

MIL-HDBK-773
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MILITARY HANDBOOK

ELECTROSTATIC DISCHARGE PROTECTIVE PACKAGING



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DEPARTMENT OF DEFENSE
Washington, DC 20301

Electrostatic Discharge Protective Packaging

1. This military handbook is approved for use by all departments and agencies of the Department of Defense.
2. Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to Director, AMC Packaging, Storage, and Containerization Center, ATTN: SDSTO-TE-S, Tobyhanna, PA 18466-5097, by using the self-addressed DD Form 1426 (Standardization Document Improvement Proposal) appearing at the end of this document or by letter.

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FOREWORD

1. Military packaging has experienced many changes in the packaging of electronic devices. Many of the new electronic parts and devices are highly susceptible to damage from static electricity, even at levels which can be neither seen nor felt. Electrostatic discharge (ESD) affects many components such as transistors, resistors, integrated circuits, and many types of semiconductor devices. Static charge can degrade or destroy electronic devices during shipping, handling, and installation. Often it takes only a small level of charge to cause this damage. In fact, nearly half of today's new semiconductors, with their denser geometries, have a static sensitivity of 100 volts or less. This means that almost any moving object can generate a dangerous charge in an unprotected environment. A spark discharge resulting from the accumulation of electrostatic charges does not necessarily destroy a device or cause a circuit in which it is used to become nonfunctional. The device can be permanently damaged, yet perform its intended function. Additional exposure to these spark discharges or using the device in a circuit can further damage and degrade it until failure occurs. This is known as a latent failure and can seriously affect a system's reliability.

2. It is essential that everyone involved in the acquisition, handling, transporting, and storing of electrostatic discharge sensitive (ESDS) items be concerned about ESD. All ESDS items shall be packaged, shipped, and stored in ESD protective materials, including condition code F returns (economically reparable materiel which requires repair, reconditioning, or overhaul).

3. Reducing damage to ESDS items begins with understanding the problem. This standard is intended to provide guidelines on precautionary measures for reducing failures as they relate specifically to packaging and handling of ESDS items.

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1. SCOPE

1.1 Purpose. This handbook provides detailed guidance for DOD personnel who use, handle, package, or store ESDS items. It is designed to promote the use of standardized packaging materials as well as promote an understanding of the ESD threat through all levels of maintenance and supply.

1.2 Applicability. This handbook is applicable to all DOD personnel involved in assembly, handling, packaging, and storage of ESDS items.

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2. REFERENCED DOCUMENTS

2.1 Specifications, standards, and handbooks. Unless otherwise specified, the following specifications, standards, and handbooks of the issue listed in that issue of the DOD Index of Specifications and Standards specified in the solicitation form a part of this specification to the extent specified herein.

SPECIFICATIONS

FEDERAL

- | | | |
|------------|---|--|
| PPP-B-636 | - | Box, Shipping, Fiberboard |
| PPP-B-1672 | - | Boxes, Shipping, Reusable, with Cushioning |
| PPP-C-795 | - | Cushioning Material, Flexible, Cellular, Plastic Film for Packaging Applications |
| PPP-C-1752 | - | Cushioning Material, Packaging, Unicellular Polyethylene Foam, Flexible |
| PPP-C-1797 | - | Cushioning Material, Resilient, Low Density, Unicellular, Polypropylene Foam |
| PPP-C-1842 | - | Cushioning Material, Plastic, Open Cell (for packaging applications) |
| PPP-T-97 | - | Tape, Packaging/Industrial, Filament Reinforced |

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- | | | |
|-------------|---|---|
| MIL-B-117 | - | Bags, Sleeves and Tubing - Interior Packaging |
| MIL-B-81705 | - | Barrier Materials, Flexible, Electrostatic-free, Heat Sealable |
| MIL-P-81997 | - | Pouches, Cushioned, Flexible, Electrostatic-free, Reclosable, Transparent |

STANDARDS

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- | | | |
|-----------------|---|---|
| MIL-STD-129 | - | Marking for Shipment and Storage |
| MIL-STD-2073-1A | - | DOD Materiel Procedures for Development and Application of Packaging Requirements |
| MIL-STD-2073-2B | - | Packaging Requirement Codes |

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- DOD-STD-1686 - Electrostatic Discharge Control Program for Protection of Electrical and Electronic Parts, Assemblies, and Equipment (Excluding Electrically-Initiated Explosive Devices)
- DOD 4500.32R, Volume I - Military Standard Transportation and Movement Procedures

HANDBOOK

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- DOD-HDBK-263 - Electrostatic Discharge Control Handbook for Protection of Electrical and Electronic Parts, Assemblies, and Equipment (Excluding Electrically-Initiated Explosive Devices)

(Copies of specifications, standards, handbooks, drawings, and publications required by contractors in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting officer.)

2.2 Order of precedence. In the event of a conflict between the text of this handbook and the references cited herein, the text of this handbook shall take precedence.

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3. DEFINITIONS

3.1 Electrostatic discharge (ESD). A transfer of electrostatic charge between bodies at different electrostatic potentials caused by direct contact or induced by an electrostatic field.

3.2 Electrostatic discharge sensitive (ESDS) items. Parts or assemblies that are sensitive to ESD damage.

3.3 ESD protective material. Material capable of limiting the accumulation of electrostatic charges by safely dissipating electrostatic charges, or by shielding parts from the effects of external electrostatic charges.

3.4 ESD protective packaging. Packaging with ESD protective materials to minimize the chance of damage to sensitive items.

3.5 Static safe area. Any area that is capable of controlling static charge on people and conductive/nonconductive materials.

3.6 Worksite. Area identified, constructed, and equipped with materials for trained personnel to handle ESDS items.

3.7 Workstation. Area centrally located within the worksite, containing the workbench and material to handle ESDS items.

3.8 Static dissipative. A material which will rapidly dissipate electrostatic charges over its surface or volume, having a resistivity range between conductive and insulative.

3.9 Conductive. Materials defined as being either surface or volume conductive. Such materials may be either metal or impregnated with metal, carbon particles, or other conductive ingredients or whose surface has been treated with such materials through a process of lacquering, plating, metallizing, or printing.

3.10 Triboelectric effect. The generation of static electricity caused by rubbing two substances.

3.11 Conformal coatings. Liquid materials applied directly to printed circuit boards (PCBs) and electronic components during final manufacture; once hardened they will provide physical, electrical, and environmental protection.

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3.12 Static shielding. Containers or packages capable of protecting from static discharges as well as static fields.

3.13 Antistatic tote tray. Conductive containers ideal for static-safe storage, kitting, and in-process handling and transporting of static-sensitive assemblies or devices.

3.14 Antistatic fast pack. Reusable container with anti-static cushioning and the word "antistatic" printed on both ends.

3.15 Unit pack. The first tie, wrap, or container applied to a single item or a quantity thereof or to a group of items of a single stock number, preserved or unpreserved, which constitutes a complete or identifiable package.

3.16 Intermediate pack. A wrap, box, or bundle that contains two or more unit packs of identical items.

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4. GENERAL INFORMATION

4.1 Generation of electrostatic charges. Electrostatic charges are generated by the separation of the surfaces of two materials, with at least one being nonconductive. Friction caused by rubbing materials together tends to increase the amount of accumulated electrostatic charges. A familiar example of ESD is the spark that occurs by walking across a carpet and touching a metal doorknob. The separation of shoes and carpet generate an electrostatic charge that is induced on a person's body, which is sufficiently conductive due to salty moisture on the body's surface. Since the doorknob is metal and highly conductive, a spark occurs when the hand is brought close to the doorknob, assuming the electrostatic charges are great enough.

4.1.1 Dry and moist materials. Separating dry materials generates greater electrostatic charges than moist materials because the moistness is sufficiently conductive and helps to dissipate the charge. For this reason, ESD effects are more noticeable in the winter since heating systems reduce moisture on the surfaces of furniture and other objects. Any circumstance that results in a low relative humidity will permit a greater accumulation of electrostatic charges.

4.1.2 Static charge. A static charge is an excess or a deficiency of electrons on a surface. An excess of electrons produces a negatively charged surface and a deficiency of electrons produces a positively charged surface. Table I gives examples of common materials that charge positively or negatively when separated from each other. Materials that charge positively lose their loosely bound surface electrons and materials that charge negatively attract and maintain those electrons. Table II shows typical electrostatic voltages that occur during normal workday activities and table IV lists typical electrostatic charge sources.

4.2 ESD damage. As shown in table II, activities such as walking, working at a bench, and handling common materials can generate thousands of volts of static electricity. If a spark discharge occurs from an accumulation of electrostatic voltage, electronic components, PCB components, and other electronic assemblies can be destroyed or damaged. Spark discharges cannot be felt if the electrostatic voltage is less than the threshold level for that particular individual. This threshold level is usually within the range of 2,500 to 4,000 volts of electrostatic charge.

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4.3 Description of an integrated circuit. Since the advent of the integrated circuit, electronic components have become smaller and their functional capabilities have become greater. A microprocessor, the core element in a microcomputer, is less than one-half of a cubic inch in volume. Because of the micro-miniature size of the functional components in an integrated circuit, they are much more susceptible to ESD damage than their earlier, significantly larger counterparts. Table III provides these relative ranges for possible damage.

4.3.1 Damage by spark discharge. Considering the threshold levels at which most people can feel a spark discharge from electrostatic voltage, it is easy to understand how electronic parts can unknowingly be damaged during handling. If it is not immediately destroyed, the damaged part may not cause a functional system failure until after it reaches the user.

4.3.2 Microscope view. Figure 1 is a Scanning Electron Microscope view of a capacitor on a microchip of a high performance operational amplifier that has been damaged by ESD. Figure 1 shows the capacitor magnified at two different ranges with damaged areas indicated by arrows. The ESD damage resulted in a 400 ohm path from the capacitor to ground, causing a malfunction in the amplifier.

4.4 Identification/acquisition. Items identified as ESDS will be protected from the very beginning of the acquisition process to final disposal. Specific control programs involved with item design, test, inspection, manufacture and maintenance are contained in DOD-STD-1686 as implemented by DOD-HDBK-263.

4.4.1 Special protective devices. The requirements for the use of special protective devices prior to packaging, as with shunting bars, clips, or noncorrosive conductive foams for protection, is the responsibility of the Government activity involved in item acquisition. DOD-HDBK-263 provides further guidance in this area.

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5. DETAILED INFORMATION

5.1 Identifying ESDS items. Due to the tremendous volume of electronic parts presently used by the military and the methods needed to accomplish the task, identifying parts that are ESDS is essential. ESDS items are categorized as follows:

a. All printed circuit cards and wiring boards with mounted ESDS components.

b. All parts with Federal Supply Class (FSC) 5962.

c. The U.S. Army Missile Command has identified FSCs 5955, Oscillators and Piezoelectric Crystals, 5963, Electronic Modules, and 7042, Mini and Microcomputer Control Devices as ESDS items.

d. The Defense Electronic Supply Center has identified specific resistors and semiconductors listed below as ESDS items:

(1) FSC 5905 resistors:

(a) Film resistors conforming to MIL-R-55182.

(b) Resistor chips conforming to MIL-R-55342.

(c) Resistor networks conforming to MIL-R-83401.

(2) FSC 5961 semiconductor devices:

(a) Microwave diodes.

(b) Insulated gate field effect transistors (metal oxide semiconductor field effect transistors (MOSFETs)).

(c) Junction field effect transistors.

(d) Silicon-controlled rectifiers.

(e) Hybrid semiconductors.

(f) Small signal Schottky diodes.

(g) Semiconductor devices, not otherwise named, which operate at a frequency above one gigahertz.

e. Type of cargo, coded 3, is the fourth position of the five position alphanumeric Commodity and Special Handling Code as specified in DOD 4500.32R, volume I. Type of cargo code is located in block G of DD Forms 1348-1/-1A (DOD Single Line Item

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Release/Receipt Document), dated 1 March 1974. This document will be used until the onhand supply is exhausted, but not later than 31 October 1989, when the bar coded DD Forms 1348-1/-1A, dated June 1986, or any updated version, will become mandatory. Type cargo code will be found in block 8 of the bar coded version of DD Forms 1348-1/-1A.

5.2 Packaging of ESDS items. In all cases the first contacting layer (with bare item) of the selected protective material will be static dissipative and not conductive. Such a layer may be in the form of a homogeneous single film or cushion thickness or a multilayered structure either as a flat film or cushioning pad as in a pouch configuration. Shielding will be required to protect against the effects of static discharge. This protection is normally available in materials through the use of conductive layers attained by carbon loading metallization or other manufacturing techniques as provided by MIL-B-81705, type I, barrier material. When applied, whether as composite structure, pouches, or laminates, inside surfaces of MIL-B-81705, type I, material will not be permitted to be placed against bare items or be used as the outside layer of unit packs. Selection of the appropriate preservation materials will be based on the nature of the item and prescribed packaging data. MIL-STD-2073-2B identifies procedures for the packaging of ESDS items with codes 33, 96, A9, C2, and C4 in table Ia; codes GX and JK in table Ib; and code 39 in table X. Unpreserved ESDS items shall be handled only at an ESD protective worksite by trained personnel (see app C), who can effectively employ the protective materials and equipment provided. Only new antistatic preservation materials will be used to form the unit pack. Preserve and pack ESDS items using the following procedures (see fig 2):

a. Wrap the item with barrier material conforming to MIL-B-81705, type II; or cushion the item with antistatic material conforming to PPP-C-795, class 2, PPP-C-1752, type VII, class I, or PPP-C-1842, type III, style A or B (open cell), or PPP-C-1797, type II; or place the item in an antistatic pouch conforming to MIL-P-81997, type I, interlocking (zipper-type) closure, type II (heat-sealable lip) closure, constructed from MIL-B-81705, type II, material to prevent bag puncture.

b. Place the wrapped or cushioned item in a bag (MIL-B-117, type I, class F, style I) made from material conforming to MIL-B-81705, type I. The bag shall be made of one piece of material folded in half and heat sealed on three sides. This becomes the unit pack which can be handled as you would any non-ESDS item.

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c. Place a sensitive electronic device unit pack label (see fig 3) on the unit pack as illustrated in figure 4. In the absence of national stock numbers (NSNs), local purchase procedures shall be followed when ordering this unit pack sensitive electronic device label. Should this label be temporarily unavailable, unit packs may be marked with the sensitive-electronic device symbol and the statement "DO NOT OPEN EXCEPT AT APPROVED FIELD FORCE PROTECTIVE WORK STATION" or "DO NOT OPEN EXCEPT AT APPROVED STATIC-FREE WORK STATION."

d. Most ESDS items (e.g., circuit cards, resistors, and semiconductors) can utilize 1 of the 12 reusable PPP-B-1672, type II, style D, folding convoluted "fast packs," which are the only fast packs authorized for ESDS items (see fig 4). ESDS items that will not fit into 1 of the 12 authorized fast packs will be packed according to prescribed packaging instructions or into PPP-B-636 fiberboard containers. Allowing for antistatic cushioning, measure for desired size fiberboard container and refer to the recommended fiberboard most frequently used container list (see MIL-STD-2073). The listed sizes may be requisitioned through normal supply channels. If box making equipment is available, containers shall be fabricated in accordance with PPP-B-636. After closure, in accordance with PPP-B-636, apply a sensitive, intermediate, or exterior electronic device caution label on the appropriate container (see figs 3 and 4). Label and mark according to MIL-STD-129.

5.3 Transporting before final unit pack. If the unit pack must be opened for any purpose, it shall be opened at an ESD-controlled workstation (see fig 5). If the item needs to be transported to several areas before it is converted to a unit pack (e.g., from receiving inspection, to repair and test, to inspection, then to final unit pack), use the following procedures:

a. Wrap, cushion, or pouch the item in accordance with paragraph 5.2.

b. Place the wrapped or cushioned item in a bag (MIL-B-117, type I, class F, style I) with one open edge made from material conforming to MIL-B-81705, type I.

c. Fold the open edge over and place a rubber band around the bag to hold the flap down. Adhesive tape shall not be used since it can generate an electrostatic charge when removed from the roll or the bag.

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d. Transport the item by using a covered antistatic tote tray or by placing the item in an antistatic type II, style D (folding convoluted), fast pack, PPP-B-1672. Protecting items in this manner ensures that the item is first placed in an antistatic environment and then transported.

5.4 Condition code F. All reparable ESDS items shall be rendered the level of packaging that will prevent further deterioration of the item. Returned condition code F materiel shall be given the same applicable packaging referenced on the preceding pages beginning with paragraph 5.2.

5.5 ESD protective packaging materials. Materials with known NSNs are included in appendix B. The list may not be all-inclusive because of the rapid technological changes which affect items available from supply sources.

NOTE: Only approved antistatic protective materials will be used.

5.6 The ESD protective worksite. A worksite containing the workstation will require a minimum floor area of 150 square feet. It is recommended that the workstation occupy approximately 70 square feet and be centrally located within this site, the outer perimeter will be identified as a restricted area for trained personnel to handle ESDS items. Figure 5 is a sketch of an ESD-controlled workstation, with the items necessary to handle ESDS parts. The ionizer is a precautionary device that, within its effective area of control, will aid in removing electrostatic charges from nonconductive surfaces such as the surface of an inadvertently placed styrofoam cup. Heel straps and a static dissipative floormat are also included with the essential worksite items. Heat-sealing equipment should be located adjacent to the workbench so that the wrist strap remains attached while heat sealing bags. The tabletop and floormat ground wires should each go to ground directly (see fig 5, item 6). To prevent the possibility of shocks from high-voltage sources, wrist straps for use at ESD-controlled workstations contain a protective resistor (usually one megohm).

5.7 Precautions. Observe two basic rules: Handle all ESDS items at a static-safeguarded worksite and transport all ESDS items in static protective containers or packages. Adhere to the following precautions when using an ESD-controlled worksite.

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- a. When protective apparel is worn it should be frequently checked, especially after cleaning, by scanning personnel with an electrostatic field meter to monitor for damaging ESD voltages.
- b. Be sure to attach the wrist strap (mandatory) and heel straps (if used) before handling any ESDS items.
- c. Avoid the presence of any nonantistatic or insulative material on or near the worksite such as styrofoam cup, common plastic or masking tape, common wrapping or barrier materials (e.g., bubble pack, plain poly, etc.), cigarette packs, and synthetic materials (e.g., rayon, orlon, plastics of any type, etc.).
- d. Do not store or use magnetic material near the work-site.
- e. Do not perform stretch- or shrink-wrapping operations within the ESD-controlled work area.
- f. If more than one ESD-controlled workstation is located in the same area, do not connect the table tops or floormats in series; individually ground each one.
- g. Do not use waxes, polishes, or similar material on the floormat or tabletop. They may deposit an insulating layer of residue reducing or eliminating the effectiveness of the floormat or tabletop. For the same reason, the use of topical anti-static spray is not recommended on packaging materials.
- h. Sweep dust and dirt from the tabletop and floormat as often as needed to prevent any accumulation which will also insulate them and make them ineffective.
- i. Perform continuity checks of all ground wires weekly to ensure that the proper grounding is maintained.
- j. Check wrist straps weekly to ensure that the protective resistor (usually one megohm) is still in the circuit. If the wrist strap resistance is less than 250K ohms or indicates an open circuit, do not use it.
- k. Antistatic pouches should be used for technical manuals, drawings, work instructions, etc., rather than plain plastic pouches, if they are used at all.

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5.8 Typical ESD-controlled workstation. Figure 5 shows a typical ESD-controlled workstation (the heat-sealing equipment is not shown). Indicated on the figure are the key ESD-control components comprising a workstation. Figure 6 depicts several closeup examples of these components.

5.8.1 Conductive material. The term "conductive" is often used in reference to ESD protective tabletops, floormats, and chairs, but this term is a misnomer. They are not conductive as are common metals (e.g., copper, aluminum, etc.), but are classified between metal conductors and insulators of electricity such as ceramic, dry paper, and mica. The resistance characteristics of static dissipative tabletops, floormats, and chairs prevent the possibility of a spark discharge or high current flow, yet allow an electrostatic charge to be safely dissipated across the surface to ground.

5.9 The ESD field service kit. ESD protection is required where formal worksites are not practical (i.e., remote locations such as shelters and vans). ESD control field service kits provide the next most effective means of preventing ESD damage. Their primary use is in support of personnel who remove ESDS items from service or who place them in operation during which time items are outside of prescribed packaging. Kits are available which allow protection for ESDS items at the ultimate user level (see app A). Figure 7 reflects a typical kit as described in figure 8 with instructions for use. It is noted that these static dissipative mats with accessories are not a substitute for a complete ESD protective workstation. The kit is a field expedient and contains only the minimum requirements for ESD-control. This supplemental handling procedure for repair type ESDS items will be the only interim technique where the reuse of ESD preservation material is encouraged.

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6. NOTES

6.1 Subject (key word) listing.

ESD

ESD Protective Material

ESD Protective Packaging

ESD Protective Worksite

ESD Protective Workstation

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TABLE I. Common materials that generate triboelectric effect.

Positive (+)	Human hands Asbestos Rabbit fur Glass Mica Human hair Nylon Wool Fur Lead Silk
Increasing (+)	Aluminum Paper Cotton Steel Wood Amber
Increasing (-)	Sealing wax Hard rubber Nickel, copper Brass, silver Gold, platinum Sulfur Acetate rayon Polyester Celluloid Orlon Saran Polyurethane Polyethylene Polypropylene Polyvinyl Chloride Silicon
Negative (-)	Teflon

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TABLE II. Typical electrostatic voltages.

Means of static generation	Measured voltages	
	10% to 20% RH	65% to 90% RH
Walking across carpet	35,000	1,500
Walking over vinyl floor	12,000	250
Worker at bench	6,000	100
Vinyl envelopes for work instructions	7,000	600
Common poly bag picked up from bench	20,000	1,200
Work chair padded with polyurethane foam	18,000	1,500

TABLE III. Sensitivity ranges.

Component	Volts
Transistors	30-7,000
Operational amplifiers (modules)	200-2,500
Diodes	300-2,500
Film resistors	300-3,000
Low-power, integrated circuit logic	500-2,500
Silicon controller rectifier	700-1,000

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TABLE IV. Typical electrostatic charge sources.

Object or process	Common materials or activities
Work surfaces:	.Waxed, painted or varnished surfaces .Vinyl or plastics
Floors:	.Sealed concrete .Waxed, finished wood .Rugs .Vinyl tile or sheeting
Clothes:	.Clean room apparel .Animal hair-based garments .Nonconductive shoes
Chairs:	.Finished wood .Foam cushions .Vinyl .Plastic casters .Fiberglass
Packaging and handling:	.Plastic (bags, wraps, envelopes, labels, stretch and shrink films, tapes .Bubble pack, foam, loose fills .Plastic trays, pallets, tote boxes, vials, parts, bins, containers
Assembly, cleaning, test, and repair areas:	.Spray cleaners .Plastic solder suckers .Solder irons with ungrounded tips .Solvent brushes (natural and synthetic bristles) .Cleaning or drying by fluid or evaporation .Cathode ray tubes (oscilloscopes) .Heat guns and blowers .Sandblasters .Electrostatic copiers

Failure site
indicates surface
damage to capacitor
(175 magnification).



Closer view
indicates "punch-
through" due to ESD
(4,300 magnification).

FIGURE 1. Magnified views of ESD caused failure of high-performance operational amplifier.

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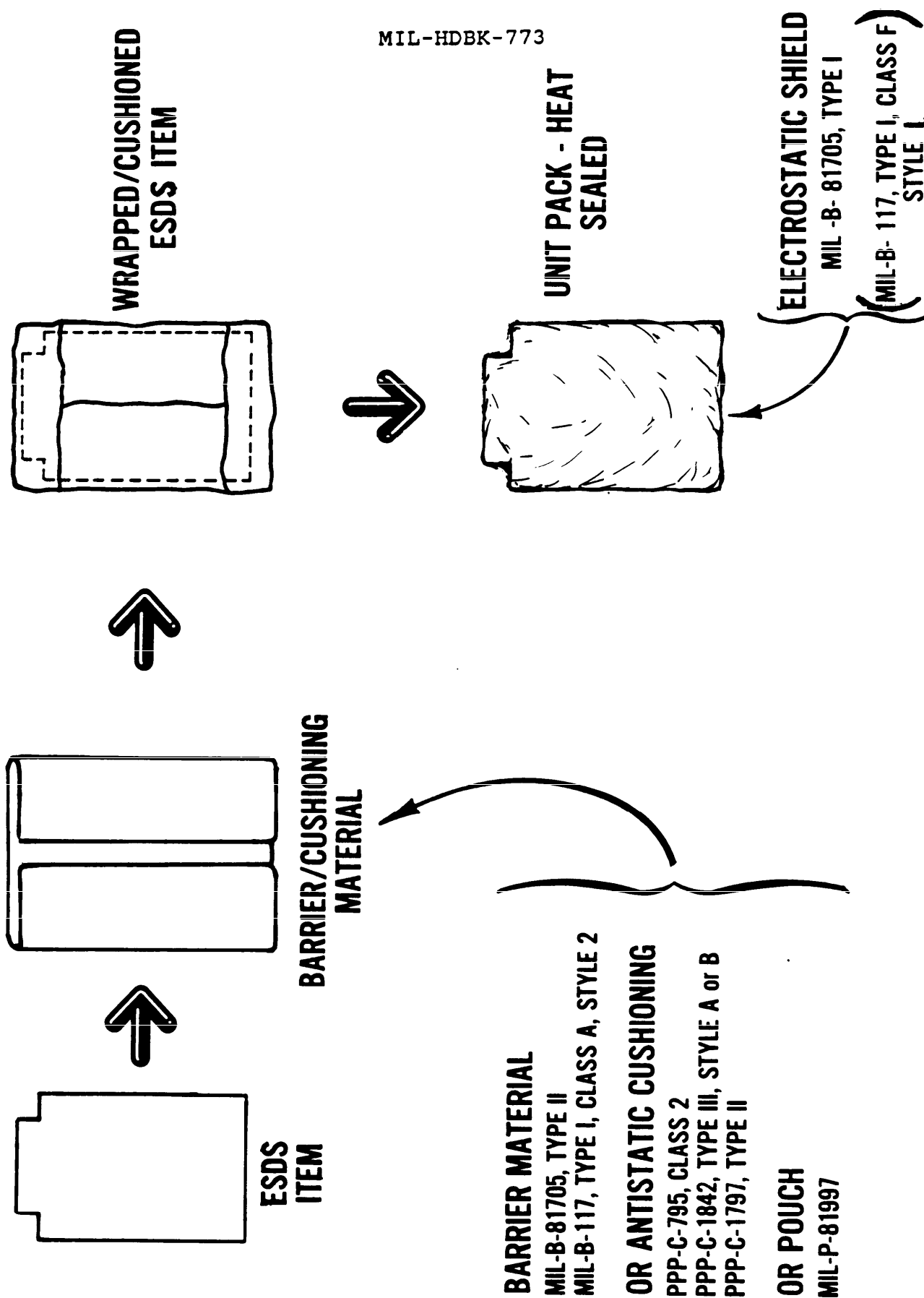


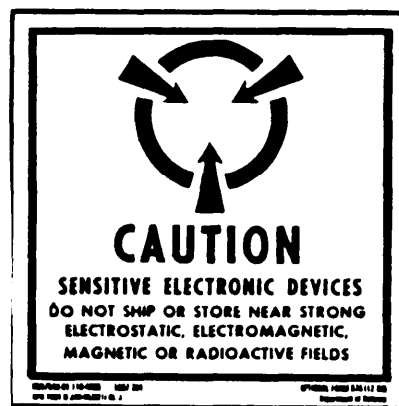
FIGURE 2. ESDS item preservation.

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Sensitive electronic device caution label.
(unit pack)

NOTE: Currently this label has not been assigned an NSN (see 5.2c).

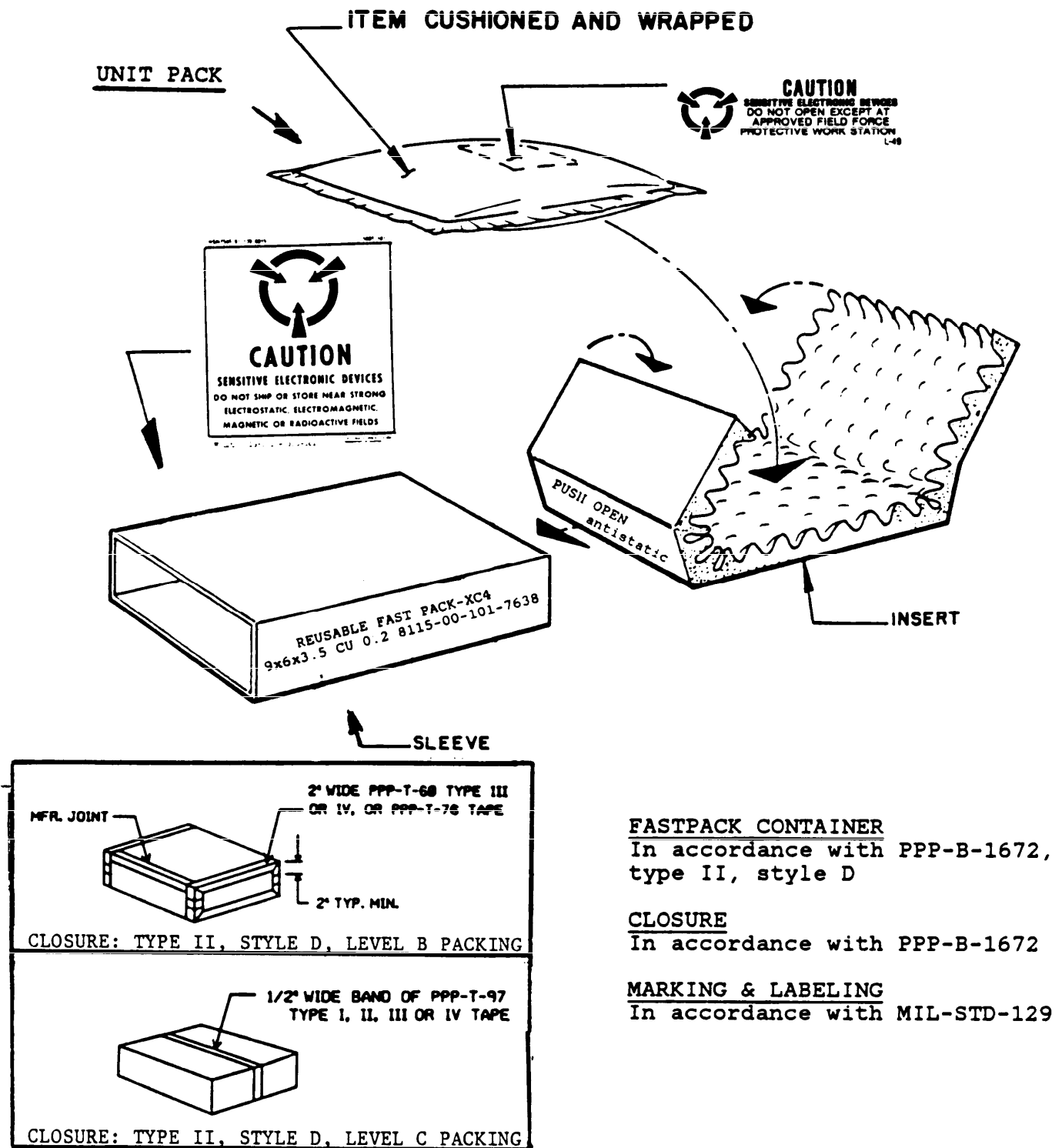


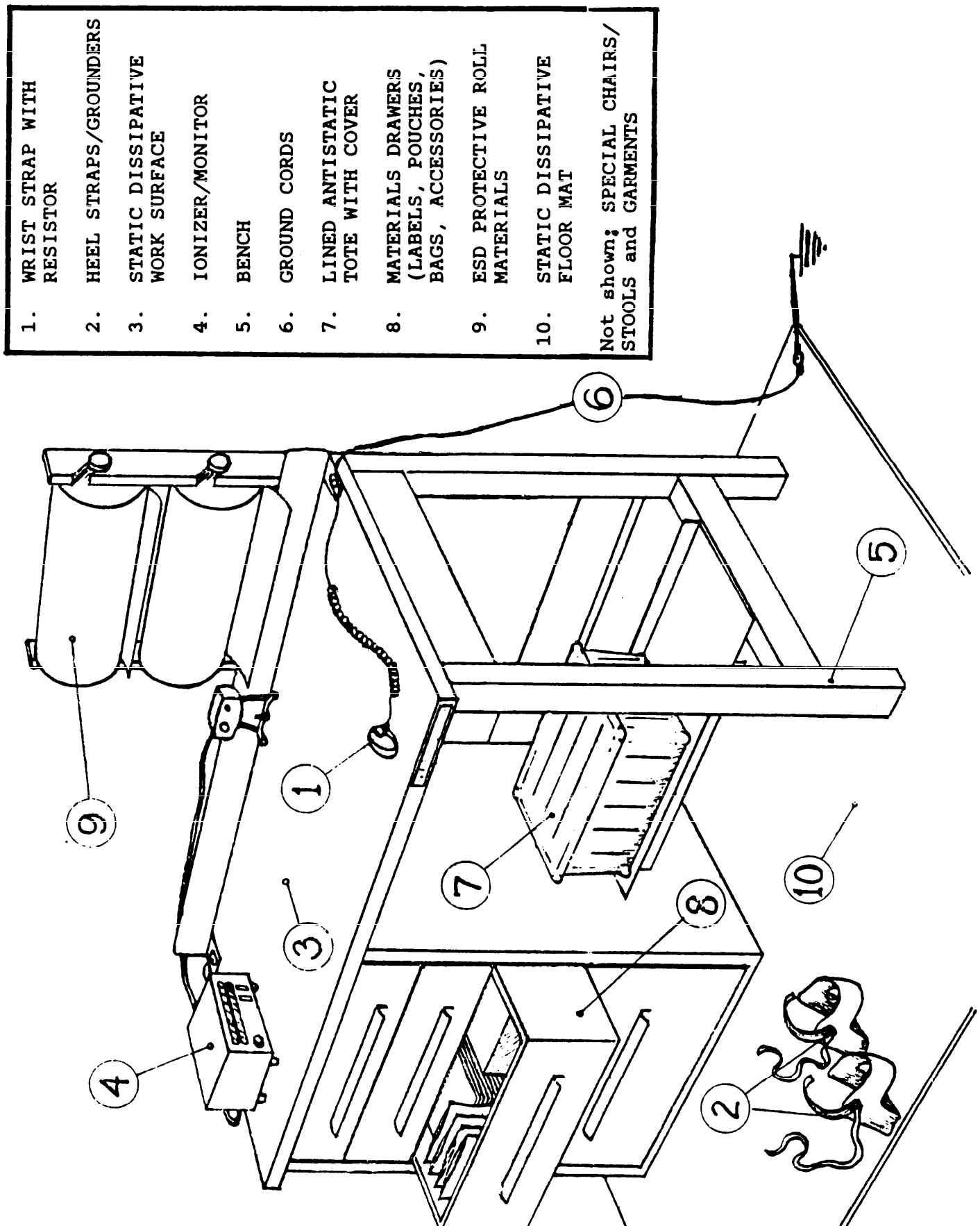
Sensitive electronic device caution label.
(intermediate and exterior packs)

NSN	SIZE	OPTIONAL FORMS
7540-01-109-8815	2- by 2-inch	87
7540-01-110-4906	4- by 4-inch	87A

FIGURE 3. Sensitive Electronic Device Labels.

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FIGURE 4. Use of PPP-B-1672, fast pack.

FIGURE 5. ESD protective workstation.

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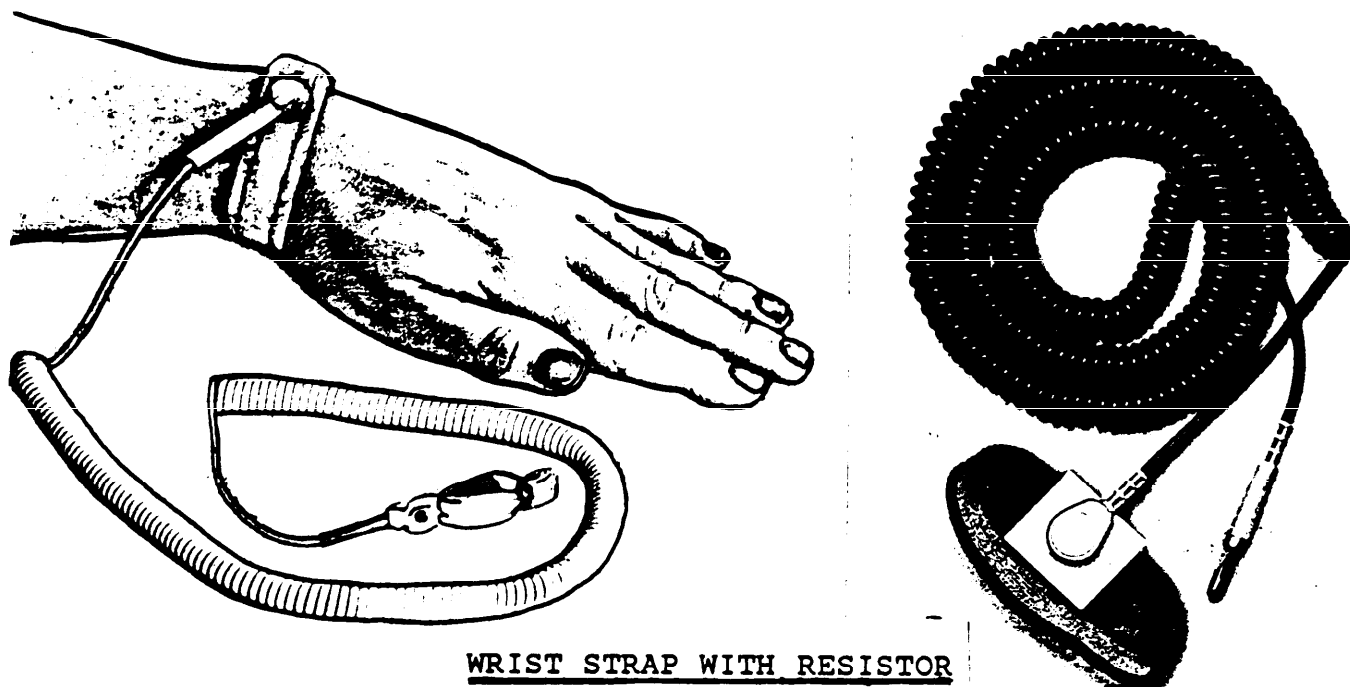


FIGURE 6. ESD protective worksite items.

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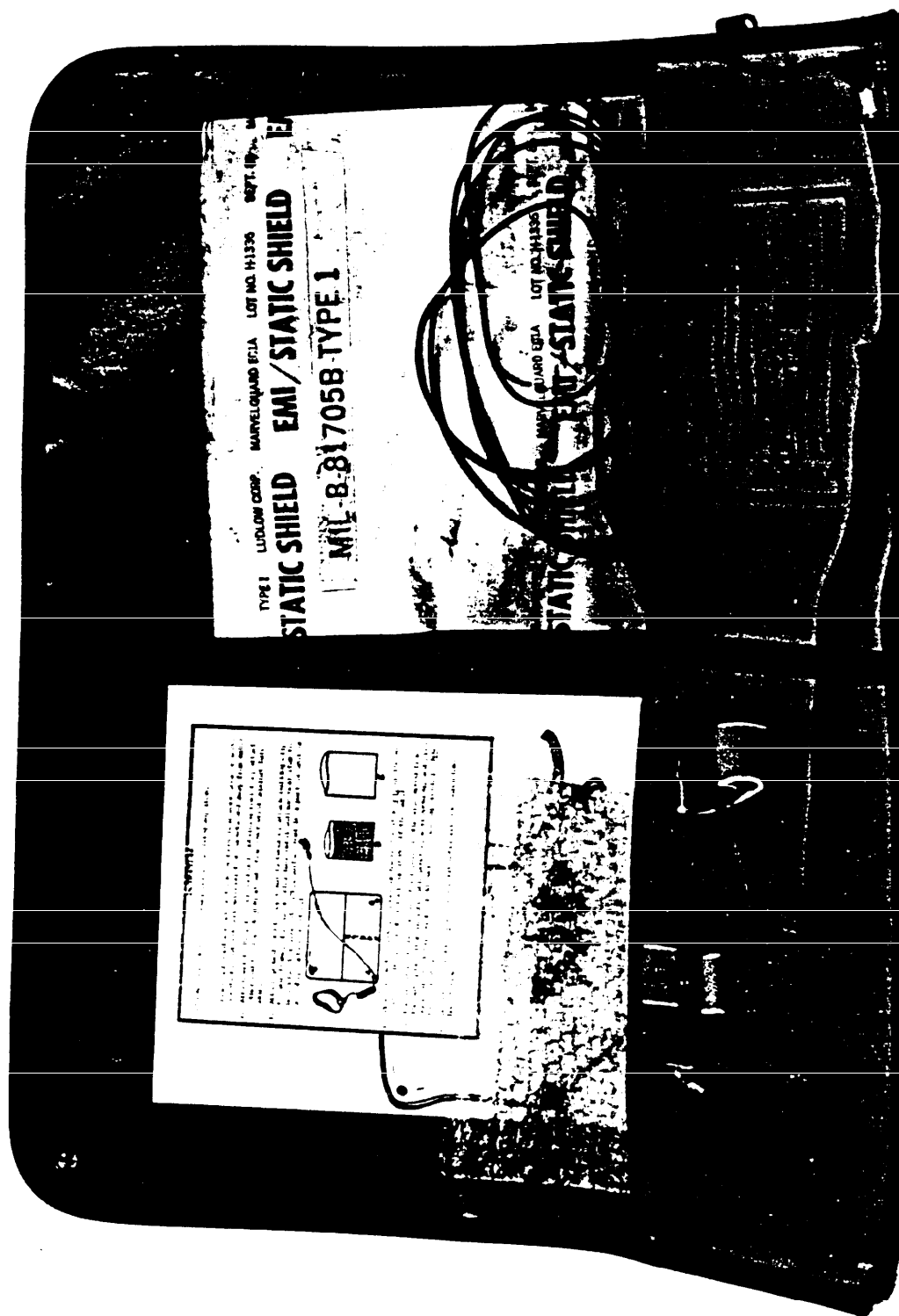


FIGURE 7. Typical ESD protective field service kit.

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INSTRUCTIONS

CAUTION: Only trained personnel shall handle unpreserved ESDS items. Disconnect all power before handling any item.

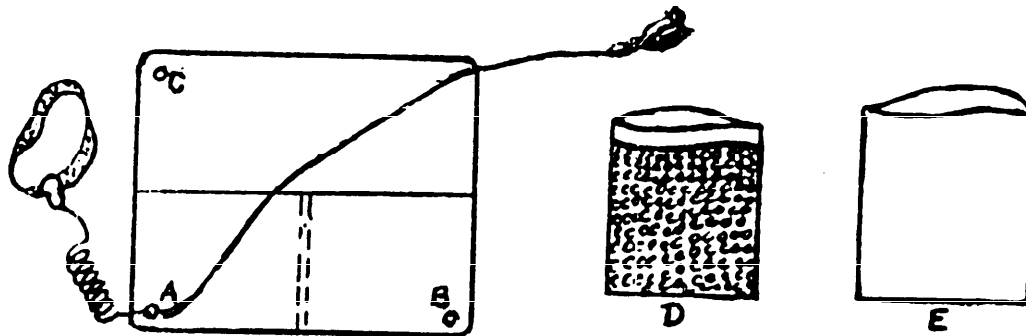
STEPS:

1. Place unfolded workmat on table or floor near work area or service location.

NOTE: Remove all material from pockets and away from mat.

2. Attach ground cord to mat fastener A, B, or C; attach bulldog clip to mainframe, chassis, or other bare metal surface near item to be replaced or removed. This surface must be a part of unit assembly containing item.

3. The wrist strap coil cord containing resistor, shall be attached to the same mat fastener as the ground connector A, B, or C; adjust wrist strap over wrist against bare skin.



4. Proceed now to remove, replace, or handle the ESDS item only on the mat surface. Keep all other tools or non-ESDS items off the mat.

5. ESDS items to be returned (e.g., condition code F) for repair or otherwise removed from the static dissipating mat shall be packaged to prevent any further deterioration (see 5.2). This procedure is the only technique where the reuse of ESD preservation material is encouraged. Place item in antistatic pouch D, made from material conforming to MIL-P-81997, type II. Fold over opening and place in shielding bag E, made from material conforming to MIL-B-81705, type I. Fold the opening, and place a rubber band over this shielding bag. Do not use adhesive tape. Item can now be handled as you would any other non-ESDS item. The above mentioned field service kit is included in appendix A.

NOTE: Do not disassemble the field service kit until all procedures have been completed.

FIGURE 8. ESD protective field service kit instructions.

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APPENDIX A

ESD workstation and field service kit equipment

Description	NSN
Wrist strap (36 inches in length with 250K resistor)	4240-01-063-4880
Static control work station components (contains 4- by 6-foot floor mat with 15-foot ground cord, table mat, wrist strap, and 5-foot bonding cord)	4940-01-087-3458
Work station, electrostatic control, static dissipative soft table mat, common point ground system, and wrist strap with current limiting resistor; to be used in all areas other than clean rooms or laminar flow booths where ESDS items are handled; includes a small/medium and a large/extra large wrist cuff.	4940-01-250-4236
Work station kit, electrostatic control, static dissipative portable work surface, common point ground system, and wrist with current limiting resistor, situations where other static control used in work stations are not available, includes a small/medium and a large, extra large wrist strap cuff.	- 4940-01-250-4237

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APPENDIX A

ESD workstation and field service kit equipment - Continued

Description	NSN
<p>Work station kit, electrostatic control, permanent technical workbench or table with static dissipative work surface; may be used in any area where ESDS items are handled. This is a specification for a work surface only. Wrist straps and a common point grounding system must be added.</p>	4940-01-250-4238
<p>Field service kit contains 3 ea pouch, MIL-P-81997, type II; 3 ea Bauer bag, MIL-B-81705, type I; 2 ea wrist strap; 1 ea ground cord; and 1 ea mat, static dissipating</p>	5920-01-253-5368

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APPENDIX B

ESD protective materialsDescription: MIL-B-81705, type I (opaque foil)

<u>NSN</u>	<u>U/I</u>	<u>SIZE</u>
8135-00-092-3220	Roll	3 ft X 600 ft

Description: MIL-B-81705, type II (transparent plastic)

<u>NSN</u>	<u>U/I</u>	<u>SIZE</u>
8135-01-158-7786	Sheet	48 in X 48 in
8135-01-163-3486	Sheet	36 in X 24 in
8135-01-197-2997	Sheet	36 in X 56 in
9330-00-113-9438	Sheet	54 in X 500 ft

Description: PPP-C-1842, type III, style A (open-celled without top laminate)

<u>NSN</u>	<u>U/I</u>	<u>SIZE</u>
8135-01-057-3607	Roll	1/4 in X 48 in X 500 ft
8135-01-087-3599	Bundle	1/4 in X 24 in X 500 in
8135-01-088-3845	Bundle	1/8 in X 48 in X 625 in
8135-01-088-3846	Bundle	1/8 in X 24 in X 625 in
8135-01-088-3847	Bundle	1/8 in X 12 in X 625 in
8135-01-088-3848	Bundle	1/8 in X 6 in X 625 in
8135-01-088-3849	Bundle	1/4 in X 12 in X 500 in

Description: PPP-C-1842, type III, style B (open-celled with top laminate)

<u>NSN</u>	<u>U/I</u>	<u>SIZE</u>
8135-01-087-3602	Bundle	1/4 in X 24 in X 375 in
8135-01-087-3603	Bundle	1/4 in X 12 in X 375 in
8135-01-088-3850	Bundle	1/4 in X 48 in X 375 in
8135-01-088-3851	Bundle	1/4 in X 6 in X 375 in

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APPENDIX B

ESD protective materials - Continued

Description: MIL-P-81997 (pouch with air-cap surrounded by plastic, zipper closure)

<u>NSN</u>	<u>SIZE</u>
8105-01-197-2965	12 in X 12 in
8105-01-197-2966	10 in X 10 in
8105-01-197-7846	10 in X 12 in
8105-01-205-0207	8 in X 12 in
8105-01-215-0462	8 in X 8 in
8105-01-215-4752	11 in X 15 in
8105-01-216-7804	8 in X 12 in

Description: Plastic, Single Wall Bags (fabricated from material referenced to MIL-B-81705, type II)

<u>NSN</u>	<u>SIZE</u>
8105-01-216-3923	8 in X 12 in
8105-01-216-3924	15 in X 18 in
8105-01-216-6253	11 in X 15 in
8105-01-217-4311	10 in X 30 in
8105-01-217-4312	10 in X 12 in
8105-01-217-7252	10 in X 26 in
8105-01-217-7587	4 in X 4 in
8105-01-217-7588	5 in X 8 in
8105-01-217-7589	8 in X 8 in
8105-01-217-7590	6 in X 10 in
8105-01-217-7591	8 in X 10 in
8105-01-217-7593	10 in X 14 in
8105-01-217-7594	11 in X 15 in
8105-01-217-7595	4 in X 6 in
8105-01-218-5320	12 in X 18 in
8105-01-218-5321	14 in X 18 in
8105-01-218-5323	18 in X 18 in
8105-01-218-5324	10 in X 24 in
8105-01-218-5325	4 in X 24 in
8105-01-218-5326	12 in X 16 in
8105-01-220-2955	5 in X 10 in

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APPENDIX B

ESD protective materials - Continued

Description: Plastic, Single Wall Bags With Zipper Closure
(fabricated from material referenced to
MIL-B-81705, type II)

<u>NSN</u>	<u>SIZE</u>
8105-01-162-2174	6 in X 10 in
8105-01-180-7919	10 in X 12 in
8105-01-181-5534	8 in X 10 in
8105-01-185-2632	24 in X 36 in
8105-01-185-2634	6 in X 8 in
8105-01-185-2635	8 in X 10 in
8105-01-185-9680	10 in X 16 in
8105-01-207-9590	8 in X 12 in
8105-01-207-9591	12 in X 12 in
8105-01-208-4339	12 in X 12 in
8105-01-217-3773	6 in X 8 in

Description: Fast Pack (PPP-B-1672, type II)

<u>NSN</u>	<u>SIZE</u>
8115-00-101-7638	9 in X 6 in X 3 1/2 in
8115-00-101-7647	9 in X 6 in X 2 1/2 in
8115-00-787-2142	6 in X 5 in X 2 1/2 in
8115-00-787-2146	12 in X 8 in X 2 1/2 in
8115-00-787-2147	6 in X 5 in X 3 1/2 in
8115-00-787-2148	12 in X 8 in X 3 1/2 in
8115-01-019-4084	18 in X 12 in X 3 1/2 in
8115-01-019-4085	18 in X 12 in X 2 1/2 in
8115-01-057-1243	13 in X 13 in X 3 1/2 in
8115-01-057-1244	10 in X 10 in X 3 1/2 in
8115-01-057-1245	16 in X 16 in X 3 1/2 in
8115-01-093-3730	24 in X 16 in X 3 1/2 in

PPP-B-1672, type II, style D, fast packs used for ESDS items have the word "antistatic" printed on both ends.

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APPENDIX C

TRAINING

Some available movies, video cassettes, training aids, and training courses for ESD-related programs are:

a. Dan C. Anderson on ESD Damage Prevention (produced by Richmond Technology, Inc.).

b. ESD video presentation (produced by Marketing Communications Department of Motorola, Inc.).

c. Static Safeguard Systems (produced by Static Control Systems Division of 3M).

(These video cassettes can be obtained from the Defense Audiovisual Agency, Audiovisual Library, Norton Air Force Base, San Bernardino, CA 92409.).

d. Static Electricity (produced by the Bureau of Mines) , available from Television Branch, U.S. Army Signal Center, Training Films (TF) 5924, Fort Gordon, Augusta, GA.

e. Movie: ZAP! STATIC AWARENESS, No. 35407DN (available from Navy film libraries to Government personnel in 16mm and 1.9cm video tape.).

f. School of Military Packaging Technology course, titled, Packaging and Handling of Electrostatic Discharge Sensitive (ESD) Items, SMPT-6.

Dean
School of Military Packaging Technology
ATTN: AMXMC-SMPT-T
Aberdeen Proving Ground, MD 21005-5001

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Custodians:

Army -SM

Air Force - 17

Navy - SH

DLA - ES

Preparing Activity

Army - SM

(Project PACK 0817)

Review Activities:

Army - AM, AT, CR, MI

Air Force - 01, 11, 15, 18, 19, 43, 70, 71, 80, 82, 84, 99

Navy - AS, CG, EC, MC, MS, OS, SA, YD

