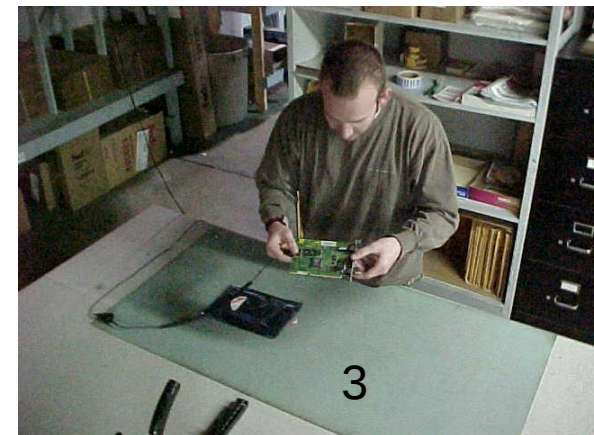
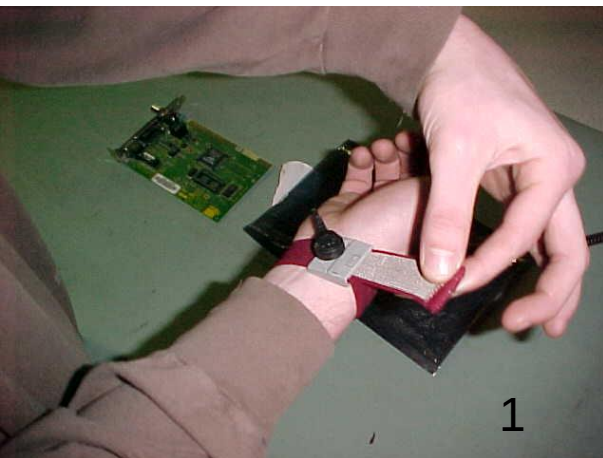
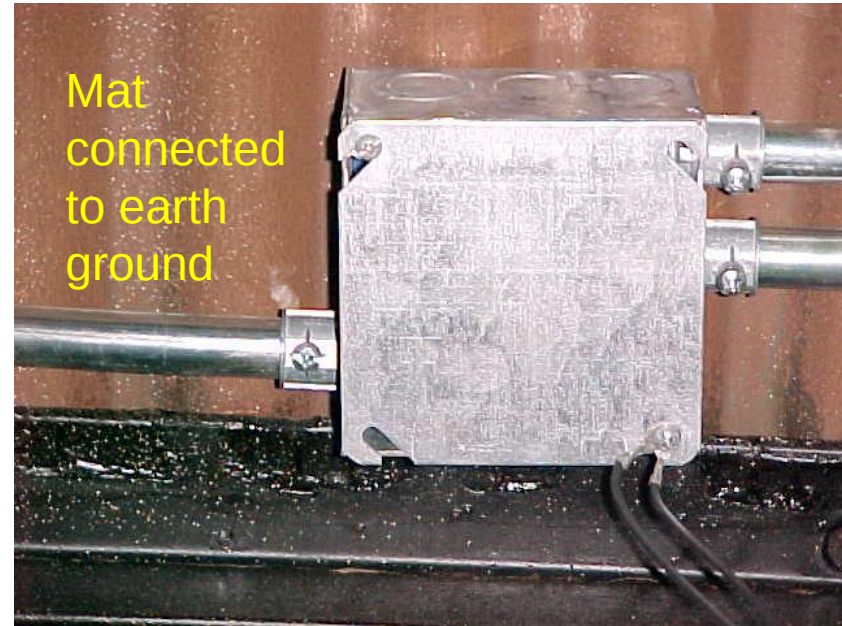
***Notice the
topics
addressed in
this document***

Essentially, there are two types of ESD Inspection Stations a distributor may chose from:

A)A simple station with a wrist strap and cord tester, or

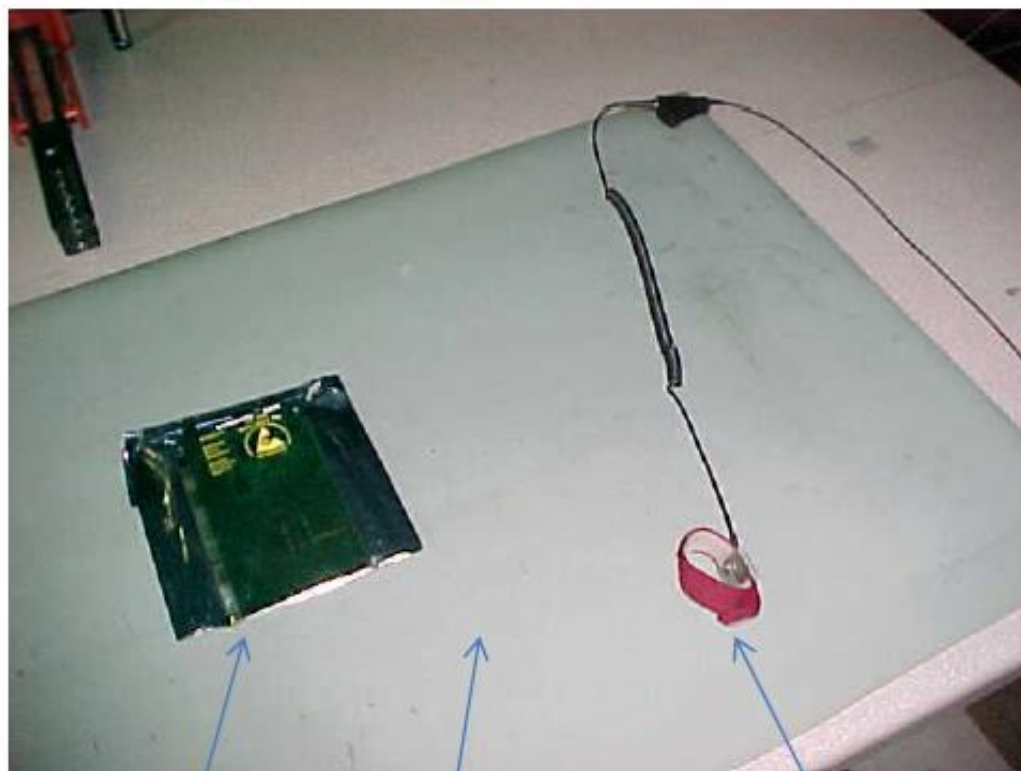
B)A station with continuous monitoring

A TYPICAL ESD SIMPLE STATION



Selection of Equipment for an ESD Protected Area (EPA)

Figure 1: Typical Simple EPA



To Ground,
See figure 2



ESD protected
area

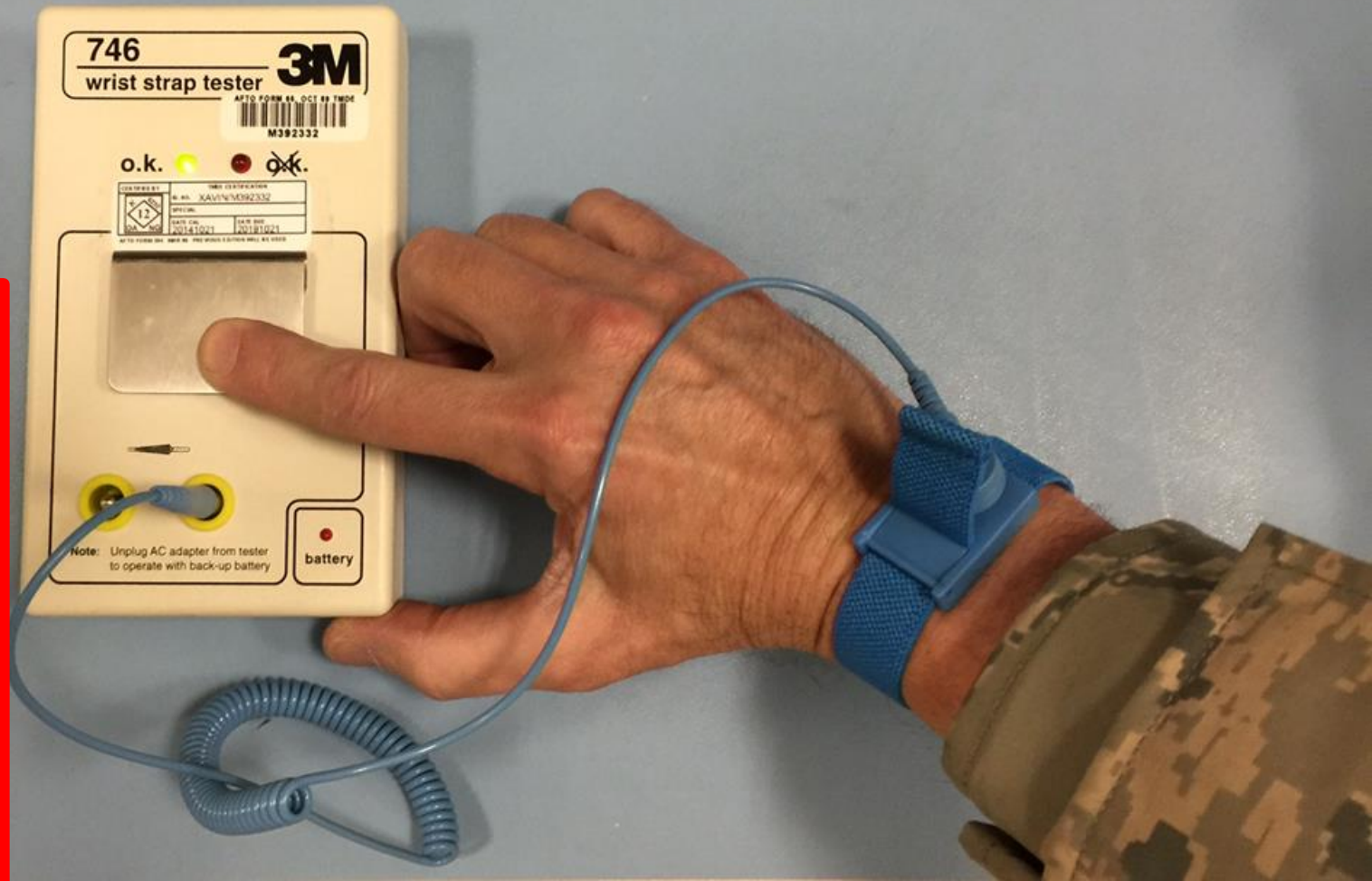
Part to be
inspected

ESD Mat

ESD Wrist Strap
and chord

“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. “

BTW: For the Simple EPA Setup, the wrist-strap/Chord combination seems to be the weak link in the ESD protection chain. A common method to check for its integrity might include this tester:



Causes of Wrist-strap-chord failures:

- Loss of elasticity-tightness
- Dirty
- Oxidation on connections
- Hair or dirt on the human

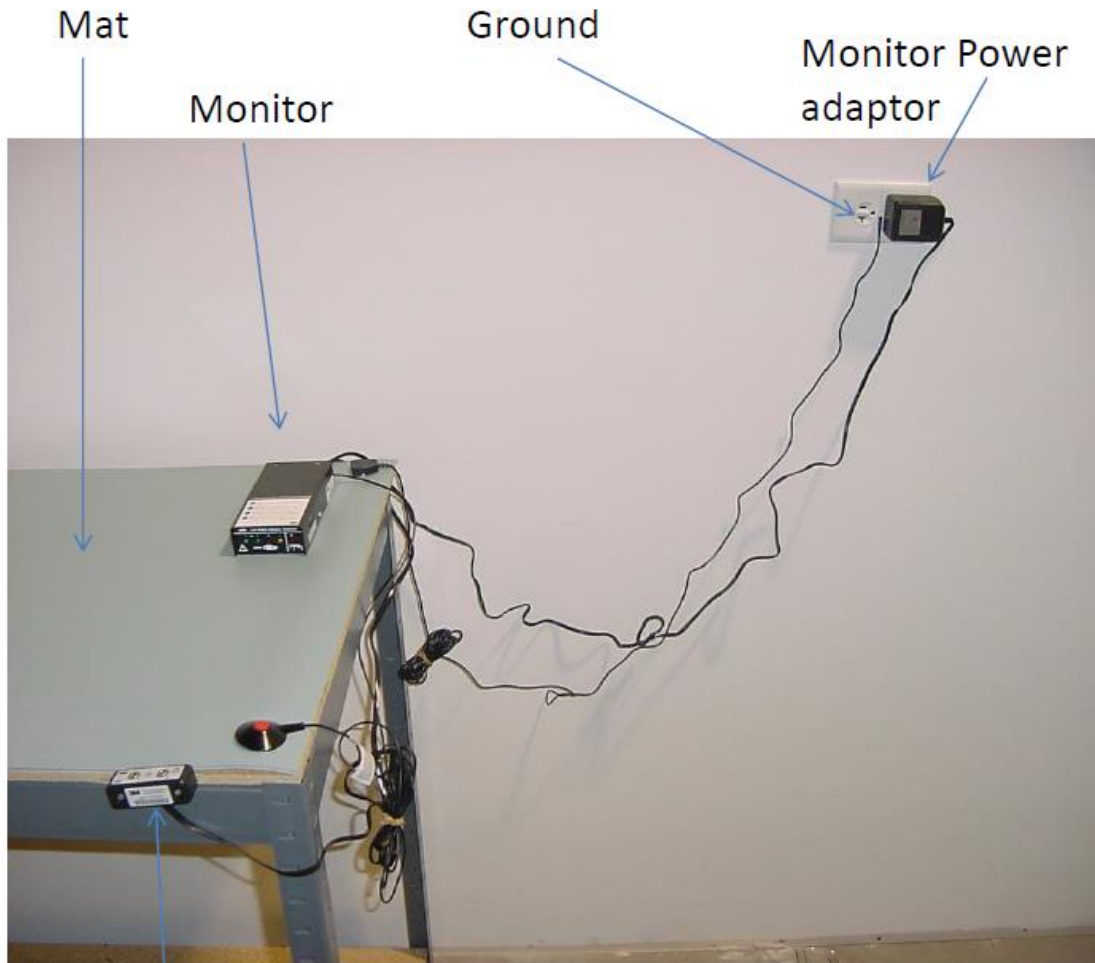
About those floor mats some of you are using with your Simple ESD Station:

- 1) **The ASA Best Practice *does not* require them**
- 2) While it adds another layer of protection, they are not as effective as you might think for the following reasons:
 - Your shoes are actually very good insulators and will not ground your body's static charges unless:
 - You wear these which touch your body and connect directly to the mat bypassing your shoe's insulation:





A Continuous Monitoring Station

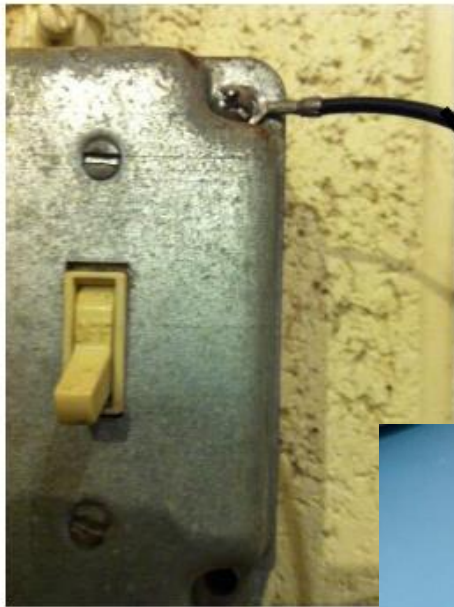
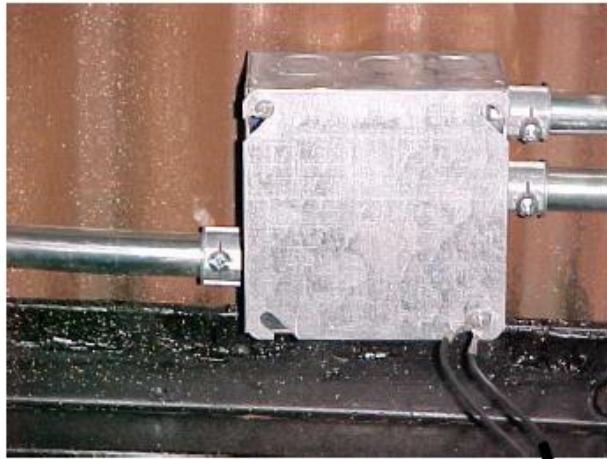


**ESD protected
area**

“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. “

Dual Conductor wrist strap
chord plugs-in here

Selection of a Ground for an ESD Protected Area (EPA)



From Mat

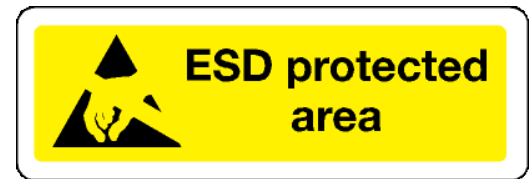


BTW: Need some terminal solutions? Go to your local automotive shop and buy a cheap Wire Crimp Kit similar to the one shown





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. “**

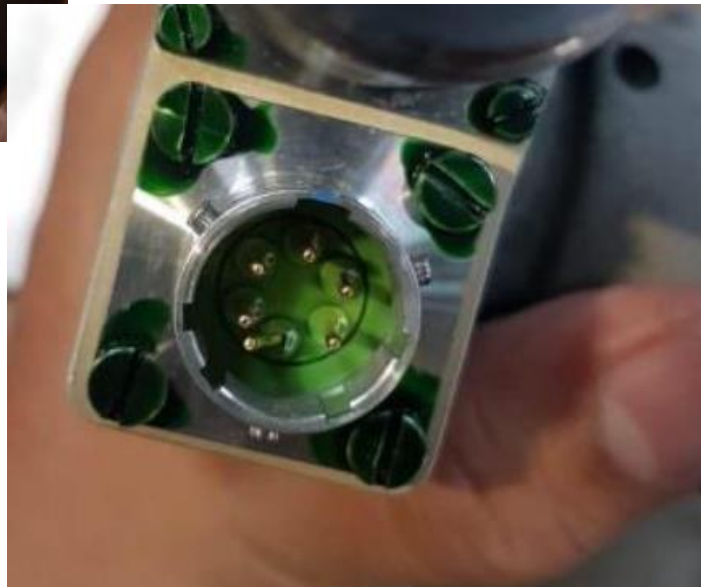
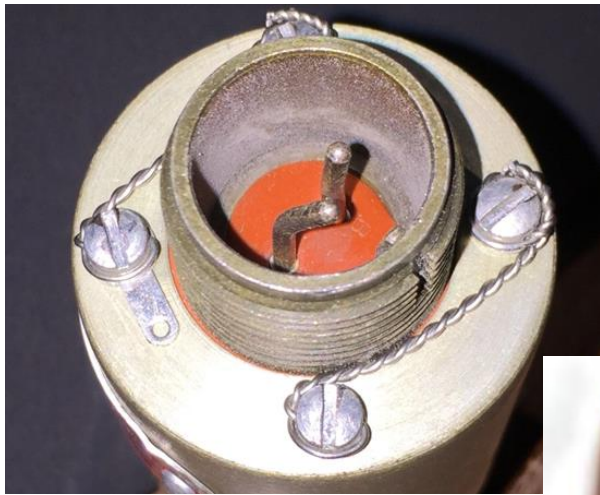


***End of:
ESD Inspection Station setup***

***Next:
Handling and Visual
Inspection of ESD Parts***

About Components:

By the way, it is strongly recommended that when performing a visual inspection, you look under those caps!



About Components:



It is desirable to remove a cap to inspect the connector for:

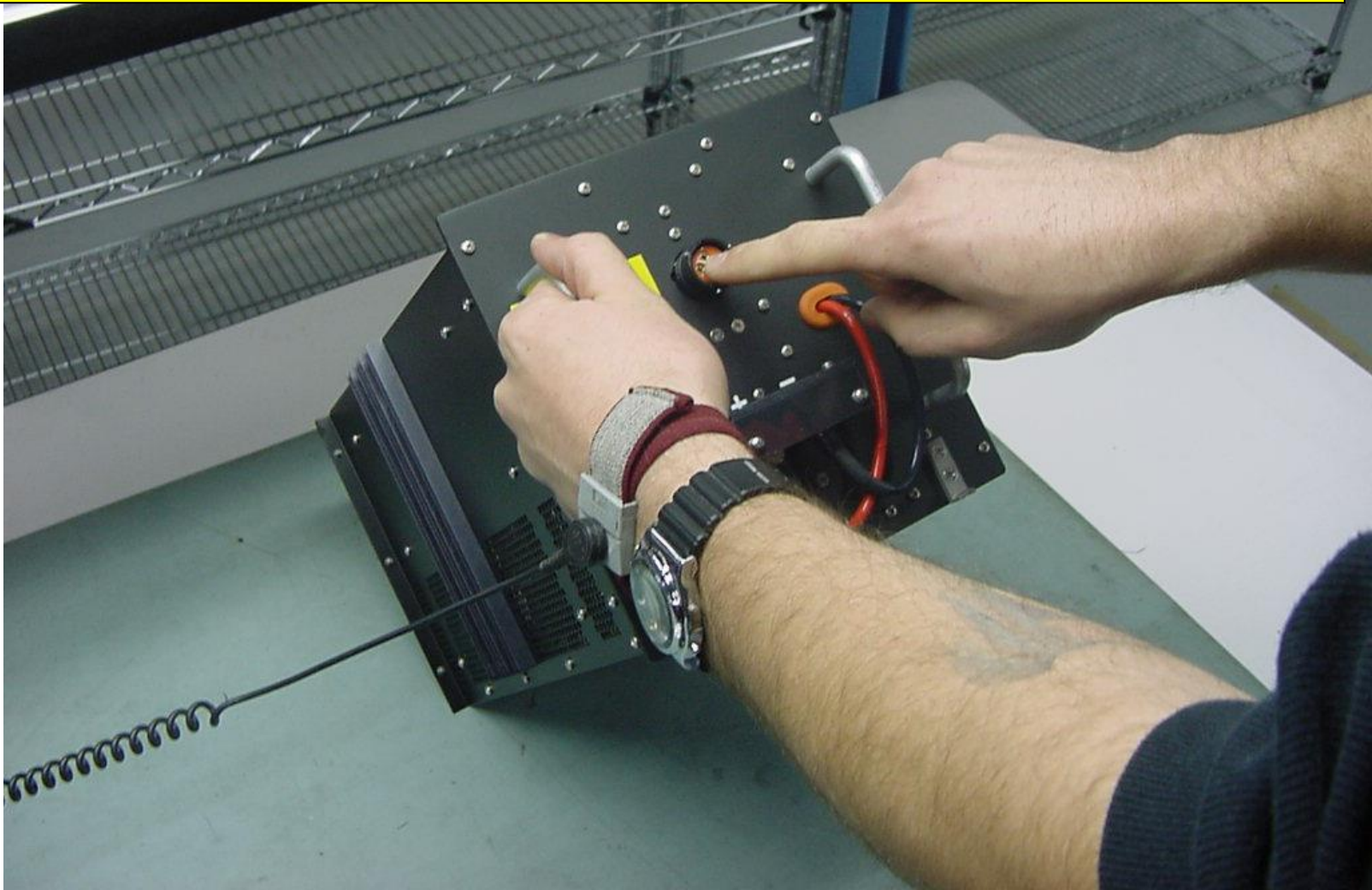
- *Missing pins*
- *Bent pins*
- *Corroded pins*

*In this case, you **MUST** be properly protected*

About Components:



You can now safely touch the connector, or handle an IC Chip, or PC Board





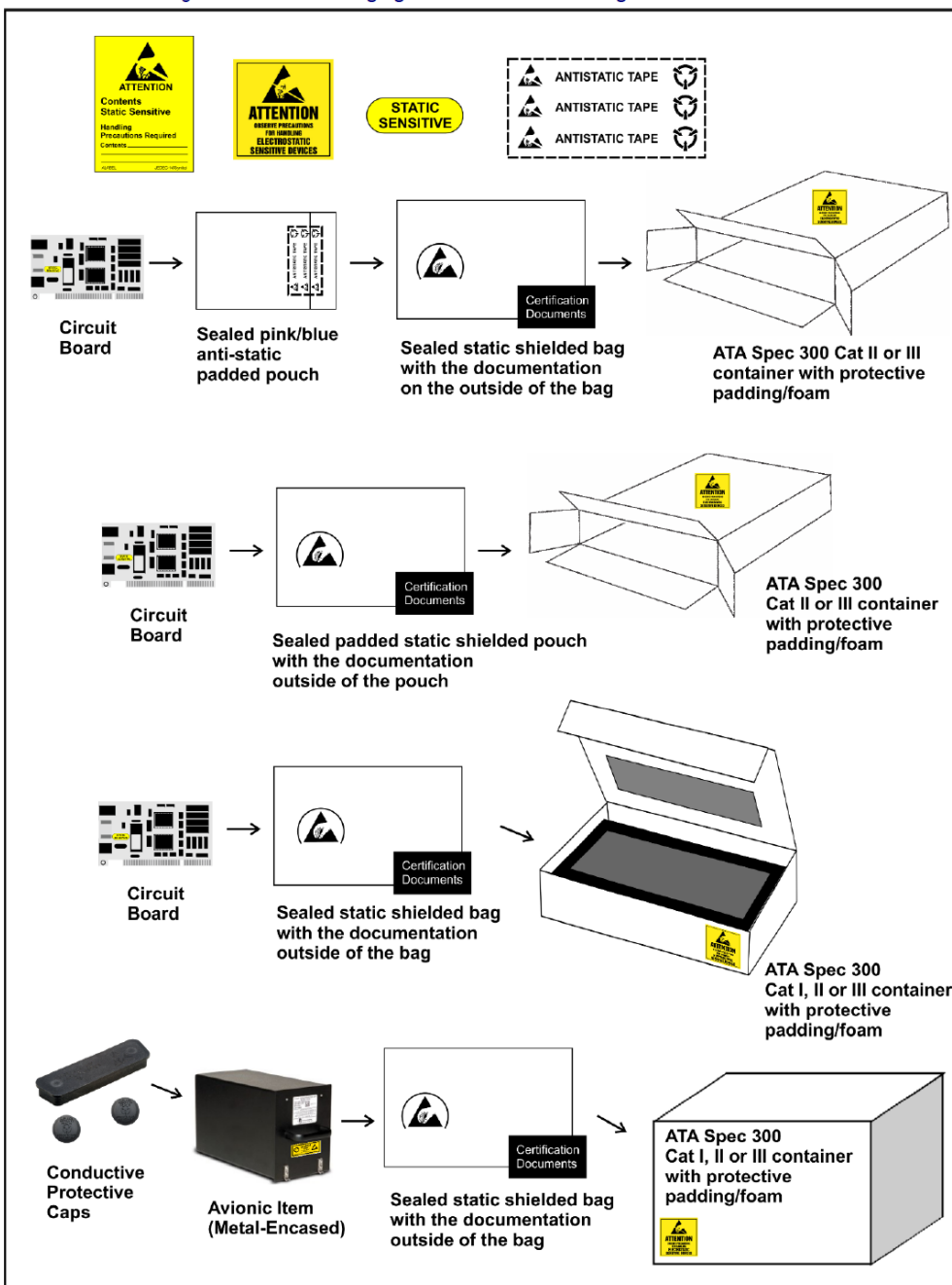
***Next:
Packaging***



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). ATA Specification 300 offers simple additional guidance.”

Figure 6-2.1. Packaging of Electrostatic Discharge Sensitive Devices



ESD Packaging: A common standard is ATA Specification 300



Roy Resto is an experienced aviation industry professional having served in management positions with several firms and is currently Principal of AIM Consulting Solutions. Most recently he was Vice President of Technical Operations for Safran Messier-Bugatti Repair Stations. Prior to this position, he was the COO of Quality Management Solutions LP, a consulting firm specializing in aircraft maintenance. In addition, Roy worked with American Airlines in their Maintenance and Engineering center where he retired as a level 5 Manager, and before that, with McDonnell Douglas. He was also a member of the US Air Force in the Reserves/ANG having served 32 years in Electronic Warfare and Avionics. Resto has served on the FAA's Suspected Unapproved Parts Steering Committee and the Aviation Suppliers Association Board of Directors.



Roy has an MBA in Finance from Oklahoma City University, a BS from Oklahoma State University, an AAS in Avionics from the Community College of the Air Force, and is an Aviation High School graduate. Complementing these, he has an FAA A&P license, an FCC Radiotelephone license with a RADAR endorsement, is an FAA DAR (Designated Airworthiness Representative), Instrument Rated Pilot, and speaks fluent Spanish. His website is:

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***You're Good
To Go!***

