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Installation and Maintenance of ESD Protective Work Surfaces

Foreword

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

ANSI/ESD S20.20 - Development of an Electrostatic Discharge Control Program
ESD ADV 1.0 - Glossary of Terms
ESD S4.1 - Work Surfaces
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.

Introduction

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

1. Providing an antistatic work surface 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 work surface.

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

A conductive work surface is defined by most documents as a material that has a surface resistivity of less than 1×10^5 ohms/square. Conductive materials are the quickest to ground a charge, but they can also cause damage by discharging too rapidly. Conductive materials are usually used as floor mats or flooring products.

A dissipative work surface is defined as being materials having a surface resistivity of at least 1×10^5 , but less than 1×10^{12} ohms/square. 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 work surfaces.

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 might come into contact with electrical sources.
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 when the station is installed and periodically thereafter.

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 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.

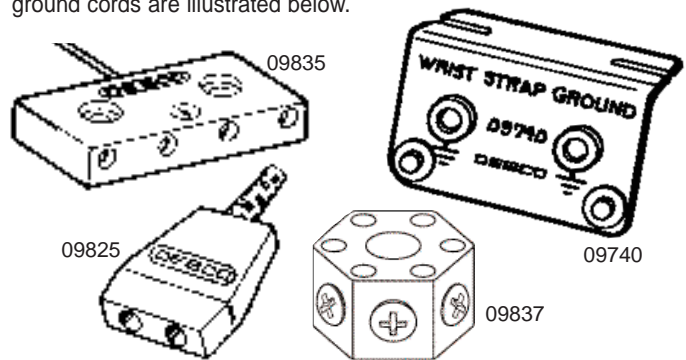


Figure 1. Typical common point grounds.

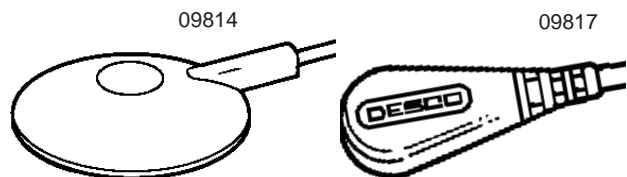


Figure 2. Other ground cords.

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.

COMMON POINT GROUND

Per ANSI/EOS/ESD S6.1, Grounding paragraph 4.1.1 "Every element to be grounded at an ESD protected station shall be connected to the same common point ground."

ESD Handbook TR 20.20 paragraph 5.1.3 Basic Grounding Requirements "The first step in ensuring that everything in an EPA is at the same electrical potential is to ground all conductive components of the work area (worksurfaces, people, equipment, etc.) to the same electrical ground point. This point is called the common point ground. The next step in completing the ground circuit is to connect the common point ground to the equipment ground (third wire, green)."

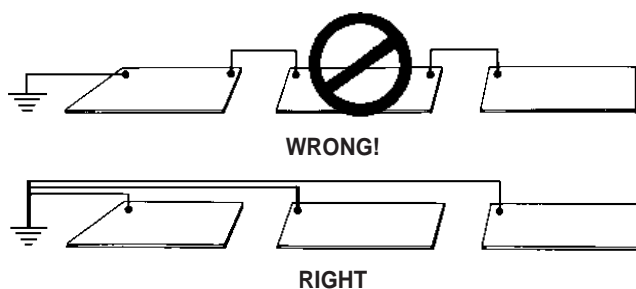


Figure 3. ESD work surfaces should never be grounded in series, i.e. daisy chained.

Grounding Methods

Method 1 (Grounding via ground cords)

1. Desco recommends using a common point ground cord when grounding via 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 ground should be installed at each workstation and should be connected directly to a verified utility "green wire" ground or to a verified grounding bus which is connected to the utility ground. Only one groundable point should exist on a work surface.

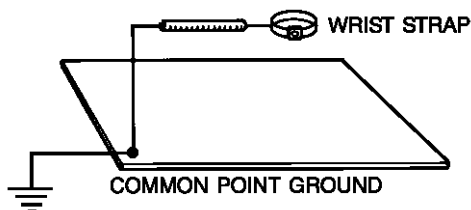


Figure 4. Common point ground for each workstation.

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

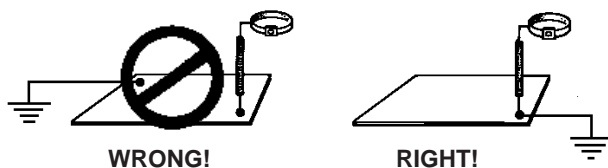


Figure 5. Proper grounding of wrist straps.

4. A current limiting resistor in the wrist strap ground cord is recommended. The EOS/ESD Standard S-1 calls for this to be a one megohm resistor.

Method 2 (Grounding via a grounded conductive surface)

1. This alternate form of grounding should only be employed when using a homogeneous 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 worksurface 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.

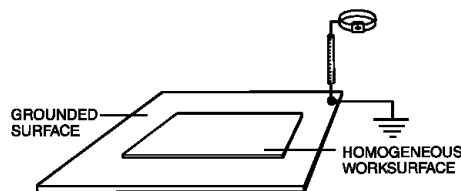


Figure 6. Alternate grounding method

For additional information on grounding we recommend Desco Technical Bulletin TB-2007.

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.

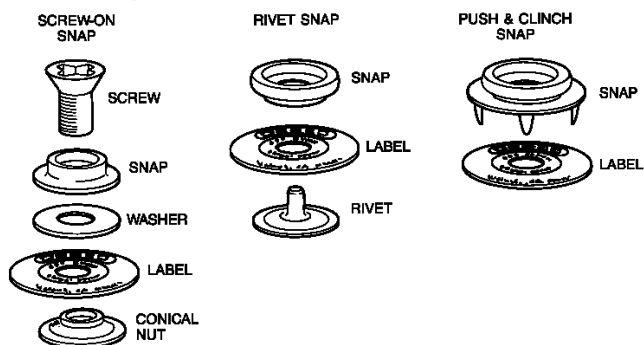


Figure 7. Three kinds of snaps.

2. Desco has three types of 10mm (.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 two-layer work surfaces without ill effect. This is Desco item number 09864.

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 a small phillips screwdriver or awl.

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 .100" thick - short screw
Material greater than .100" thick - 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 screws.

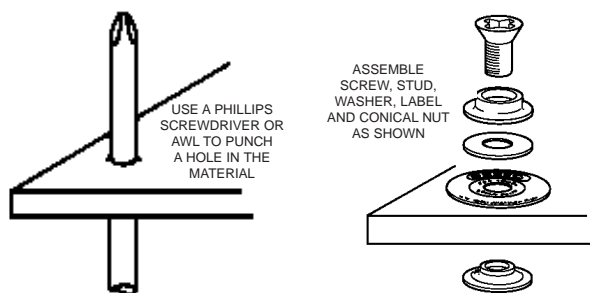


Figure 8. Installing screw-on mat grounding snap.

- The second type of mat grounding snap is the 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 three-layered material, because it provides excellent contact with the internal 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 stud as item #09861 and as a snap socket as item #09863.

- Remove the release paper from the circular label and affix it onto the material in the desired location.
- Center the prongs on the snap assembly with the label. Apply pressure to the snap until the prongs come through the back of the mat, then clinch over prongs to secure snap as shown in Figure 9.

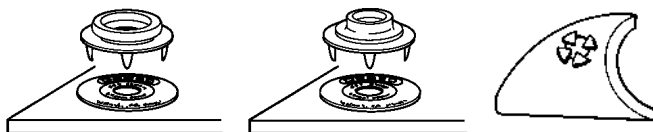


Figure 9. Installing push and clinch mat grounding snap.

- The third type is the rivet style mat grounding snap. This type of snap assembly is installed using a rivetting hand tool, item #09867. Male snap studs and rivets are available as item #09856 and female snap sockets and rivets are available as item #09857. Groundable point labels are not included with either the item #09856 or #09857 snap kits.

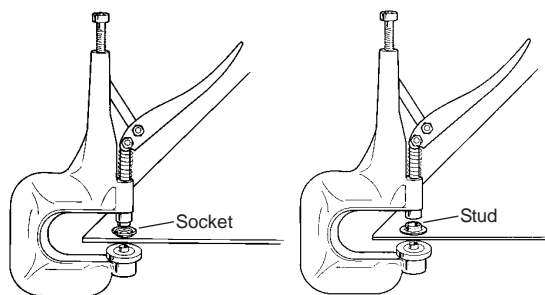


Figure 10. Installation using a rivetting hand tool.

Selection of Common Point and Floor Mat Grounding Systems

- Determine the type of common point grounding system you will use: barrier strip, bus bar, grounding block, or common point ground cord. Desco recommends the use of common point ground cords or our 09740 dual bench mount.
- 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. 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.

- Desco offers a variety of ground cords designed to ground work surfaces or floor mats. See selection chart below for details on ground cords.

Model #	1 Megohm Resistor	Designed for Work Surface Use	Designed for Floor Mat Use
09814			X
09813	X		X
09817			X
09818	X		X
09820		X	
09821	X	X	
09825		X	
09826	X	X	
09835		X	
09836	X	X	
09837		X	
09740		X	
09741		X	

- The 09837 Multi Grounding Hub is designed for use as either a multiple grounding block or as a common point ground. The Multi Grounding Hub incorporates six standard banana jacks, and six terminations for ring terminals (10-32 screw in threaded holes).

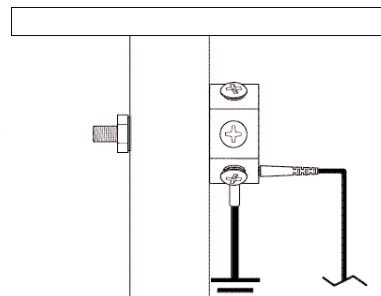


Figure 11. Mounting the 09837 to a table leg.

- The 09740 dual bench mount allows the grounding of two operators at one common point. The 09740 mounts easily under the front edge of a workstation. For detailed information on this common point grounding device ask for Technical Bulletin TB-2003.

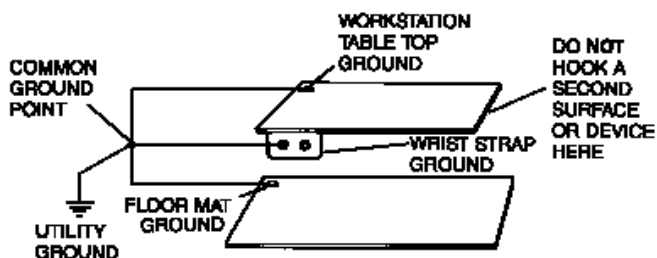


Figure 12. 09740 dual bench mount.

- The 09813/09814 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 09814 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.

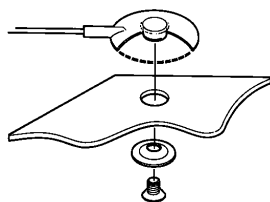


Figure 13. Installing 09814 to mat using supplied hardware.

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 Desco Technical Bulletin TB-2007 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 Desco ground cord.

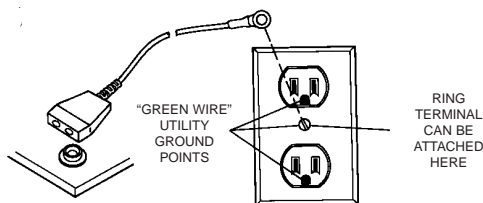


Figure 14. Hooking up ground cords

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 worksurface 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^{12} 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. Desco sells this as the Digital Surface Resistance Test Kit, Item #19780. For more information on the 19770, ask for Technical Bulletin TB-3014.
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 backplate of the wrist strap to the common ground point. It should read 1 Megohm \pm 20 percent.

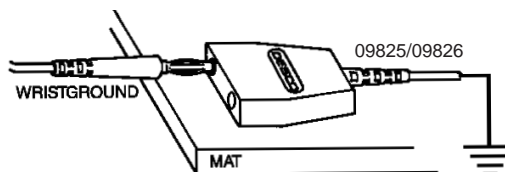


Figure 15. Adding the wrist strap.

8. Your completed installation of a Desco ESD workstation should comply with one of the electrical diagrams illustrated in Figure 16.

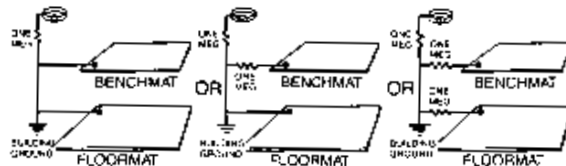


Figure 16. Proper wiring diagrams for conductive and dissipative ESD workstations.

BE SURE YOU TEST ALL GROUNDS AND THE WRIST STRAP FREQUENTLY.

The following bulletins are available from Desco:

TB-2004 Operation of 19350 Wrist Strap Tester
TB-2005 Wrist Straps, Grounding, Testing, Maintenance
TB-2007 Safe Grounding of Static Controlled Workstations

Cleaning

For optimum electrical performance, surfaces must be cleaned regularly with a mild detergent and water solution or an anti-static cleaner. Desco recommends our "REZTORE" Surface and Mat cleaner, item #10435. **DO NOT USE CLEANERS WITH SILICONE.** They will build up a silicone coating on the surface which will cause the surface to become an insulator. Many common household cleaners contain silicone.

Limited Warranty

Desco expressly warrants that for a period of one (1) year from the date of purchase, Desco grounding products will be free of defects in material (parts) and workmanship (labor). Within the warranty period, the product will be tested, repaired, or replaced at Desco's option, free of charge. Call our Customer Service Department at 909-627-8178 (Chino, CA) or 781-821-8370 (Canton, MA) for a Return Material Authorization (RMA) and proper shipping instructions and address. 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 Desco Charleswater factory. Warranty repairs will take approximately two weeks.

If your unit is out of warranty call Customer Service at 909-627-8178 (Chino, CA) or 781-821-8370 (Canton, MA) for a Return Material Authorization (RMA) and proper shipping instructions and address. Ship your unit freight prepaid and Desco will quote repair charges necessary to bring your unit up to factory standards.

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

In no event will Desco or any seller be responsible or liable for any injury, loss or damage, direct or consequential, arising out of the use of or the inability to use the product. Before using, users shall determine the suitability of the product for their intended use, and users assume all risk and liability whatsoever in connection therewith.