Handling Static-Sensitive Materials

Contents

(continued)

Contents

1. General

1.1 Purpose

This practice provides guidelines and precautions for storing and handling components and printed wiring card (PWC) assemblies which can be destroyed or damaged when subjected to static discharge.

CAUTION: Static-sensitive components and PWCs can be destroyed or damaged by static discharges of as little as 40 volts. Charges carried by the human body can be thousands of times higher. Follow the procedures described in this practice to prevent unseen damage from occurring.

1.2 Filing instructions

Remove and discard Issue 5, and file this issue in its place in your GTE Telephone Operations practices set.

1.3 Reason for Reissuing

This practice has been reissued to incorporate multiple changes in the content. Read this entire practice to ensure your familiarity with the new information.

1.4 Supersedures

This practice supersedes:

- All local practices, policies, procedures, general instructions, letters, and memoranda which address this subject.
- Any document which provides information contrary to the information contained in this practice.

1. General, continued

1.5 Copyright and Responsibility

This practice was published by the GTE Telephone Operations Administrative Services Department. For more information about this practice contact the Headquarters COE Construction Department.

1.6 Disclaimer

This practice was prepared solely for the use of GTE Telephone Operations. It must be used only by its employees, contractors, customers and end users, when installing, operating, maintaining, and repairing GTE Telephone Operations' equipment, facilities and services. Any other use of this practice is forbidden. The information contained in this practice may not be applicable in all circumstances and is subject to change without notice. By using this practice the user agrees that GTE Telephone Operations will have no liability (to the extent permitted by applicable law) for any consequential, incidental, special, or punitive damages that may result.

2. Overview

2.1 Acronyms

This practice uses the following acronyms.

Acronym	Definition
DVM	Digital Volt Meter
MOS	Metal-Oxide Semiconductor
PWC	Printed Wiring Card
SSD	Static-Sensitive Device
VOM	Volt-ohm Meter

2.2 References

For more information on this subject, refer to the following documents.

- GTE Telephone Operations Practice 200-91 O-200, Printed Wiring Circuits, Maintenance and Modification.
- GTE Telephone Operations Practice 808-21 O-072, Environmental Control Guidelines - Electronics Equipment Storage.
- AG Communication Systems Practice 996-100-100, Printed Wiring Card Repair and Modification, Shop Procedure.

3. Identifying Static-sensitive PWCs/Components

3.1 Introduction

Static-sensitive PWCs require special handling to prevent damage from static discharge. Static-sensitive PWCs are:

- Integrated circuits.
- PWCs containing integrated circuits.
- Hybrid circuits containing integrated circuits.

3.2 Identifying Static-Sensitive Assemblies

Manufacturers have made the decision that because most printed circuit boards today have static sensitive components, it is no longer practical to individually identity them. Because of this decision, all printed circuit boards must be treated as being static-sensitive. This precaution should be taken with any PWC, regardless of manufacturer.

3.3 Identifying Static-Sensitive Components

Identity static-sensitive components which are not mounted on cards by their packaging. Common static-sensitive components and the way they are packaged are described in the chart below.

A(n)...	Is Packaged in a(n)...
Integrated circuit	• Specially treated anti-static tube (labeled as such). **OR** • Conductive tube (labeled "SSD" in red ink). **OR** • Anti-static plastic bag with its leads surrounded by conductive material. There are two types of conductive bags: - A transparent, metallic, blue-black metalized finish. AND - A pale pink color.
Static-sensitive component other than an integrated circuit material; i.e., foam.	Protective static-shielding plastic bag with its leads surrounded by conductive
PWC with static-sensitive components	Protective static-shielding plastic bag.

NOTE: If any static-sensitive components are received and not properly identified as defined above, contact your Headquarters staff.

4. Handling Static-sensitive PWCs/Components

4.1 Introduction

The most serious threat to static-sensitive devices exists during the initial installation, power up, and testing of electronic equipment. The PWC mortality rate is the highest during this period. The Installation and Maintenance groups must take anti-static precautions to prevent destroying or damaging PWCs during these operations.

4.2 Static-Free Work Stations

Remove static-sensitive devices from their protective packaging only at a static-free work station (see Exhibit 1). Keep static-free work stations:

- Clean and neat.
- Off-limits for eating, drinking, and smoking.
- Free of static-generating materials such as Styrofoam, plastic solder removers, vinyl sheet protectors, plastic notebook folders, combs, etc.

A static-free work station must have a(n):

- Bench or optional floor mat (bench, Part No. 8211, MC 748128; floor mat, Pan No. 8221, MC 760995).

- Operator's adjustable wrist strap (5-foot, Pan No. 2214, MC 576589; 10-foot, Part No. 2224, MC 576591) and optional heel strap.

The mat and wrist/heel strap must be connected to electrical ground through a 1 megohm resistor. (The minimum allowable functioning resistance is 800K ohms. See Sections 9.2 and 9.3.)

All work stands and other fixtures that might come in contact with static-sensitive PWCs must:

- Have a conductive (i.e., metal) outer surface.
- Touch the grounded mat. (See Exhibits 2 and 3.)

Ground all equipment (soldering irons, testing devices, etc.) on or about the work station.

A conductive wrist strap and heel strap (if required) will be issued to any person working with equipment containing static-sensitive devices. Wear the wrist/heel strap:

- In snug contact with the skin.
- At all times when handling static-sensitive devices.

CAUTION: A worker must never be connected to hard (building) ground. A hard ground could allow hazardous and potentially lethal currents to flow through the worker if accidentally shocked by a piece of equlpment. The 1 megohm resistor allows the wrist band to function as a ground to static but not as a hard ground.

4.3 Connecting Wrist Strap to Equipment Frame Ground

IMPORTANT: Read the following paragraph before connecting wrist strap to an equipment frame.

To avoid potential release of a damaging electrostatic discharge when connecting an uninsulated alligator clip or plug from your wrist strap to the frame:

- Do **not** make contact directly with the equipment frame.

- Do **not** bypass the 1 megohm resistor.

NOTE: **By not bypassing the 1 megohm resistor, you protect both yourself from electric shock and equipment from damage.**

4.4 Alligator Clip Insulated Cover Ordering Information

Rubber insulating covers are available for protecting the uninsulated alligator clip. The following chart contains ordering information.

Description	Part Number	Material Code	Vendor Code
Insulator, Alligator Clip	632	582276	MUEO
Insulator, Mini Alligator Clip	32	582273	MUEO

NOTE: One package contains 50 (each) red and black insulators.

4.5 Connecting Wrist Straps to Frame Jacks

When connecting wrist strap plug/banana clip type connection to a frame jack, always handle the plug/banana clip on the plastic insulated portion. This will prevent accidental release of damaging electrostatic discharge.

4.6 Clothing Precautions

Workers who must move about in a limited area may use conductive heel straps as an alternate grounding method only upon a grounded conductive floor mat (see Exhibits 4 and **5).** Wrist straps must be used while seated and working.

4.7 Guidelines for Handling

Remove PWCs from their protective packaging only when they are ready to use or insert into a frame.

NOTE: If the protective packaging becomes damaged in any manner, properly grounded personnel should repackage the **static-sensitive units in protective containers at a static-free work station.**

Wear a wrist strap (and optional heel strap) grounded to the bare metal of the equipment frame when removing PWCs from protective bags or system card files, in order to dissipate any static charges which may have been generated.

Use extreme caution to prevent direct contact between unpacked PWCs/components and possible sources of static charges. Sources of static charges include:

- Ungrounded people.
- Common plastics.
- Styrofoam.
- Clothing.

NOTE: When adding/changing cables on PWCs, always wear a wrist strap.

4.7 Guidelines for Handling, continued

Workers handling PWCs or static-sensitive devices **must** follow these safety precautions.

- Do **not** allow "naked" (i.e., unbagged) PWCs/components to touch plain plastic bags, clothing, textiles, or ungrounded skin; these are static sources.
- **Do not** use hand creams or lotions containing silicone, which can cause solderability problems. Lotions formulated for use in solder-assembly areas are available.
- Do **not** substitute holding or touching a grounded conductive surface for the wrist strap grounding method. Touching or holding an electrical conduit, a grounded conductive mat, or the bare metal pans of frames, test equipment, or containers:
  - Is **not** acceptable grounding.
  - Defeats the purpose of the wrist strap's resistor.
  - Exposes the worker to potentially dangerous shocks.
- Do **not** use a static-shield bag as a glove by placing a hand inside the bag to hold the PWC.
- Do **not** handle a PWC by using a folded bag in contact with the PWC.
- Do **not** place a PWC or static-sensitive component on top of static-shield bags for protection.
- Do **not** turn an static-shield bag inside out.

CAUTION: Do not use the static-shield bag to hold the PWC. The bag provides a static shield and is not anti-static; it is conductive. Using the bag to pick up PWC can cause static damage. Use your wrist strap at all times when handling PWCs.

4.8 Removing PWCS from Files

A static charge can develop when two materials come into contact and then separate. Removal of a PWC from a file can generate static charges on the operator's body. If not properly discharged, the static charge can destroy or degrade the PWC with the touch of a finger.

The following procedure must be employed when removing a PWC from a file.

Step	Removing PWCs from Files
1	Power down, if the frame is a working frame. Use the appropriate procedure as explained in the system repair manual. Power must be removed and the input signal eliminated from a working frame before removing or installing a PWC with metal-oxide semiconductor (MOS) components. **NOTE: Some cards are to be removed wfth power on. Verify card removal procedures prior to removing any card.** **This step is not necessary for nonworking or spare-card frames, since they have no power or input signal.**

(continued)

4.8 Removing PWCs from Files, continued

Step	Removing PWCs from Files
2	Attach the wrist strap's alligator clip to a bare metal surface of a frame shelf or a mounting screw **before** removing a PWC or other static-sensitive device from the shelf. **NOTES:** • **Do not attach the alligator clip to the scalloped edges of the card guides.** • **Do not make contact with the frame by using the bare end of the wrist strap button. This defeats the purpose of the strap's 1 megohm resistor.** • **The alligator clip must be insulated with a nonconductive cover (MC 582276 or MC 582273).**
3	Remove the PWC from its file.
4	Place the PWC in a transparent conductive plastic bag (MC 747525).
5	Detach the wrist strap assembly's alligator clip.
6	Take the PWC to a properly grounded work station.

4.9 Removing Faulty PWCs from Files

When removing a faulty or damaged PWC from a frame, follow the same anti-static precautions as when removing a functioning PWC. (See Section 4.8.) **This** will prevent further damage to the:

- Faulty PWC.
- Static-sensitive components in the frame.

Do **not** fasten a common (i.e., nonconductive) plastic envelope directly to a PWC. The envelope may be carrying or could generate a high static charge.

4.10 References

For further information about anti-static precautions required during repair or modification of PWCs containing static-sensitive components, see:

- GTE Telephone Operations Practice 200-910-200, Printed Circuit Cards, Maintenance and Modification.
- AG Communication Systems Practice 996-100-100, Printed Wiring Card Repair and Modification, Shop Procedure.

5. Storing PWCs/Components

5.1 Introduction

Store static-sensitive PWCs/components in the protective static-shielding packaging in which they were shipped from the factory. If static-sensitive devices are out of their protective packaging, any person who comes into contact with them (including stockroom personnel, stock handiers, maintenance personnel, etc.) must be properly grounded. (See Sections 4.7 and 6.4.)

Maintain the proper storage environment (e.g., acceptable temperature, humidity level, storing arrangements, etc.) for PWCs/components. For details on the proper storage environment, see GTE Telephone Operations Practice 808-210-072.

5.2 Repackaging Subdivided Lots

Properly grounded workers will repackage subdivided lots of static-sensitive devices:

- In anti-static containers.
- At a static-free work station.

Label containers to clearly show that they contain static-sensitive devices.

6. Transporting PWCs

6.1 Introduction

Two types of carrying cases are used to transport small numbers of PWCs while protecting them from static discharge and physical abuse. They are the:

- Wood frame case.
- Two-piece molded Velostat™ shell, with card frame enclosed (MC 589376 [single-height] or MC 589377 [double-height]).

There is no need to use static-shield bags.

For shipping purposes, use boxes furnished by the supplier.

6.2 Wood Frame Cases

The wood frame case carries PWCs enclosed in static-shield bags. Insert or remove PWCs from this case by carefully grasping the exterior of the bag that enclosed the PWC. Do **not** grasp the PWC.

Do **not** let unprotected PWCs come in contact with:

- The carrying case shell.
- Clothing.
- Carpeting.
- Plastic materials.
- Styrofoam.
- Floor tile.
- Any other materials which may carry a static charge.

Velostat™ is a trademark of 3M Corporation.

6.3 Fiberglass Cases

When inserting or removing PWCs from a fiberglass case, treat the case's card frame as if it were a large static-shieid bag. Specifically:

- Wear a grounded wrist strap. (See Section 4.6.)
- Do **not** touch PWCs before connecting or after disconnecting the wrist strap.

6.4 Handling PWCs Away from Frames/Work Stations

PWCs should be unloaded from carrying cases or loaded into static-shield bags only:

- At a static-free work station.

  OR

- Near the system framework where they will be installed.

If PWCs must be loaded or unloaded in other places, follow the steps in the chart below.

Step	Handling PWCs Away from Frames/Work Stations
1	Fasten a ground strap (MC 747547) to: • The carrying case card file (MC 589376 or MC 589377). AND • A convenient ground point. **NOTE: The connection to ground must be through a 1 megohm resistor for safety. (The minlmum allowable functioning resistance of the connection to ground is 800K ohms.)**
2	Fasten the wrist strap assembly and insulated alligator clip to the carrying case card file.
3	Remove the PWCs from the carrying case.
4	Place the PWCs in static-shield bags.
5	Disconnect the wrist strap assembly's alligator clip from the card file.
6	Transport the PWCs to the system framework.

NOTE: Never carry a PWC without enclosing it in a static-shield bag.

7. Anti-static Materials

7.1 Introduction

Order anti-static (i.e., static-protective) materials with initial equipment installation. The materials are used during the installation phase and later turned over to maintenance personnel.

7.2 Additional Approved Anti-static Materials

Order the following additional approved anti-static materials as required. (Other approved items are referenced in Product Standardization Bulletin [PSB] 3082.)

Part Number	Material Code	Description
8210	760994	Velostat Table Mat, 1/16 in. by **2 ft.** by 4 ft. with snap fasteners in two corners
2214	576589	Static Control Wrist Strap Band (adjustable) with 5-ft. ground cord and 1 megohm resistor in line. Snaps around wrist and has a banana plug at one end, with an alligator clip adapter. (Seven of these are recommended upon initial installation.)
2224	576591	Static Control Wrist Strap Band (adjustable) with IO-ft. ground cord and 1 megohm resistor in line. Snaps around wrist and has a banana plug at one end, with an alligator clip adapter. (Three of these are recommended upon initial installation.)
2100 12x18	749328	Transparent Static Shielding Bags (@100/box), 12 in. by 18 in. (for PWCs). Bags unmarked.
2100 15x18	747546	Transparent Static Shielding Bags (@100/box), 15 in. by 18 in. (for PWCs). Bags unmarked.
SH-8524	589376	Case, Carrying PWC (3M), Single-Height Cards
DH-8525	589377	Case, Carrying PWC (3M), Double-Height Cards
5414	866676	Cabinet, PWC storage, double-sided free-standing. 84" high, 54" wide, 14" deep. (For PWCs up to 10-1/4" deep .)
5421	889286	Cabinet, PWC storage, double-sided free-standing. 84" high, 54" wide, 18" deep. (For PWCs up to 18" deep.)

(continued)

7.2 Additional Approved Anti-static Materials, continued

Part Number	Matetlal Code	Description
3014	**889287**	Cabinet-Mini, PWC storage, rack or free-standing. 30" high, 21" deep, 21-1 /4" wide (front) and 21-3/8" wide (rear). (For PWCs up to10-1/4" deep.)
3002	889288	Cabinet-Mini, PWC storage, rack or free-standing. 30" high, 21" deep, 20-1/4" wide (front) and 21-3/8" wide (rear). (For PWCs up to 18" deep.)
3050	886111	Snap Fastener (for repairing mats)
63	571979	Alligator Clip (adapter to banana plug on static control ground cord)
32	582273	Insulator, Alligator Clips, 50 red and 50 black in each package.
632	582276	Insulator, Mini-Alligator Clips, 50 red and 50 black in each package.
716	776489	Wrist Strap Tester (for the testing of cord, band integrity, and personal safety).
2210	**576590**	Replacement Grounding Cord, coiled 5-foot.
2220	576592	Replacement Grounding Cord, coiled 1 O-foot.
2204	576597	Replacement Adjustable Wrist Bands. Bulk package of 25.
3040	747548	Static Control Ground Cord, 1/8 in. diameter, 15 ft. long, 1 megohm resistor in line, male snap fastener on one end and solderless terminal on the other end. Use to connect table mat to building ground.
3051	747547	Static Control Ground Cord, 1/8 in. diameter, 5 ft. long. For common point grounding of field service kits.
4061	588934	Velostat Tray, 13 in. by 18 in. by 1-3/4 in.

(continued)

7.2 Additional Approved Anti-static Materials, continued

Part Number	Material Code	Description
7201	**431101**	Static Awareness Labels (for marking Bags, Frames, and PWCs)
8200	**760993**	Floor Mat - Gold (See Section 9.4.)
8201	748126	Floor Mat - Brown (See Section 9.4.)
PA-2700-I	588294	Ground Cord, 8 in. (DMS-100 only)
2051	**318291**	Heel strap grounding assembly with 1 megohm resistor.
8501	748124	Field service kit. Work mat with two pockets, ground cord, adjustable wrist strap.
8021	318292	Table and floor mat work station kit. E/W 3040 ground cord, 3048 grounding system.
3047	318293	Common point grounding system for work stations.
3048	318294	Wrist strap/table mat grounding system for work stations.

NOTE: Proper handling requires:

- **Large static-shielding bags (MC 747546) at** GTD-5 **installations only.**
- **Velostat trays (MC 588934) at Equipment Repair Centers only.**

8. Labeling

8.1 Labeling PWCs

identify with red stencil or red letters (i.e., warning labels) all static-sensitive PWCs, to indicate their special handling status.

CAUTION: **In the past, manufacturers labeled all static-sensitive Printed Wiring Cards (PWCs). Today, because most PWCs contain some static-sensitive components, some manufacturers have stopped identifying static-sensitive PWCs. Because of this change, it is imperative that all PWCs be treated as static-sensitive. We will continue to identify static-sensitive PWCs.**

8.2 Labeling Repackaged PWCS

When static-sensitive PWCs are repackaged in containers other than the originals, affix a "Warning: Static Sensitive" label to the container.

Also affix a new label over the existing packaging label to indicate the contents. Include the following information on the new label.

- Part number.
- Issue number.
- Quantity.

8.3 Labeling Bags

Seal conductive bags containing static-sensitive PWCs with a "Warning: Static Sensitive" label.

8.4 Labels Available

Labels available from local supply are listed in the chart below.

Part No.	Material Code	U/M	Description
7101	749255	Roll/500	"Warning: Static Sensitive" label (reusable)
7102	749542	Roll/,500	"Warning: Static Sensitive" label (disposable)

9. Audits

Responsibility

The Installation or Switching Services person assigned to manage the site monitors anti-static work stations to verify that:

- Anti-static equipment is in good working order.
- Workers handle static-sensitive PWCs/components in the manner described in this practice.
- Maintenance personnel and other non-electronics workers who might touch static-sensitive devices are properly grounded.

9.2 Wrist Strap Testing

IMPORTANT: Remove ail community type anti-static wrist straps connected to electronic equipment frames. In order for **wrist straps to be effective, they** must be custom-fitted to an individual's wrist.

At the beginning of each work shift all employees that work on static sensitive equipment must adhere to the following procedures, prior to starting work activity.

- Perform a physical inspection of your wrist strap, cord, and alligator/banana clip. Inspect all components for any of the following defects.

  - Worn areas.
  - Frayed areas.
  - Stretched out of shape.

  If any defects are noted, replace the wrist strap.

- Use only your assigned wrist strap. Refrain from using community wrist straps permanently connected to electronic equipment frames. (See IMPORTANT notice at the beginning of Section 9.2.)

- Ensure that your wrist strap is tight-fitting. If your wrist strap is loose and cannot be tightened, replace it with an adjustable wrist strap (MC 576591).

NOTE: if static discharge occurs while you are wearing an anti-static wrist strap, the fault is usually not with **the wrist strap component. The normal cause for wrist strap failure is an open condition** between **the skin and the wrist strap.**

- When attaching your wrist strap, ensure that the button makes good contact with your wrist. An open condition will normally be caused by one or more of the following problems.

  - Loose strap (open).
  - Dry skin (no continuity).
  - Wrist hair (insulated).

9.2 Wrist Strap Testing, continued

If...	Then...
You experience a "dry skin" condition	Apply water to your wrist prior to attaching the wrist strap. This will improve continuity between your wrist and the button. **NOTE: Normally after a wrist strap is worn for over five minutes, the moisture developed will eliminate any problem with dry skin.**
Wrist hair causes an open between the wrist strap and your wrist	Apply water to your wrist. This will improve continuity until your normal body moisture has time to react.

Your wrist strap must be attached for the duration of the work shift. Wear the snap button on the wrist strap on the inside of the wrist. Disconnect the ground cord and carry it in your tool pouch or tool box, until it is required.

Use a **3M** Charge-Guard (MC 776489 or equivalent) wrist strap tester to test the entire wrist strap system:

- At the beginning of each shift.
- After you have attached it to your wrist.

Step	Using a 3M Charge-Guard Tester to Test the Wrist Strap System
1	Test the batteries. Depress the metal contact plate fully. Observe the battery check lamp (amber). If the lamp is ON, the batteries are operational; if not, replace the batteries. **NOTE: The battery indicator lamp must be ON each time the contact plate Is activated. If the lamp extinguishes at any time during testing, replace the batteries.**
2	Select the 10 megohm switch on the tester.
3	Place band snugly on bare wrist. Connect snap fastened to band.
4	Insert banana plug into jack on tester, or attach alligator clip to middle post.

(continued)

9.2 Wrist Strap Testing, continued

Step	Using a 3M Charge-Guard Tester to Test the Wrist Strap System
5	With bare fingers, press metal contact plate until either green or a red lamp glows. (The amber battery check lamp will also be ON during this test. See Step 1.)

If the...	It Indicates that...
Green (PASS) lamp is glowing	Band and cord are functioning properly.
Red (FAIL) lamp is glowing	The resistance is greater than upper limits selected or tower than 500,000 ohms which is internally set. Proceed with Step 6.
Green and red lamps glow simultaneously	The resistance of the wrist strap is at the same level as selected on the resistance range switch, and the wrist strap must be replaced.

6	If the red (FAIL) lamp is on, check to see if your wrist strap is being worn correctly. When you have ensured that the wrist strap is fitted properly, proceed with the cord test. (Step 7).

Perform the cord test as follows.

Step	Petforming Cord Test
1	Leave banana plug or alligator clip attached to tester. Disconnect snap from wrist fastener and attach to top post on tester.
2	Press metal contact plate with bare hand, and watch lamps.

If the...	Then You Must...
Red lamp glows	Discard the cord.
Green lamp glows	Discard the wrist band.

9.2 Wrist Strap Testing, continued

NOTE: if the Charge-Guard wrist strap tester is not available, use the following method.

Step	Alternate Method of Testing the Wrist Strap System
1	Remove the wrist strap from your wrist.
2	Use a Volt-ohm Meter (VOM) or Digital Volt-ohm Meter (DVM) to measure the resistance from the banana plug on the wrist strap cord to the side of the snap-on button that touches your skin.
3	If the wrist band resistance range tests below 800K or above 1.2 megohms, it **must** be replaced. **NOTE: if the resistance is found out of the stated ranges, it is an indication that the wrist band is deteriorating and must be replaced before injuring personnel or damaging equipment.**
4	After testing, it is imperative that you follow procedures stated in the first part of Section 9.2.

9.3 Heel Strap Testing

Test the heel strap as follows.

Step	Testing the Heel Strap
1	Test the batteries. Depress the metal contact plate fully. Observe the battery check lamp (amber). if the lamp is ON, the batteries are operational; if not, replace the batteries. **NOTE: The battery indicator lamp must be ON each time the contact plate is activated. if the lamp extinguishes at any time during testing, replace the batteries.**
2	Select the 10 megohm switch on the tester.
3	Follow the manufacturer's instructions to ensure the heel strap is correctly installed.
4	Ensure the male snap on ground cord is connected to the floor mat. Attach the other end (banana connector) to the Charge-Guard Tester.

(continued)

9.3 Heel Strap Testing, continued

Step	Testing the Heel Strap
5	Stand on the floor mat. Press the metal contact plate with bare fingers until either a green or red lamp glows.. (The amber battery check lamp will also be ON during this test. See Step 1.)

If the...	It Indicates that...
Green (PASS) lamp is glowing	The heel strap is functioning properly.
Red (FAIL) lamp is glowing	The resistance is greater than upper limits selected or lower than 500,000 ohms which is internally set. **NOTE**: **Ensure that heel strap is being worn correctly. If so, replace heel strap and repeat test.**
Green and red lamps glow simultaneously	The resistance of the heel strap is at the same level as selected on the resistance range switch. If the switch is set on 2 megohms, replace the heel strap.

9.4 Floor/Table Mat Specifications

Anti-static floor and table mats resistivity is 10^6 to 10^9 ohms per square inch. This resistivity does not need to be tested. It is a function of the material and normally will not deteriorate.

The most common resistivity problem with mats is poor contact on the end of the wire connected to ground or on the end of the wire connected to the mat. Check the continuity across these contact points.

NOTE: According to the major digital switch manufacturers, anti-static mats for the equipment aisles are not required. The anti-static wrist bands are adequate for protection when properly used. Employees must wear these bands at all times when working in electronic equipment areas.

However, anti-static mats currently in place in central office equipment aisles may be used as additional protection.

9.5 Static-shield Bag Specifications

Static-shield bags with resistance material:

- Sandwiched inside the bag have a resistivity of 10^2 to 10^4 ohms per square inch.
- On the outside of the bag have a resistivity of 10^5 ohms per square inch or less on the outside.

It is practical to measure this resistivity. The bags can be destroyed through normal use long before the resistivity drops.

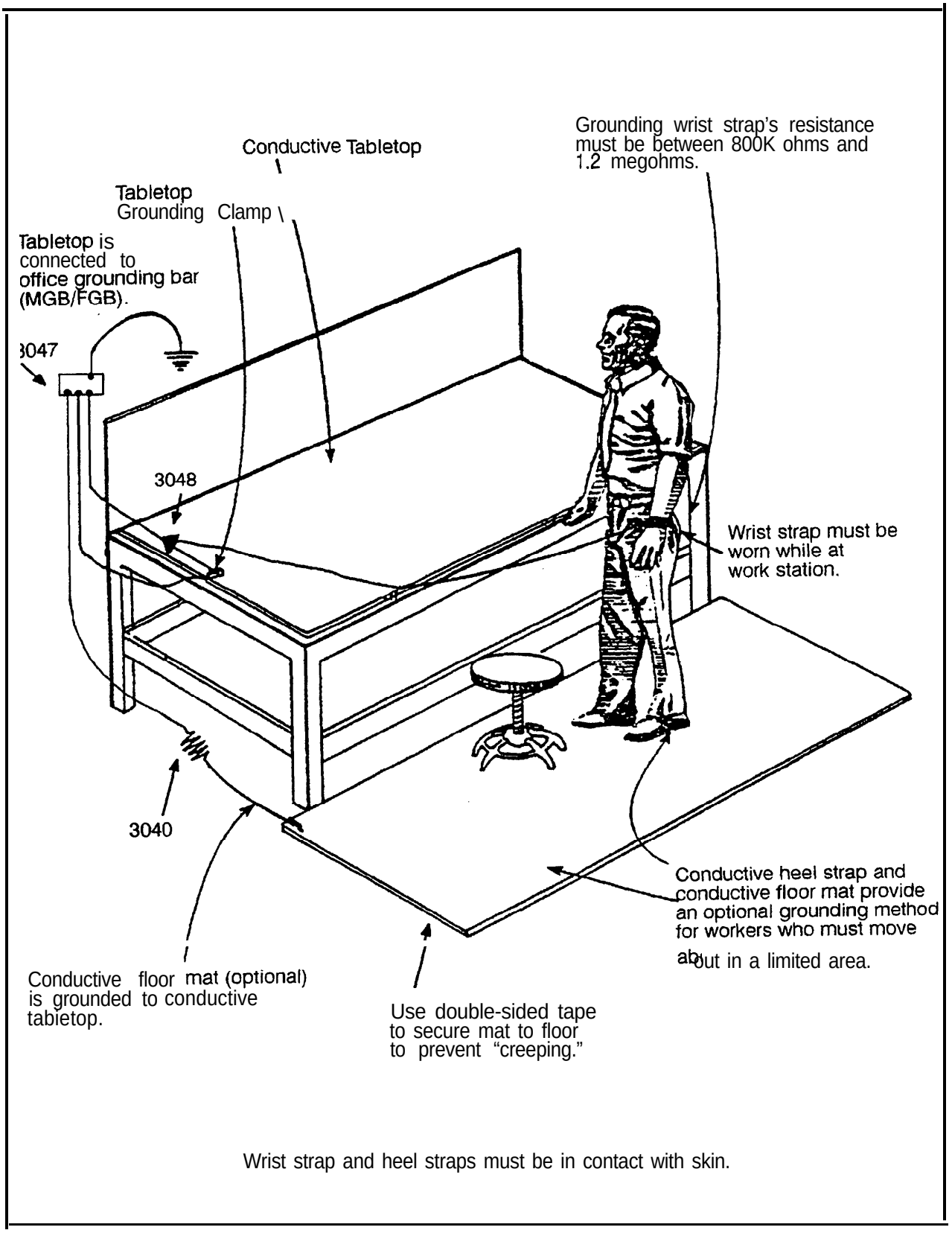
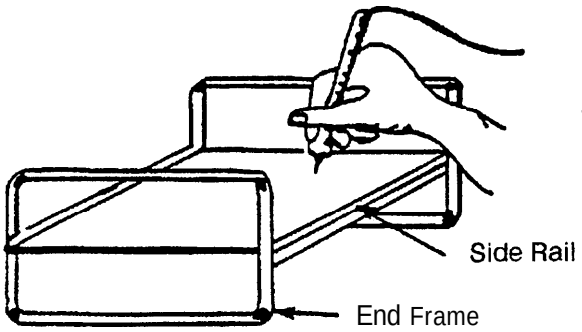
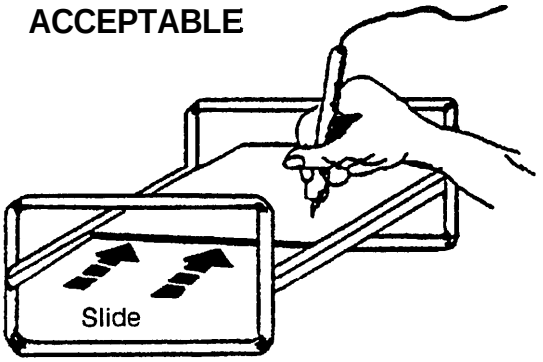


Exhibit 1 – Static-Free Work Station



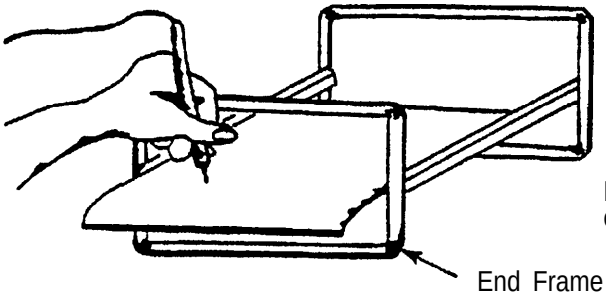
The PWC area to be worked on must be between the side rails and the end frames.

ACCEPTABLE



If it is difficult to work near the end rails, slide the PWC out just enough to be able to work on the desired area.

ACCEPTABLE

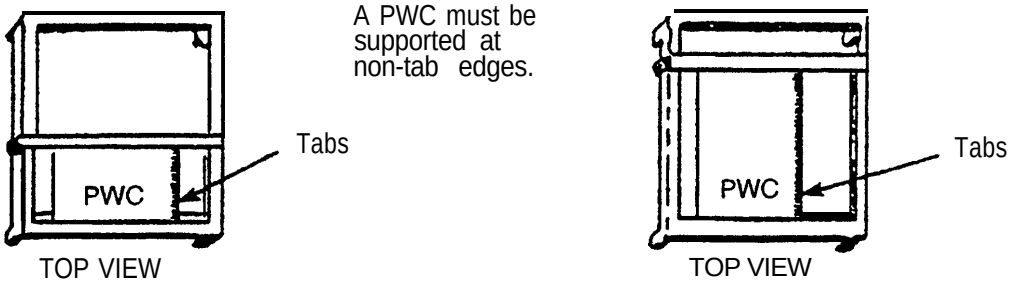


Do not work on any part of the PWC that extends past the end frames.

NOT ACCEPTABLE

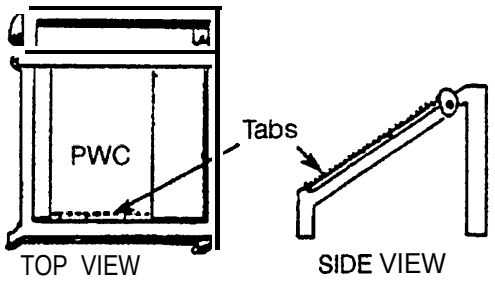
Exhibit 2 - Using a Non-Adjustable Flip Fixture/Work Stand

THE CORRECT WAY TO PLACE A PWC IN A WORK STAND



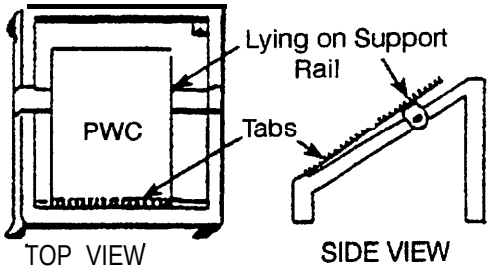
INCORRECT WAYS OF PLACING A PWC IN A WORK STAND

A PWC must not be supported on tabs.



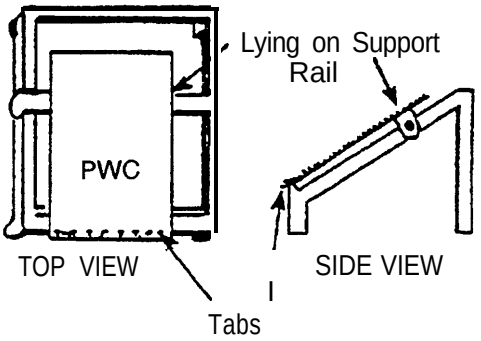
WRONG

A PWC must not be supported on tabs and on solder connections and component leads.



WRONG

A PWC must not be supported on solder connections and component leads.



WRONG

Exhibit 3 - Placing PWCs in Work Stands

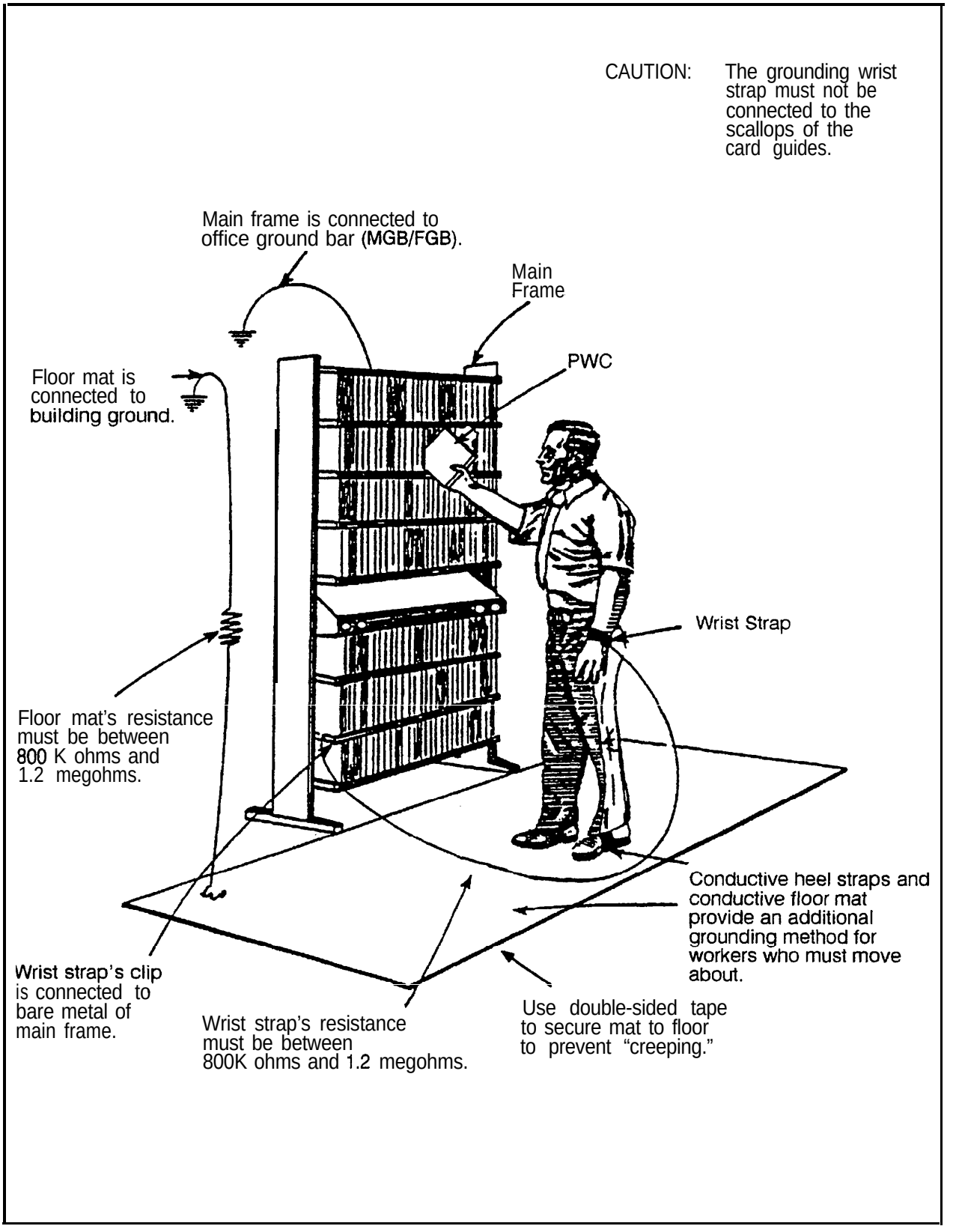
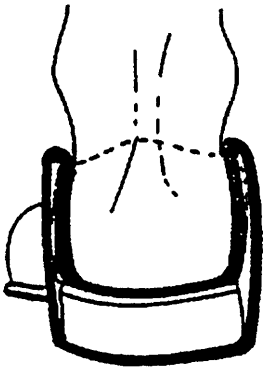


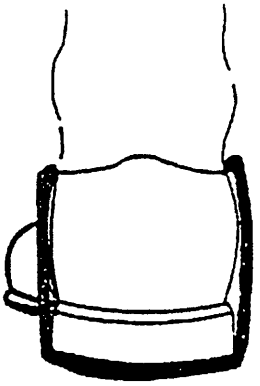
Exhibit 4 Approved Grounding Technique for Working with Files



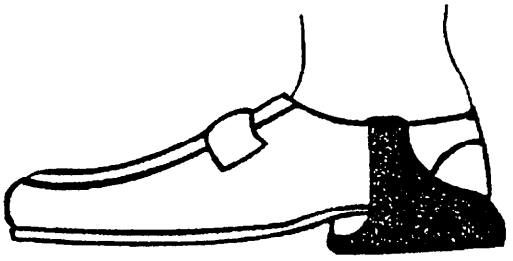
The body-contact part of the strap must be tucked into the shoe between the heel of the sock and the inside surface of the shoe (see A).

A. CUT-AWAY VIEW

The remainder of the strap goes around the outside of the heel of the shoe. It crosses the walking surface of the heel (see B and **C).**



B. REAR VIEW



C. SIDE VIEW

Exhibit 5 - How to Wear Conductive Heel Straps