

## Installation and Maintenance of ESD Protective Surfaces



### Foreword

To enhance your understanding of this technical bulletin we recommend that you read the following ESD Standards:

- ANSI/ESD S20.20 - Development of an Electrostatic Discharge Control Program
- ESD ADV 1.0 - Glossary of Terms
- ESD S4.1 - Worksurfaces
- ESD S6.1 - Grounding
- ANSI ESD S11.11 - Surface Resistivity

These documents can be obtained directly from the ESD Association, 7902 Turin Rd., Building 3 Suite 2, Rome, NY 13440-2069, (315-339-6937), [www.esda.org](http://www.esda.org).

### Introduction

The purpose of an ESD protective worksurface is to aid in the prevention of damage to ESD sensitive components and assemblies. An ESD protective worksurface provides protection in the following two ways:

1. Providing an antistatic worksurface area that will not allow static electricity to be generated at potentially hazardous levels.
2. Removing the charge from a conductive object placed on the worksurface.

ESD protective worksurfaces are categorized into two general categories: conductive and dissipative.

A conductive worksurface is defined by most documents as a material that has a surface resistivity of less than  $1 \times 10^5$  ohms. Conductive materials are the quickest to dissipate a charge, but they can also cause damage by discharging too rapidly. Conductive

materials are usually used as floor mats or flooring products.

Dissipative worksurfaces are defined as materials having a surface resistivity of at least  $1 \times 10^5$  ohms, but less than  $1 \times 10^{12}$  ohms. Dissipative materials minimize the generation of static charges, and will dissipate a charge slow enough so that a spark will not occur. Dissipative materials are usually the preferred choice for bench top worksurfaces.

### General Guidelines

1. ANSI/ESD S20.20 requires that all conductors, including personnel, must be electrically connected and attached to a known ground.
2. For proper and safe grounding the ESD ground must be tied directly to and at the same potential as the building or "green wire" ground.
3. Per ANSI/ESD S20.20, the ESD control program can in no way replace or supercede and requirements for personnel safety. Ground fault circuit interrupters (GFCI) and other safety protection should be considered wherever personnel safety might come into contact with electrical resources.
4. All electrical circuits at an ESD protected workstation (especially those used as the tie in point to the utility ground) should be verified for proper wiring configuration, ground impedance and GFCI function. This is required when the station is installed and then tested periodically.
5. The selection of ground cords is intimately related to the material selected for an ESD protected work area, personnel safety and the products'

relationship to the organization's material handling procedures. It is important for a user to be familiar with their organization's grounding specifications and ESD control procedures prior to selecting ground cords.

### Common Point Grounds

A common point ground is defined by the ANSI EOS/ESD S6.1, "Recommended Grounding Practices" as:

- 1.) A grounded device where two or more conductors are bonded.
- 2.) A system or method for connecting two or more grounding conductors to the same electrical potential.

Examples of conventional common point grounds and other ground cords are illustrated below.

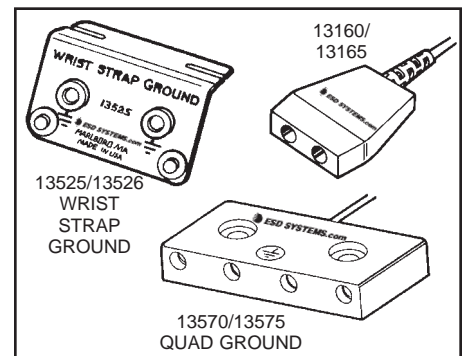


Figure 1. Typical common point grounds

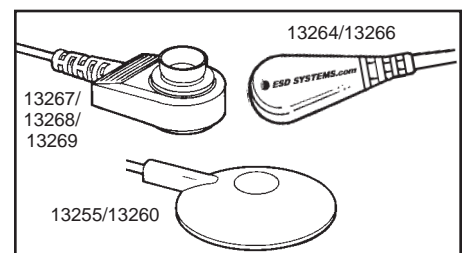


Figure 2. Other ground cords.

Common point grounds are designed to provide earth ground for table mats and

wrist straps. **NOTE: DO NOT DAISY CHAIN.** Because of the high resistances inherent to many types of protective surfaces, daisy chaining of these materials can severely limit their ability to properly dissipate and protect against static charges.

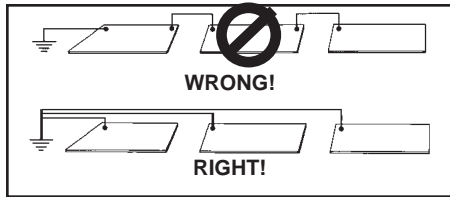


Figure 3. ESD work surfaces should never be grounded in series i.e. daisy chained.

## Grounding Methods

### Method 1

(Grounding Via Ground Cords)

1. ESD Systems.com recommends using a common point ground cord when grounding by ground cords. Most common point ground cords will ground your ESD protective work surface and provide banana jacks for two wrist strap grounds.

2. A common point should be installed at each workstation and it should be connected directly to a verified building “green wire” ground or to a verified grounding bus which is connected to the building ground. Only one groundable point should exist on a work surface.

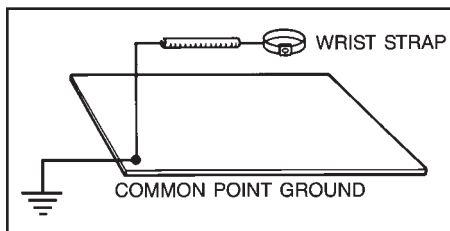


Figure 4. Common point ground for each workstation

3. Wrist straps should never be grounded through a work surface, as the added resistance of the work surface material may prevent the wrist strap from operating properly.

4. A current limiting resistor in the wrist strap ground cord is recommended.

EOS/ESD S.1 Standard calls for this to be a one megohm resistor.

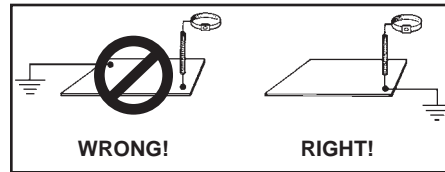


Figure 5. Proper grounding of wrist straps.

### Method 2 (Grounding With A Grounded Conductive Surface)

1. This alternate form of grounding should only be employed when using a conductive, homogeneous or multi-layered dissipative material with a volume resistivity of less than  $10^8$  ohms/centimeter.

2. The dissipative or conductive work surface may be placed on a properly grounded laminate, metal or other conductive surface. The work surface will electrically couple to the grounded surface and may not require separate grounding.

3. When using this type of grounding method be sure to test that the worksurface is properly grounded.

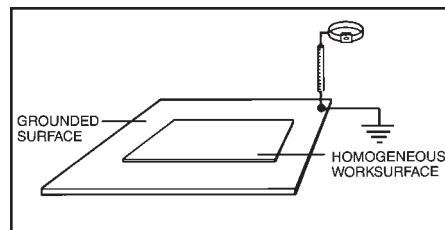


Figure 6. Alternate grounding method

For additional information on grounding we recommend ESD Systems Tech Brief PS-2022.

## Groundable Point Installation

1. Before installing a groundable point on your work surface you must first determine whether you will need a snap socket or stud, the type of snap hardware and the location.

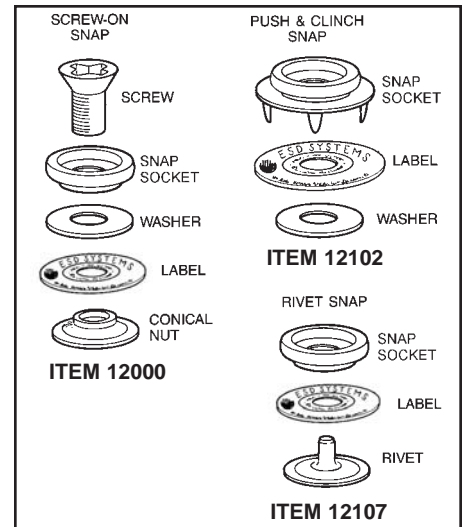


Figure 7. Three kinds of snaps

2. ESD Systems.com has three types of 10mm (0.395") field installable mat grounding snaps. The first type is a screw-on snap kit designed for use on homogeneous mats, but it can also be used on multi-layered work surfaces without ill effect. This is ESD Systems.com item number 12000.

A. Determine the position of the grounding snap (one only per mat) and type of fastener you will be installing (socket or stud). Punch a hole through the material with an appropriate tool such as a small phillips screwdriver, an awl or hole punch.

B. Remove the release paper from the circular label and affix it so that it aligns with the hole on the material.

C. Select one of the screws as follows:  
Material less than 0.100" thick - use the short screw  
Material greater than 0.100" thick - use the long screw

D. Insert the screw through the top on the snap fastener, the washer, the label and the material. Affix the assembly with the conical nut supplied with the kit and tighten down the screw.

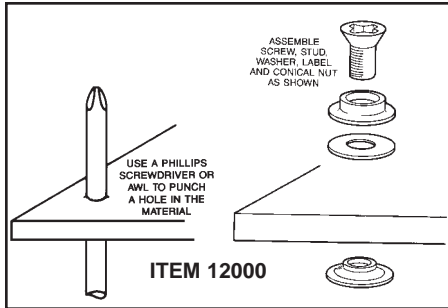


Figure 8. Installing screw-on mat grounding snap.

3. The second type of mat grounding snap is a push and clinch snap. This snap is designed for use with any type of soft mat material: dissipative, conductive or multi-layered. It is recommended for use with multi-layered material, because it provides excellent contact with the conductive layer. It is recommended that before inserting this snap, the mat be punctured with a sharp tool where the snap will be placed. This type of snap is available as a snap socket as item #12102 or as a snap stud as item #12101.

A. Remove the release paper from the circular label and affix it onto the material in the desired location.

B. Center the prongs of the snap assembly with the label. Apply pressure to the snap until the prongs come through the back of the mat. Clinch over prongs to secure snap as shown below in Figure 9.

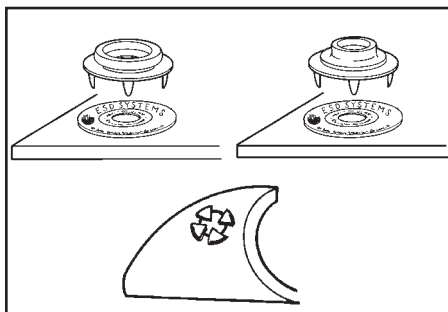


Figure 9. Installing push and clinch mat grounding snap.

4. The third type is a rivet style mat grounding snap. This type of snap assembly is installed using our snap attaching tool, item #12108. Male snap

studs and rivets are available as item #12106 and female snap sockets and rivets are available as item #12107. Groundable point labels are not included with either the item #12106 or #12107 snap kits.

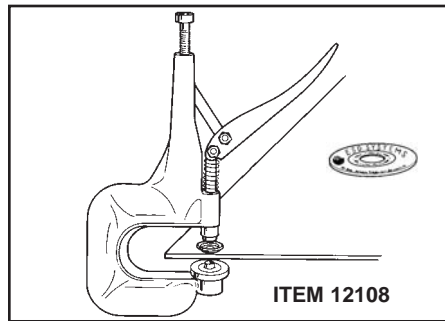


Figure 10. Installation using the snap attaching tool.

### Selection of Common Point and Floor Mat Grounding Systems

1. Determine the type of common point grounding system you will use: barrier strip, bus bar, grounding block or common point ground cord. ESD Systems.com recommends the use of common point ground cords or our model 13525 dual bench ground.

2. If you determine that you will use ground cords you must now determine the type of ground cord you will use for your workstation grounds. The ANSI EOS/ESD S6.1 recommends that a non-resistor ground cord be used to ground work surfaces and floor mats. Selection of the ground cord is determined by user needs and specifications.

Model #	1 Meg Resistor	Designed for Work Surface Use	Designed for Floor Mat Use
13160		X	
13165	X		
13255			X
13260	X		X
13264	X	X	X
13266		X	X
13267	X	X	
13268	X	X	
13269	X	X	
13525		X	
13570	X	X	
13575		X	

Ground cord selection chart.

3. ESD Systems.com offers a variety of ground cords designed to ground work surfaces or floor mats. See selection chart for details on ground cords.

4. ESD Systems.com's 13525 dual bench mount allows the grounding of two operators at one common point. The 13525 mounts easily under the front edge of a workstation. For detailed information on this common point grounding device ask for Tech Brief PS-2020.

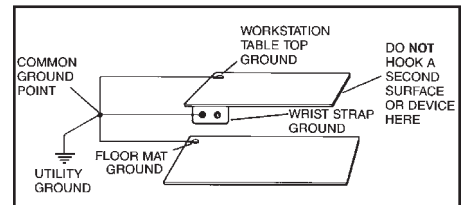


Figure 11. 13525 dual bench mount.

5. The 13255/13260 floor mat ground may be either attached to a mat by snapping onto a 10mm socket, or by bolting it to the mat with the hardware supplied with the cord. When bolting the 13255 to the mat, use a 3/8" diameter hole punch to create the hole for mounting. This will allow cord to sit flush on the mat. **Note:** For both applications, remove screw from floor mat ground before attaching to mat.

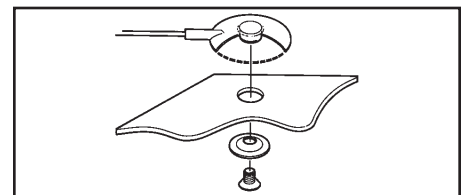


Figure 12. Installing 13255 to mat using supplied hardware.

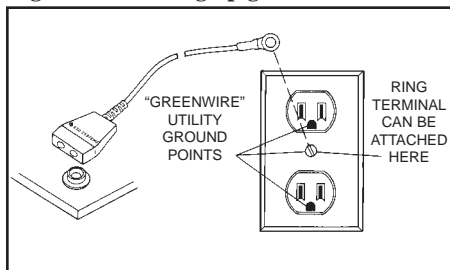
### Mat Installation

1. For best results, allow the mats to lay flat for about four hours at room temperature before installing. This will give the material time to flatten out from being rolled for shipment.

2. Test all workstation grounds for proper impedance to ground. See ESD Systems.com Tech Brief PS-2022 for a complete discussion of grounds.

3. Lay the mat in position and snap the ground cord to it. Bring the other end of the ground cord to the common ground point and attach it using the ring terminal. A suggested ground point is the center screw of a standard outlet. Testing is recommended to ensure that the screw is properly grounded. Tie the ground wire to the bench to keep it out of the way and neat. You may cut and strip the ground wire to a shorter length and attach it with the extra ring terminal included with each ESD Systems.com ground cord.

**Figure 13. Hooking up ground cords**



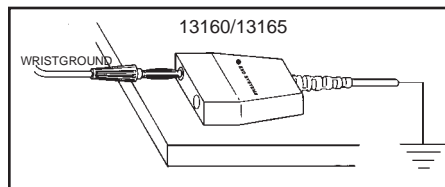
4. If your kit includes a floor mat you should duplicate step 2 and attach the floor mat ground to the same point as the work surface ground.

5. Measure the resistance from the ground snap on the mat to the common ground point. It should read 1 megohm  $\pm$  20 percent if you are using a ground cord with a resistor, and less than 10 ohms if you are using a non-resistor ground cord.

6. If you have a surface resistance or resistance to ground tester available, you may wish to test the resistance to ground from the mat surface. Note: depending upon the accuracy of the instrument you are using, you may get a wide range of results in resistance to ground tests. **Any reading below 10<sup>12</sup> ohms is acceptable for lower cost "field grade" instruments.** In order to get the electrical readings specified for the materials you must use laboratory instruments under controlled conditions per ESD S4.1. This will require a megohmmeter with 100 volt open test

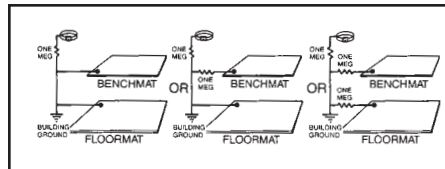
circuit voltage and two five pound electrodes per ASTM-150. For more information on the ESD Systems.com Surface Resistance Test Kit item #41273, ask for Tech Brief PS-2060.

7. If you are using a mat kit that includes the wrist strap, install the wrist strap directly to the common point mat ground cord. Again test the resistance from the back plate of the wrist strap to the common ground point. It should read 1 Megohm  $\pm$  20 percent.



**Figure 14. Adding the wrist strap.**

8. Your completed installation of a ESD workstation should comply with one of the electrical diagrams illustrated in Figure 15.



**Figure 15. Proper wiring diagrams for conductive and dissipative ESD work stations.**

### BE SURE YOU TEST ALL GROUNDS AND WRIST STRAPS FREQUENTLY.

The following Tech Briefs are available from ESD Systems.com:

PS-2057 Operation of 41201 Wrist Strap Tester

PS-2017 Wrist Straps, Grounding, Testing, Maintenance

PS-2022 Safe Grounding of Static Controlled Work Stations.

### Cleaning

For optimum electrical performance, surfaces must be cleaned regularly with a mild detergent and water solution or an anti-static cleaner. ESD Systems.com suggests Reztore Surface

& Mat Cleaner Item #16030. **DO NOT USE CLEANERS WITH SILICONE.** Silicone buildup will create an insulative film on the surface. Many common household cleaners contain silicone.

### Limited Warranty

ESD Systems.com expressly warrants that for a period of one (1) year from the date of purchase, our work surfaces and grounding components will be free of defects in material (parts) and workmanship (labor). Within the warranty period, a unit will be repaired or replaced at our option, free of charge. Call Customer Service at 508-485-7390 for a Return Material Authorization (RMA) and proper shipping instructions and address. You should include a copy of your original packing slip, invoice, or other proof of purchase date. Any unit under warranty should be shipped prepaid to the ESD Systems.com factory. Warranty replacements will take approximately two weeks.

### Warranty Exclusions

THE FOREGOING EXPRESS WARRANTY IS MADE IN LIEU OF ALL OTHER PRODUCT WARRANTIES, EXPRESSED AND IMPLIED, INCLUDING MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE WHICH ARE SPECIFICALLY DISCLAIMED. The express warranty will not apply to defects or damage due to accidents, neglect, misuse, alterations, operator error, or failure to properly maintain, clean or repair products.

### Limit of Liability

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